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Incorporating Sustainability Principles

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Palgrave Studies in Environmental Policy and Regulation
ISBN 978-3-030-80941-6 ISBN 978-3-030-80942-3 (eBook)
https://doi.org/10.1007/978-3-030-80942-3

This Palgrave Macmillan imprint is published by the registered company Springer Nature Switzerland AG.
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Acknowledgments

Various individuals deserve recognition and thanks for their much appreciated role in making the book a reality. First, there are four independent reviewers who provided much welcomed advice. Many friends and colleagues with whom I have shared ideas, while sharing the occasional drop of good wine or nip or two of a favorite spirit, have influenced my thinking on environmental impact assessment (EIA). None have been consulted on, or read a draft of, this book.

These folk are all retired, or semi-retired. They are Eric Anderson, John Ashe and Brett Odgers who were the most senior EIA practitioners in Australia in the concept's formative stage; Barry Sadler, an Englishman living in Canada who has played a catalytic role in environmental impact assessment throughout much of its history; Patrice LeBlanc, a senior environmental impact specialist in Canada throughout the concept's formative stages; Martin Wood, the senior New Zealand government EIA specialist in those same years; Brian Clark of Aberdeen University; Rabel Burdge of University of Illinois; the late Geoff McDonald of Griffith University and the University of Queensland; Calvin Rose, Des Connell, Lex Brown, Greg Miller, Roy Rickson, John Ware and Ron Neumann, all of Griffith University; and Daryl McPhee of Bond University.

Three colleagues kindly read an early draft of the book. They are Lachlan Wilkinson, Peter Burnett and Mark Breitfuss. I thank them for their advice, which I hope I have incorporated to their satisfaction.

Ultimately, the final product is my responsibility.

The Environment Institute of Australia and New Zealand kindly provided seed funding, for which I am grateful. However, the book does not necessarily represent the views of that organization.

I offer a special thanks to Rachael Ballard of Palgrave. From the very instant I contacted Rachael, she has been both encouraging and very helpful with suggestions. This book would not exist without her belief in the project. During the production process, Asma Azeezullah was my helpful guide.

Prologue

Modern environmental management and science as a combined discipline is more than half a century old—put its birthday as January 1, 1970. On this day, the concept of environmental impact assessment (EIA) replaced previous approaches to evaluating and assessing the worthwhileness of major projects, such as dams, highways, mines, power plants, tourism resorts, broad-acre agricultural developments, basically any new thing that was likely to have a negative impact on the environment while also providing benefits. No longer would the "bottom line" be simply the prospective benefits; unless they outweighed the long-term costs, projects would not be deemed worthwhile and sustainable.

This was to be achieved via a paradigm-changing law of the Congress of the United States of America, titled the "National Environmental Policy Act", which was to spread to the rest of the world. This law was signed in late 1969 by the then-American President, Richard Nixon, to take effect from the start of the next year. A precedent was set, and country after country followed suit—some quickly, as was the case of Australia, while others took their time in adopting the new concept. That is understandable—it was a radical change. While no one person and no one case of pollution or resource depletion was responsible for the paradigm change, it would be a historical mistake to not recognize Rachel Carson's 1962 book, with its emotive title, "Silent Spring". This book did more than anything else to alert humankind that environmental degradation was counteracting human progress. Biology, botany, chemistry and the other major bio-chemical-physical sciences got to earn their place in public policy, and in discussions in business boardrooms. This was unheard before the introduction of EIA. To complement this development, the discipline of economics faced the challenge of incorporating environment impacts in its previously sole, pre-eminent role in decision-making. Today, the concept of environmental impact assessment is acknowledged worldwide and practiced in some form in the majority of countries.

I commenced writing this book in 2020 to acknowledge the 50-year milestone. That achievement was, I reckoned, worthy of a book. The book—this book—was not simply written to celebrate the birthday without turning a critical eye on how the practice of environmental impact assessment has developed, and how it could—should—be improved. The thrust of the book is on how to advance the practice—and, where necessary, make theoretical changes. A critical eye, one might expect, would find shortcomings—possibly, even serious faults. This proved to be the case. I propose a new stage, the second stage, of environmental impact assessment, one in which considerable attention is paid to enhancing the skills of environmental practitioners and advancing the recognition of these people as professionals—I call them "Earth Doctors".

In the lead up to the introduction of environmental impact assessment, there had been an awakening to the fact that the life-support system provided by Planet Earth needed to be protected, if a good life on Earth was to be sustained. We needed to know what harm we were doing, and how to bring that to a halt—if not directly, by taking action to offset the damage. We needed to ask what was the impact of our lifestyle, of the production of the goods and services we needed for survival and, over and above these goods and services, the goods and services we expected—and, if rich enough, got—for our increasingly environmentally demanding mode of living?

We are not all rich, with the choice to ever-expand our material consumption. If poor, we struggle to meet our basic needs, and when extreme poverty sets in, our next meal is all that matters, and helpless as we are, nature is required to provide or give way, often harmed as a result. As a consequence, we are even poorer in the future. To make matters worse, our human numbers keep increasing, which means just to stand still on a per capita basis, our demands on the natural environment continue to increase.

It was the mid to late 1960s that we realized that we needed to measure our impacts on the environment. Complaining about local pollution was not, by itself, going to change matters. We had to look to science to provide the understanding and the solutions. Only empirical evidence would convince our fellow citizens and voters and, importantly, politicians and others with power, of the need to manage and reduce, where necessary, our negative impacts on Mother Nature. In seeking a sustainable future as a species, we realized that we were not to overlook each other and the other animals with which we shared the planet. The future was to be “Our Common Future”. Some many years later, this was to be the title of a book which introduced to the world the *sustainable development* imperative.

As a result of our increasing concern with pollution, resource degradation and per capita material demands on a finite Earth, *Spaceship Earth* was coined as the apt name for the planet. We invented a procedure based on scientific assessment and a set of tools to measure and evaluate how we were impacting the health of the planetary ecosystem. We gave it a name—Environmental Impact Assessment. This book is its story—warts and all. As it comes with warts, I am duty bound to seek and identify remedies, and this takes us to what has to be done—soon. Fifty years is more than enough time to get it right.

The book is a source for those charged with managing our relationship with Mother Earth (as we fondly name the planet). This does not limit its readership to those engaged in environmental impact assessment as paid professionals. Far from it. Any interested or concerned citizen is, via the explicit right to scrutinize and comment on environmental impact statements, involved in environmental management. This invitation to public involvement is one of the radical features of the EIA concept. This book is also a source for those charged with teaching the next generation of environmental practitioners; it serves as a text for their students.

The case is made that the disciplines of environmental science and environmental management have reached the stage of development and maturity that an agreed, common curriculum is practical. It certainly is necessary. Once formulated and agreed to, this common approach will go a long way in improving the practice of environmental impact assessment. History illustrates that professional practitioners in all fields of endeavor have, once their profession reaches maturity, found it necessary to agree on the basic material that is to be taught to future practitioners. I have come to the view that we have with the success of the medical profession an appropriate, time-honored model in professional education and standard-setting. I find many similarities between working to safeguard human health and working to safeguard the planet's health. As noted above, I have labeled future environmental scientists and environmental managers *Earth Doctors*.

My challenge is to deal with the most important environmental impact issues in a readable form. To this end, I use minimal scientific jargon, with no resort to mathematical equations (I firmly believe whatever can be expressed in mathematics can be more eloquently conveyed in English) and no assertion of scientific certainty where there is none. That noted, the book provides an evidence-based exploration of all relevant matters. The sciences I rely on are ecology, and its various subdisciplines, plus economics and all the relevant social sciences. This reliance on science puts this book in contrast to the numerous polemical treatments of environmental issues.

As a scientific journey, I am conscious of the wise advice of famous brain surgeon Henry Marsh. I quote him here:

> *Science is … a long series of questions. You open one door into a room, only to find many more doors, with yet more doors beyond them. You are less likely to get lost in the resulting maze if you start from the beginning.* (*New Statesman, 24–30 April, 2020*)

I start by opening the first door. However, I might not examine in full detail what is the first room before I am led by enticing clues into the next room. I hope you will excuse me when I do this. I usually return to the earlier room to complete my unfinished exploration. My frustration in writing the book was that I kept coming across yet more doors—but, if I was to get this book into your hands, I had to restrain myself from opening each and every one of them. In being selective, I hope I have not left unexplored your favorite topic.

There is one name that you will read a number of times in the book. It is Adani. It refers to a proposed coal mine in outback Australia, and to the owner of the proposed mine, Gautam Adani. According to public reports, Mr. Adani is the second richest person in India and the third most powerful person in that country. He is clearly a member of the *one percent*. His mine is in the Galilee Basin coal deposits, situated in the State of Queensland. The Galilee Basin is the same size as the United Kingdom. That is some coal deposit!

As of 2021, the year of publication of this book, the environmental impact assessment process for this mining proposal had been underway for over ten years. Draft, supplementary and final environmental impact assessments have been prepared, published and publicly criticized. Various aspects of the science in these assessments—of both an ecological and economic nature—have been challenged in the courts, and a serious mistake found and admitted to by the proponent. Nevertheless, conditional approval has been given to the project. However, more legal challenges are likely—and there is yet no proof that the offset conditions for endangered fauna and flora will be successful.

The Adani mine proposal deserves its appearance in any book on the subject of environmental impact assessment. On a world scale, the project and its assessment already sit alongside the other *celebrated*—for the wrong reason—examples of extremely controversial environmental impact assessments, and the end is not clearly in sight for this one. There is much to learn by scrutinizing the Adani case.

The Adani story is guaranteed a place in the history books. The most controversial issues in environmental impact assessment play key roles in this case—how to account for the climate change impacts of burning coal? Will local graziers lose much needed water due to its allocation to the mining process? Can an endangered bird be saved? If not, will this be the death-knell for environmental offsets? Will the people who own the coal, the citizens of the Australian State of Queensland, be financially rewarded via royalty payments from the mining company? Will the money paid to the Queensland government be invested in a sovereign wealth fund, with the aim of providing a flow of income into the future? Will local workers get jobs in mining, and, if so, how many? Many of these are issues common to environmental impact assessments around the world.

The concept of environmental impact assessment is one of the very few progressive ideas in recent human history. If allowed to achieve its potential, then it has the ability to guide humans to a sustainable—and enjoyable—future on Planet Earth.

I welcome feedback on any aspect of this book and can be contacted by email: t.hundloe@uq.edu.au.

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Part I

The Background to Environmental Impact Assessment

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Environmental Impact Assessment: The Awakening

Introduction

Fifty plus one years ago, on the first day of 1970, environmentalism became of the mainstream. It did not arrive out of the blue, so to speak. Its near history was but an element of the ferment of the street politics of the 1960s, dwarfed by the civil rights movement, the anti-Vietnam War campaign, newfound feminism and the free speech movement. Rachel Carson had sown the seeds early in that decade with her paradigm-changing book *Silent Spring*. Paul Ehrlich, in 1968, with his fear of overpopulation and excessive demands on planet Earth, put an ever-increasing human population on the agenda. Massive oil spills at sea, the *Torrey Canyon* of the coast of Cornwall in Mach 1967 and the Santa Barbara oil spill in January 1969, brought, via television, environmental catastrophes into dining rooms. Smog in New York City and Los Angeles was all too obvious to citizens of those two cities. An environmental awakening was inevitable.

Environmentalism's more distant history dates to the declaration of Yellowstone National Park in 1872, followed by the 1879 declaration of Royal National Park on Sydney's south side. These were numbers one and

T. Hundloe, *Environmental Impact Assessment*, Palgrave Studies in Environmental Policy and Regulation, https://doi.org/10.1007/978-3-030-80942-3_1

two in the world in what became a global roll-out of National Parks. This seemed to be a promising start to a new approach to our relationship with the natural world. The early promise withered on the vine. Notwithstanding the massive soil erosion in the 1930s of farmlands in mid-USA, the famous London *smog* of the early 1950s, the increasing pollution and resource degradation, as well as the threats to both human health and that of the other animals, there was a general *laissez faire* attitude until the 1960s.

The Awakening

Rachel Carson's paradigm-changing book *Silent Spring* was published in 1962. She told a simple story—simple once we read the book and then came to understand the reason for the broken bird eggs and deformed hatchlings we saw when walking the coast. Chemicals in various mixes were shown to have a very nasty side—one example became obvious once our eyes were opened. Spraying DDT, to control mosquitos and for other purposes, resulted in it entering the food chain of marine life, and eventually the eggs of sea birds (the birds dependent on that poisoned marine life) were laid ill-formed and with weak shells. In the years following Rachel Carson's message, television films showed the devastation of rice fields and tropical forests—and innocent people—as napalm bombs and agent orange were used in the unsuccessful attempt to defeat the Viet Cong in Vietnam. Oil spills were becoming, if not common, too regular to be dismissed—the Santa Barbara spill was the largest to that time. Acid rain, a mixture of chemical pollutants in the atmosphere, was killing lakes and forests in Western Europe and Northern America. These disasters did not go unnoticed. The media was taking a serious interest and the public was perturbed if not alarmed.

In Australia, the Great Barrier Reef, the world's largest living marine ecosystem, was being eyed-off by the oil industry. The industry had been given exploration permits and, in an unrelated proposal, the mining of limestone on the Great Barrier Reef was about to commence in 1967. In New Zealand, in Fiordland, Lake Manapouri was threatened by a hydro-electric scheme, which was to provide an aluminum smelter with cheap electricity. The tundra and permafrost of Alaska and northern Canada had been studied by geologists, and the mining and transport south of fossil fuels by extremely long pipelines was soon to be the major environmental issue in the north of America. It was difficult not to look to any of the world's continents (except Antarctica) and not find cause to ask: are we confident that we will not cause damage—serious damage?

A public increasingly aware of environmental matters, some of which were disasters which had happened, others scary possibilities such as an uncontrolled oil spill on the Great Barrier Reef, wanted a say in what was being done to the planet. We only learned of a damaging event when the oil-coated birds struggled out of the oil-slimy sea. We discovered that a government with no concern for the long term—and potentially open to corruption—was exposed by a hardworking journalist to have allocated oil-drilling leases on the Great Barrier Reef. People were very keen for more information, particularly scientific information. The usual bland public announcement that a dam was to be built on a river in a certain valley, without explanation of why and how it could impact both the natural and social environment would no longer suffice. The public would eventually succeed in their demand for something better. The better would be the philosophy, procedures and practice of environmental impact assessment.

The Books That Changed Our Thinking

It was not only Rachel Carson's book that was the stimulus for change. The late 1950s through to 1970 was a period when numerous paradigm-changing books were published, most best sellers—that is why they changed paradigms. Only one, which I mention here, was directly aimed at environmental matters, Paul Ehrlich's 1968 *The Population Bomb*—it led to the formation of the Zero Population Growth organization. The others dealt indirectly with environmental issues. But because they went to the nature of late-twentieth-century *laissez-faire* materialist society, they were powerful contributors to the paradigm change.

There were Vance Packard's 1957 *The Hidden Persuaders*, his 1959 *The Status Seekers* and his 1960 *The Waste Makers*, all of which were in the tone of Thorstein Veblen's satirical attack on *conspicuous consumption*, which had been published at the end of the previous century. Conspicuous consumption was a *keeping-up-with-the-Joneses* zero-sum game—and very wasteful of resources. To this very day we struggle to have those who can afford to keep-up-with-the-Jones come to understand that there is no winner in their pursuit of public attention, and in spending their money in this competition, they are forgoing the enjoyment of many other things that could be bought with that wasted money.

Eminent economist, John Kenneth Galbraith, published *The Affluent Society* in 1958, in which he outlined the high level of private affluence with a poverty of public goods. He followed it with *The New Industrial State* in 1967. These books helped sow the seeds for a marriage of economics and ecology. Then there was Ralph Nader's *Unsafe at Any Speed* released in 1965. In 1966, Kenneth Boulding published *The Economics of the Coming Spaceship Earth*, and in the same year, Barbara Ward published *Spaceship Earth*. The notion of a finite planet threatened by overpopulation, resource depletion and pollution was firmly established in both of these books. Economists were adding their weight to the public concerns of the biologists. In the same period, English environmentalist James Lovelock was promoting his *Gaia* thesis. In a following chapter, we will meet a range of authors who are specialists in the environmental field. For a more detailed history of the events, the ideas and the people behind them, go to Appendix 1.

The Birth of Environmental Impact Assessment

It was in this extraordinary political and intellectual environment that the then president of the USA, Richard Nixon, read a public mood in need of placating. No, not on the war on Vietnam—well not immediately. Nor did he necessarily read the public mood on the other matters that had brought hundreds of thousands on to the streets in his country. However, Nixon understood the concern for the environment as something fairly easy to placate, and by an act of Congress elevated environmental matters into the mainstream of public policy. In an immediate sense, this was a costless policy initiative. That it was costless in a political sense—it improved his standing—is what made it attractive to Nixon. It would be years before complaints were laid that this *green-tape* was a form of red-tape frustrating the business of moneymaking. We do not know if Nixon exercised his mind on the long-term impact the statute he signed into law could have. It seems not and we can be thankful. It was going to change the world. If Nixon came to realize that, it was too late once the law came into being—*it was too late to shut the gate, the horse had bolted*. However, if the horse was to be a winner, it had to stay the distance. Environmental management and its tool EIA have proved to be long-distance stayers—getting to the 50-year mark and beyond is proof of that.

Nixon's initiative was based on an idea formulated by a consultant to Senator Henry Jackson, Lynton Caldwell. Nixon's initiative was brought about by a law signed at the end of 1969, to become effective on January 1, 1970. The law was titled the *National Environmental Policy Act* (NEPA). It introduced to the world the concept of *environmental impact assessment* (EIA) and the public release of reports of these assessments, called *environmental impact statements* (EISs). There is a consensus that if there was to be a *magna carta* of environmental laws NEPA would be it. There will be a number of mentions of this paradigm-changing law throughout this book.

In 1968, Lynton Caldwell had drafted a document that was to become the genesis of NEPA. It was titled *A National Policy on the Environment*. Caldwell was an academic, teaching and researching in the field of public administration, a disciplinary offshoot of economics and political science. He was one of the very early advocates of environmental education and was instrumental in founding, in 1972, the School of Public and Environmental Affairs at Indiana University. Only Australia's Griffith University's environment school was to be established earlier, in 1971.

Today, in the order of half the world's nations have a form of EIA based on NEPA, others have homegrown laws that were probably influenced by NEPA. We cannot be sure. For a range of reasons, mainly depending on the form of government and institutional settings, as well as the strength of nongovernment environmental organizations—not to downplay the attitude and interest of politicians in environmental management—there is around the world everything from strong to weak adherence to the

NEPA principles. This will become obvious when we describe the theory and practice in some of the major nations.

However, there is no secret that the Australian EIA law was initially, and remains, the one most in common with the groundbreaking American EIA statute of 1969. In 2011, American author Jessica Rieder set out to compare EIA law in the USA and Australia. She concluded that both are *landmark laws*. That cannot be claimed for the other NEPA clones. It is for this reason that I shall, when appropriate, make reference to NEPA and its Australian counterpart. The redeeming characteristic of the Australian EIA law is its consistency over the decades. In near to 50 years, there has only been one change, and that has strengthened the law by identifying environmentally precious areas and endangered fauna and flora species which are to be protected in all circumstances. A number of precious areas will never be subject to an EIA, for example, to drill for oil on the Great Barrier Reef.

Reverting to NEPA, an unheralded environmental advisor to President Jimmy Carter, Nicholas Yost, has recently contemplated and commented on NEPA's history. In his publication *NEPA at 50* he comments:

> *Good ideas are contagious; I believe NEPA is the most imitated law in history.*

Undoubtedly, in 1970, it was time for this law. Interestingly, Australia's EIA law was a result of the Australian Labor Party taking office after 23 years of conservative government. The political campaign was labeled *It's Time*.

An Initial Description of EIA

Before our unraveling of EIA, it is appropriate to, ever so briefly, define the concept. The United Nations Economic Commission for Europe (UNECE) could not be briefer: it states that an EIA is *an assessment of the impact of the planned activity on the environment*. Somewhat more helpful is the description by the International Association for Impact Assessment (IAIA). For more information on IAIA, go to Appendix 2. The Association defines EIA:

as *the process of identifying, predicting, evaluating and mitigating the biophysical, social and other relevant effects of proposed development proposals prior to major decisions being taken and commitments made*.

The focus was, and remains, on large projects, such as dams, mines, pipelines, power stations and the like. In the initial announcements on the scope of EIA, undertaking EIAs on proposed government policies, including major taxation changes (an EIA on a carbon tax would be very sensible), was floated as a possibility. The fact that EIA has remained stuck with project assessments, and not being directed to assess government policies, programs or tax changes could suggest there was, and is, no political appetite for this to occur. This is a serious shortcoming, and until it happens, EIA will fall short of its paradigm-changing potential.

That noted, if EIA had been opened up to include these higher-level governmental matters, it would have been radical beyond imagination. In a muted response to the shortcomings in EIA practice, there has been the development of what has come to be called *Strategic Environmental Assessment* (SEA). As a concept, this method deals with some of the higher-level matters that EIA was supposed to deal with when it was originally formulated. Matters such as long-term infrastructure planning and resource development (where government has a role) are the main subjects of SEA. The willingness to engage in SEA is a country-by-country situation. In no country does it go to the fundamentals of government policy formulation. This is not to suggest that environmental impacts are necessarily absent from the cabinet room discussions that take place before major government decisions are made, rather it is to make the point formal EIAs are not prepared and put to public scrutiny for certain types of governmental decision-making.

There is another broad-ranging matter that was intended to be dealt with in an EIA. It is the notion of cumulative impacts—not just this mine, but the adjacent one, and the next adjacent one, where mining is in competition with agriculture for land and water. It is argued—and with justification—that an assessment is much improved, and potentially made easier, if the totality of proposed developments in a region is determined at a *planning* level. If a major ore body exists and many mines are proposed, it is far better to analyze the total impact than a sequential set of separate EIAs. In these situations, the value of SEA and cumulative assessments is recognized, but inertia—or fear of what the conclusions of such studies might be—has slowed progress, in some cases stymied it.

Strategic Environmental Assessment

The subfield of EIA now known as SEA developed in the 1990s, 20 years after the commencement of EIA. The SEA concept is described by the United Nations Economic Commission for Europe (UNECE) as *an extension of EIA principles*. I shall quote the UNECE on this matter although you will come to appreciate (when I develop the EIA concept in detail) that its statement is only appropriate with regard to the practice of EIA, not the theory. And even then, it applies only at project-level planning and program delivery, not for changes to policies and laws, which, initially, were to be subject to EIA. If EIA had been adopted to its fullest extent, there would not have been a need for SEA. So, what is SEA?

In its *Resource Manual to Support Application of the Protocol on SEA*, published in 2012, the UNECE stated:

> *SEA has evolved largely as an extension of EIA principles … it … offers a number of advantages compared to the EIA of projects. These follow from the higher level of plan and programme making, which sets the framework for projects subject to EIA.*

The asserted advantages of SEA are said to include the ability to consider a wider range of alternatives than in an EIA, the ability to influence the type and location of projects, an enhanced capacity to address cumulative impacts, avoidance of irreversible impacts and ability to safeguard protected areas and critical habitats. All these matters were intended to be dealt with in a standard EIA. Had they been, there would have been no role for SEA.

I must make very clear at this stage that, while recognizing the limitations in EIA practice—these are explicitly exposed in the latter case study chapters—my intention is to stay true to the original EIA theory. Whether we call a competent assessment of environmental impacts, EIA or SEA is of no consequence. My preference is to stay with the original term, one very good reason is that the public know this term; or if not EIA, they know EIS. There is, as far as I have been able to ascertain, no such thing as an *SIS—Strategic Impact Statement*—to substitute for EIS.

While on the subject of terminology, there is one other term that I believe we should avoid using for this same reason, to reduce any confusion and to cement EIA in the public's mind. It is the use of *effects* (as is done in some countries, or parts thereof) in place of *impacts*.

For readers wishing to delve into the separate SEA literature, I suggest two publications—there are many more. One is a short essay by Barry Dalal-Clayton and Barry Sadler published in 1999, titled "Strategic Environmental Assessment: A Rapidly Evolving Approach", and the other a lengthy book edited by Barry Sadler and colleagues, published in 2010, titled *Handbook of Strategic Environmental Assessment*. Barry Sadler, a friend and colleague, is a name one comes across over the many decades of policy formulation for EIA and SEA. Barry Sadler from Canada, plus Martin Ward from New Zealand, John Ashe and Brett Odgers from Australia and I were for some number of years members of a tri-party governmental group tasked with deliberating on EIA and SEA.

I shall have much to say in due course about the benefits—in fact, the need—to undertake project-based environmental assessments in a strategic framework. A strategic overview, in terms of a thorough understanding of a nation's (or a region's) resources, human population growth and demand for its exports, allows for a wide-scoped deliberation on future scenarios. It is a prerequisite for what can be thought of as a tiered system of decision-making; that is a project-specific EIA following on from an SEA, where the project being assessed would need to have passed the SEA hurdle before being subject to a finer detailed EIA. We should not lose sight of the fact that in its original form, an EIA was required to do what a combined SEA/EIA would achieve.

Strategic Environmental Assessment as Environmental Planning

The notion of SEA has become in some scholarly circles *environmental planning*. In other words, land-use planning, regional planning, economic planning and social planning, within an environmental context, have been rolled into a new discipline known as environmental planning. It is interesting to note that all these individual forms of planning, excluding strict attention to environmental impacts, have existed for many decades in modern societies. Governments have engaged in long-term strategic planning when the will has existed.

It is very noticeable that changes in economic ideology result in attitudinal shifts to planning, with some governments keener on planning than others. Never, even with governments who deem any notion of planning socialism, does a totally *laissez-faire* attitude exist; that is, a complete disregard for planning. On the other hand, except in very unusual conditions—the New Deal in the USA—does government take complete control of development. I am, obviously, disregarding the practice of the defunct Soviet Union and pre-1979 China.

Environmental planning, where it is practiced as a new, separate discipline, tends to be confined to localized urban matters and is not applied as an SEA tool. However, governments are generally known to take a strategic approach—call it planning for the long term—when it suits them. This illustrates that it can be done. Examples include the setting aside of large forest areas as in Norway and the other Nordic countries (called State Forests in some countries); identifying and protecting certain mineral resources (an example being quarry sites, given their importance in providing road-building material); quarantining good quality agricultural land from urban expansion (in many cases very poorly done, in others exemplary); identifying and protecting highly valued areas as National Parks (not usually done comprehensively) and building roads and railways to serve important agricultural and mining industries. There are more examples. In most cases this high-level planning has had one or two primary foci, assisting resource industries and/or national defense.

Much of the strategic infrastructure planning, such as railway construction across Canada, the USA and Russia, was driven by a combination of economic and strategic defense purposes. In fact, this dual rationale can be identified in most large and strategically placed countries around the world. In German-occupied Norway in the Second World War, slave labor (prisoners of war) was used to build a railway in the far north of the country, while, in Australia, the railway construction was north-south along the resource-rich eastern part of the continent. This made sense for defense purposes and was utilized for this purpose in the Second World War. In England in the nineteenth century, the construction of canals, followed by railways, was an economic imperative.

With the advent of truck transport, road construction has replaced railway development; not entirely, if opportunities for the latter still exist. Long-distance road building is something that countries undertake on a strategic basis. There is likewise the planning of electricity transmission to meet both urban and industry demands. The point with these various examples is that strategic planning is nothing new to most countries, and hence it would be easy to expand economic and engineering planning to incorporate environmental considerations rather than come to them some time in the future when a proponent comes to take advantage of the rail line to transport minerals from a mine to a port, as can be the case.

With EIA Prevention Is Better Than Cure

There is something special about EIA in comparison to the myriad of other environmental processes that are required to be followed in most countries. Glasson and Therivel, who in 2019 published the fifth edition of their book *Introduction to Environmental Impact Assessment*, choose one word to sum up the difference between EIA to other environmental processes, *prevention*. These two experts repeat the mantra of medical practitioners—*prevention is better than cure*. In a future chapter I shall deal with the similarities between the role and responsibilities of medical doctors and those I have chosen to call *Earth Doctors*, otherwise environmental practitioners. This takes us to the next topic, the emergence of environmental practice as a discipline—admittedly still in a stage of evolution. In the concluding chapters of this book I shall present my manifesto for a strong, robust and formally recognized environmental profession. Here the topic is introduced.

A Profession Comes into Being

The enactment of NEPA had a manifest impact on the emerging environmental science and environmental management professions. It led to university degrees radically different from the conventional, narrowly focused degrees that had emerged throughout the nineteenth century as *natural philosophy*—the name given to all scholastic endeavors. By the twentieth century, natural philosophy had given way to a spate of new disciplines. Natural philosophy was an all-encompassing science. For example, when Charles Darwin and Alfred Russel Wallace were independently developing the theory of evolution, there was no discipline of ecology. It came into our vocabulary in 1866. In the social sciences, sociology and psychology did not claim disciplinary status until the end of the nineteenth century.

With the proclamation of NEPA, there was a rush by existing consulting firms, which were mainly in the engineering field, to retrain staff and recruit graduates with the requisite knowledge so that they could compete for EIA projects. Except for one very unusual case, environmental degrees did not exist in the early 1970s. Interestingly, there had been since the mid-1950s, a degree in *environmental studies* offered at the New York College of Forestry, at Syracuse University. University courses in forestry and agriculture were ideally suited to take on teaching environmental degrees for the simple reason they incorporated biological and botanical knowledge with economics. I cannot find another university that entered the environmental field in the pre-NEPA era. In the post-NEPA era, it is generally accepted that the environment degree offered by Griffith University in Australia was the world's first. It took its first enrollments in 1971 and undergraduate enrollments in 1975. This was my academic home for 18 years, where for 5 of those years I was the Director of the Institute of Applied Environmental Research.

The Emergence of EIA *How To* Guides

A vast literature on EIA soon developed with the enactment of NEPA. Initially this was written by American experts but then spread worldwide. A relatively diverse range of disciplines were represented in the first tranche of publications. Because those who were most likely to be commissioned by project proponents to undertake environmental assessments were existing consulting engineering firms—there were no large environmental consulting firms in existence—engineers were among the first to engage in developing approaches to EIA. There was no ready-made *how to guide*. This was because EIA required evaluation of topics typically ignored by professionals such as engineers and accountants or economists, these being the people conventionally having the responsibility for project design, oversight and evaluation. We cannot blame them—EIA was, as noted, a paradigm-changing approach to assessing, designing and recommending or rejecting projects. Undertaking an EIA would require a far greater range of skills than those of a well-trained engineer or economist. To assess complex projects such as mining, dam-construction, tourist resorts and freeways, a number of experts from a range of disciplines would be called upon.

The challenge was—and to a significant extent remains today—how to bring together a wide range of disciplinary-based assessment reports such that the ultimate decision-maker, say, a government executive or a politician, can comprehend the *overall* impact of the project. It is this *total picture* which is important. It will determine if the project be permitted to proceed, require modification or be rejected outright. Should the project be accepted with modification, or with some form of compensation for adverse impacts unable to be mitigated, this would be determined by the EIA process.

In the early days of EIA, the methodology applied to assess environmental impacts was driven by legal and policy initiatives, rather than evolving as traditional disciplines do, based on scientific discoveries and peer evaluation. The conventional approach would have new ideas and practice come to be known through the publication of paradigm-changing books or major journal articles. Consider how the discipline of ecology commenced and developed. We could start with the genesis of biology in the writings of Aristotle. In more modern times we are likely to go to the research and publications by eminent scholars such as Carl Linnaeus, Adam Smith, Alexander von Humboldt, Thomas Malthus, Charles Darwin, Alfred Russel Wallace and Ernst Haeckel. If you are surprised that there are two economists in the group it is because Darwin, in particular, read their works and applied their insights in his formulation of evolution. If nothing else, this suggests the marriage of natural science and economics at a very early stage.

The general point is that we expect new disciplines to emerge from within the scientific community rather than be the result of a government initiative as EIA was. This unusual birth of the EIA discipline is the reason that it is still, more than 50 years from its formation, without an agreed, uniform curriculum for training its practitioners, a matter that is extremely unusual for a profession. A matter I seek to resolve in this book.

Reverting to the earliest days of EIA, there was no manual on how to do it. The specific EIA literature that was developed focused on lengthy checklists or combining lists into a matrix. In a matrix there would be on one axis a list of environmental attributes which had to be considered, for example, the local atmosphere, the local flora and, say, the health of the likely-to-be-impacted human population. On the other axis, the particular action causing the impact would be listed. For example, if the project was to build an industrial estate, one environmental attribute could be water quality, while the list of actions could include the type of businesses allowed to operate on the estate—from clothing manufacture, to printing, to cement making and so on. If a particular type of business was far more likely to emit polluted water, its assessed importance would be higher than for other types of businesses. As an example, if there was to be only one factory likely to emit polluted water, the magnitude would be low; but, if the pollution was severe, the importance would be high, as it would be if there were to be a number of water-polluting factories.

For each measure of an action on an environmental attribute, there would be a cell in the matrix. Imagine a diagonal line drawn in each cell, creating two triangles. In one triangle there would be written a number between, say, 1 and 10, indicating the *magnitude* of an impact; for example, a measure of particulate pollution emitted. In the other triangle of the cell would be a number, again between 1 and 10 expressing the assigned weight given to the *importance* of the impact on human health. If the project was a major freeway through residential areas, noise pollution would be an important negative outcome; the busier the freeway the greater the magnitude of the impact, and given disturbance to families residing along the route, the impact would be high on importance.

In the case of the freeway, what I have described as a negative impact on residents is only one of numerous impacts, and a direct impact. A freeway would not be considered unless it had positive impacts. The increased and faster flow of traffic would be a direct positive economic impact. However, the freeway could cause the physical separation of a local community, cut in two by a very busy and wide road. This would be a direct, negative social impact. Using the matrix scheme described above, the relative importance of the various impacts would need to be assigned subjective values. Both negative and positive impacts would be treated in the same way. This arrangement, although a well-intentioned start, was far too subjective to gain scientific credibility. It would not last. However, that is far from the end of the story in the search for an EIA methodology. This is for later in the book.

Construction of checklists and matrices was not difficult per se, although those involved in this work were required to widen their scope and list impacts (both positive and negative), many of which engineers and financial planners would not have paid heed to prior to the introduction of EIA. These previously neglected impacts could be on the natural world and/or on people. They were what economists call externalities, because they would have been external—outside—the conventional matters considered in approving a project such as a freeway.

In the early days, the identification and measurement of impacts tended to range from simple technical exercises to complex ones. Staying with the highway example, taking measurements with a noise meter at traffic flows at an existing highway with similar traffic flows to those expected for the proposed freeway would provide reasonable predictions of what to expect with the proposed freeway. A result of higher than acceptable noise would lead to modifying the freeway design by, for example, constructing noise barriers or planting a dense line of bushy trees and shrubs along the periphery of the freeway.

Assessing the impact of a freeway that cut through animal habitat, restricting animal movements, would be a more complex task, particular if the range of animals was wide and one solution, for example, overhead animal bridges would not suit all the species of animals intent on crossing the freeway. While an overpass might suit one species, an underpass would suit another; a narrow, light-weight swing bridge would suit koalas in Australia, but a strong, wide bridge would be needed for elk in Canada.

I shall truncate the discussion on the earlier approach to identifying and *measuring* impacts. The recording of numbers was relatively subjective, and in some hands nonsensical, however well-intentioned. The early EIA practitioners were concerned that *if it can't be measured, it does not exist,* the problem before EIA was invented, and therefore it could not be allowed to stymie EIA before it had established itself. As I have noted, the matrices and their near-magical numbers did not last, and EIA practitioners lowered their sights on the matter of aggregating impacts, both the negative and positive ones, while seeking objective measures for each individual impact. In the freeway example, the noise level from peak hour traffic might increase from 60 dB(A) to 64 dB(A) (where dB(A) are decibels weighted to account for sound levels as perceived by the human ear); and, the number of animals killed by inadvertently finding themselves on the busy freeway would increase by 10 percent. How to aggregate these two very distinct measures was left to a few theoreticians to ponder.

Let us go to a major feature of EIA, interdisciplinarity.

Essential Interdisciplinarity

To be true to NEPA, the approach to the assessment had to be interdisciplinary. NEPA called for a *systematic interdisciplinary approach*. Many years after NEPA came into being, in 1987 when sustainable development was launched as a global imperative, published in book form as *Our Common Future*, the focus was on what were called *interlocking* issues. The imperative to adopt interdisciplinarity had been slow, and hence the need to reinforce it in 1987.

What was called for was not simply a matter of adding botanical, biological and zoological studies of the impacts of the project to the standard engineering and financial analyses—these latter two foci were what had sufficed as project assessments previously. Of course, adding biophysical impacts was a significant improvement on the pre-NEPA practice. Some would say that alone was enough to justify EIA. To go beyond simply adding other matters to be assessed would have put EIA in the realm of what was called multi-objective planning, a particular decision-aiding tool much favored by Dutch experts, and more generally town planners. Taking this approach, an EIA would offer no firm conclusion as to the overall benefits and costs of a project. Someone would still have to figure out what in totality the various disparate numbers meant in terms of net impact on the environment. We would be back to where we started. Weighing up the disparate elements (biophysical, economic and social) would be left as a task for the ultimate decision-maker, usually a government official or cabinet minister. One could surmise that in this case, decisions would be more politically based than science based—at least this would be the impression given. And we know which of the two categories of people is most trusted.

An interdisciplinary approach is different as it would require serious attempts to integrate across the separate disciplinary analyses, in other words to conceptualize the economic and social impacts of a project in biophysical terms, and vice versa. As noted above, there were very few experts with required interdisciplinary education—only those in fields such as agricultural economics, forestry and fisheries would have been able to claim some expertise as interdisciplinarians. It would be left to the universities to remedy this—and, with a handful of exceptions, it would be some time for this to happen, if it was to! Interdisciplinarity is promoted in universities, but serious attempts to make it work are few and far between. This work has to be advanced if EIA is to become a strictly technical, scientific matter, beyond politics.

In Conclusion

The search for a methodologically sound and acceptable integrative approach has continued. As noted, to this day, this matter remains unresolved—accept that a degree of rigor has been brought to bear through the linking of EIA to the principles of *sustainable development*, and in one very explicit manner. Here I quote from *Our Common Future* (p. 49):

> *Critical objectives … follow from the concept of sustainable development [including] … merging environment and economics in decision making.*

It has taken some time, but recently the much-revered science journal *Nature* has appointed an economics editor. As we will come to understand, the practice of EIA still struggles at integration. Nothing can be clearer: the integration of ecology and economics, intergenerational equity, intra-generational equity and the relationship between human population growth and the health of the environment are the basics of EIA in the age of sustainability science. In Chap. 2, we come to a detailed discussion of how EIA can be subsumed under the ambit of sustainable development, paying special attention to the ethical principles of sustainability.

Appendix 1: The Historical Background to EIA

It is difficult not to marvel that today we have EIA, and that it came about in the USA only seven years after Rachel Carson's *Silent Spring* was published in 1962. It is easy to assume all was plain sailing for Rachel Carson and her research into the dangers to life of DDT and other chemicals which were being sprayed around willy-nilly. Far from it. Historian James West Davidson in *A Little History of the United States* reminds us of the reaction to her book. In a land where motherhood is second to apple pie, Carson was described publicly as *a spinster with no children*. Worse was to come. Of all the abuse thrown at her, she was described as *probably a communist*. Be mindful that the USA was just coming out of the McCarthy era in which the naming of so-called *communists* destroyed many careers. Only a few years earlier, Julius and Ethel Rosenberg—who had two young children who would plead to the US President to save their parents' lives—were executed for being Soviet spies. We will never know the truth of that matter, but it illustrates the desperation and the fear the then American ruling class had of communists. You might think being branded a likely communist was enough to relegate Carson's research to a rubbish bin, but there was even more to the campaign to condemn her. Note that communists are supposed to be atheists, and Sam Harris in his *The Moral Landscape* reminds us that atheists are the most stigmatized minority in the USA. Carson stood above this nonsense. Let us go to a potted history.

* * *

Environmentalism commenced before the public protests and *hippie* happenings of the 1960s. But first let us recount those years. The newfound awakening of that era needs to be recognized for the new ideas it brought, some leading to significant paradigm shifts in a number of fields. Looking back to that period, it is not surprising that there arose in the liberal democracies demands to remedy social ills and *lighten up*—as the hippies did when they were not protesting.

The previous two-thirds of the twentieth century had been a relatively *dark age*. It was a period of human history that encompassed two horrible world wars, a decade-long economic disaster (from 1929 to the start of Second World War) and some newsworthy environmental disasters such as the 1930s' *dust bowl* in the US west and the London *smog* of 1952 in which 150,000 were hospitalized and 4000 died.

The Second World War over and a return to normality, that is, full employment and the introduction of new technologies (ironically a number resulting from the scientific and engineering feats of the wartime economies), there were brief periods of both optimism and pessimism. The built-up demand for consumer goods following on from wartime rations resulted in significant and sustained economic growth in the already industrialized countries. As a very important aside, be ever mindful that except for a few oil-rich Middle Eastern countries, the planet's poor were bound to remain poor. They might have got independence through de-colonization, but nothing otherwise of note changed. A major reason for pessimism was the Cold War, which at times threatened to be a very hot war conducted with nuclear weapons.

In 1957, we were standing outside of our homes peering into the night sky and, when it appeared, witnessed a tiny shining speck that moved with slow grace compared to the rapid speed of common falling stars. This new celestial body was not ours, but owned by the Soviet Union, which we were told was an evil power threatening the *free* world. The young, in particular, took the politicians at their word—the young were of the view, and took action to ensure, that their lives were to be genuinely free. They were to make that clear in the 1960s.

Young and old were frightened by the Cold War—the Cuban missile crisis remained a nightmare for all who went to bed the night of October 28, 1962, not knowing if they would awake the next morning. They had seen on newsreels the mushrooming clouds over Nagasaki and Hiroshima, and could only wonder at the power of the hellish furnace that killed and crippled the innocent victims of those cities. In the UK vast multitudes marched, led by the eminent philosopher Bertrand Russell, in the Campaign for Nuclear Disarmament. The threat remained.

In the USA, the young could dream along with Martin Luther King Jr. that all people were equal, as the American constitution declared. However, the war in Vietnam troubled many. In concert with Cassius Clay (Muhamad Ali), many citizens, in many countries around the world, had no argument with the Viet Cong. US citizens were being lied to by their President about the war in Vietnam. In 1963, a popular president, John F. Kennedy was assassinated. Some years later, his brother, Robert, a presidential contender, fell to a gunshot as he was on the cusp of becoming president. That same year, Martin Luther King Jr. was assassinated. Where would it end? With four young students gunned down at Kent State University!

By the mid-to-late 1960s, there was a hunger for a better world. It was to draw hundreds of thousands into the streets of the major US cities, and into the streets of Paris, London and Prague, as well as the streets of Australia, Canada and New Zealand cities. The issues were manifold, some overlapped. This emerging public desire for change had its genesis in 1963 with Martin Luther King Jr. explaining his dream for justice and a peaceful, compassionate world. The other social issues were to build on his dream, notwithstanding quite different catalysts. A second-wave feminism returned to build on the first wave of the mid-nineteenth century, which had been led by Mary Wollstonecraft, Harriot Taylor and John Stuart Mill. Democracy, if it was to be at all meaningful, required informed citizens—so out with censorship and in with open, transparent government decision-making, and free speech for all. Overshadowing all was the war in Vietnam.

It was very hard to find space for environmentalism, but it was found. It should be noted that in the industrialized countries there were specific environmental laws well before the legal requirement to assess environmental impacts. A major difference was that the earlier laws were specific—to such matters as water quality, air quality, sanitation, protecting certain animals and the setting aside of national parks and other types of reserves. There was also some very good environmental science underway, but this tended to focus on the pet subjects of zoologists, botanists and, from an environmental health perspective, epidemiologists. With the introduction of environmental impact assessment, environmental science and management were taken to another level, and in due course, EIA was to lead to a range of new disciplines, such as environmental (town) planning, environmental engineering, environmental law and environmental economics.

The counterculture of the late 1960s was not simply rebellious youngsters working out; there was more to being a James Dean clone—if a male—and rebelling *without a cause*. It was not simply beatniks becoming Buddhists and bra-less hippies. There was a scientific and ethical drive—*awakening* is the word I would use—which underpinned the radical social changes that were to take place as a result of the street marches, campus sit-ins and rock 'n roll concerts.

Rachel Carson's identification of the toxic impact of DDT on sea birds led to disgust with the napalm bombing and agent-orange spraying of crops and villages in Vietnam. Ecotoxicology was destined to become a key discipline. The dream Martin Luther King Jr. had led to an awakening that *race* and, hence, *racial* differences were utter nonsense from a scientific perspective. Biology and its concept of the *web of life* attracted university students to this old discipline, which had long languished. Biology formed the basics of the relatively new discipline of ecology.

Feminism led to a demand for family planning and abortion as a female's right, and this indirectly drew attention to the rapidly increasing human population in societies where women were second-class citizens. Population studies such as Paul Ehrlich's *The Population Bomb* drew attention to the limited resources of the planet. Simone de Beauvoir's *The Second Sex*, published in 1949, continued to be a best seller, and in 1969, Gloria Steiner released her polemic *After Black Power, Women's Liberation*.

Lyndon Johnson's *war on poverty* was welcomed—anything was better than nothing, the USA not being a *social welfare state*. While, commencing in the mid-1960s there has been progress in addressing the segregation and poverty of African-Americans, as noted by *The Economist* (June 6, 2020), the progress has been far from enough—in 1970, 47 percent of African-Americans were poor, in 2020, 27 percent were poor, and joblessness for black men remained as a social ill.

The breakthrough that John Maynard Keynes had made in how to manage national economies gave the discipline of economics the rigor it had lacked earlier in the century, and even in the USA the notion of a *mixed economy* was not out of place. The free speech protests called a halt to censorship and the secrecy and the lies told to the American people by their President, Lyndon Johnson, about the war on Vietnam. The cultural, free-spirited, open-minded revolution spread globally in the democracies, including Australia. As I write, the gains of the 1960s are in serious danger of regression, being wound back by so-called *identity politics* and *cultural* wars—zero-sum games retarding genuine progress. I digress. For good reason. Undoing progress has shown to be far too easy—and it is depressing when it is done by people claiming to be working for the common good. Lest we forget, we are all Homo sapiens.

In the 1960s, notwithstanding a litany of very serious complaints which motivated the protestors, the awakening gave rise to optimism—social, political and economic changes were demanded and the voices in the street could not be ignored. There is an enduring benefit from this period, but only if certain conditions prevail. We need to halt the slide of *politics by tweeting*; we need to expand our conversations from *like-thinkers* on *Facebook* to those we disagree with; and, we need to relegate conspiracy theories, such as those espoused by the *anti-vaccination proponents*, to the scientific rubbish bin. Quite some *caveats if we are to succeed!* We have come to the realization—yet again—that knowledge is power, that we need to keep building on our science and be ever mindful that a democratic society is based on genuine public engagement, not the so-called *cancel culture* that is denying genuine dialogue. The progress we have made—admittedly far too limited in some areas—is the result of free speech and free publication. It is through these attributes that good ideas have won out against narrow, vested interests. Without free speech we would not have got environmentalism.

Everything Has a History

There was a time when the coming of spring was announced by the green shoots of plants, the emerging buds of flowers and the early morning melodies of happy birds. By the 1960s, with human numbers multiplying, laissez-fare economic growth unfettered, little boxes spreading and sprawling into the hillsides of ever-growing cities, and tar and cement creating a maze of so-called *freeways*, songbirds were silenced. As noted, it took an extraordinary scientist to awaken us. This scientist was Rachel Carson. Her book *Silent Spring* was destined to become one of the most widely read books of all time. The environmental movement that commenced to develop and evolve after the book's release stood on the shoulders of Rachel Carson. This is not to infer that a concern with our impact on the natural world was a brand new issue—*ex nihilo*—as I explain next.

For readers interested in a global history of environmental concerns, Max Nicholson's 1970 book *The Environmental Revolution: A Guide for the New Masters of the World* is a very good starting point. One cannot miss the explicit optimism in the book's subtitle. This book was one of the catalysts for the formation of the Environment Institute of Australia, to become in more recent years the Environment Institute of Australia and New Zealand. Unfortunately, environmental practitioners are yet nowhere near to mounting the mantle Nicholson thought he was building for them. Progress is both good and patchy across the globe.

Another very worthwhile read is Donald Worster's 1977 book *Nature's Economy: A History of Ecological Ideas*. Note the title. It reminds us that the disciplines of economics and ecology have something in common, if today no more than the same Greek root, *oikos* meaning *home*. It was not always the case that the two disciplines were as far apart as they had become by the 1960s. In this context, we can note that Adam Smith and Thomas Malthus influenced Charles Darwin. In fact, there are many examples of the eminent eighteenth- and nineteenth-century scholars influencing each other. Today, we struggle to unite the two disciplines, having been told to do so in 1987 when the concept of *sustainable development* became humanity's global ethical principle, with the publication of *Our Common Future*, otherwise the *Brundtland Report*. Finally, I should mention *Something New Under the Sun* by John Robert McNeil, published in 2000, Jared Diamond's *Collapse in 2005* and Clive Ponting's *A New Green History of the World* published in 2007. There are others.

The mid-to-late years of the nineteenth century and the beginning of the twentieth century was a period when recognition of nature and an appreciation of our fellow animals was high on the US political agenda. Nicholson explains that we should not overlook the initiatives in other parts of the world. Yet, it is hard to go past the USA. One of the classics of early environmentalism emanated from there. In the mid-nineteenth century, Henry David Thoreau went into the woods to live with nature and in 1854 published *Walden; or Life in the Woods*. As with others of this period, his interests were wide, not limited to environmental matters.

Thoreau should be credited with justifying civil disobedience and active resistance, as unfolded in the 1960s. He was extremely disappointed that slavery had not been extinguished and he opposed the Mexican-American War, underway in the mid-1800s. As a result, Thoreau declared that if a government is failing in its moral responsibilities, we should not consent to it, and refuse to pay taxes. Imagine if we could withhold our tax payments to a government if it did not do as we expected of it! Resistance to, or rebellion against, an unjust government can be traced back to Enlightenment philosopher John Locke writing in the seventeenth century. In the twentieth century, Mahatma Gandhi and then Martin Luther King Jr. undertook their passive—and effective—resistance to unjust governments. It is not unusual to find modern-day environmental protestors justifying their actions by reference to Thoreau whom they consider to be the pioneer environmental activist. John (*John of the Mountains*) Muir cannot go without mention. He is known as *the father of national parks*.

Environmentalism was an integral part of the philosophy of the late nineteenth- and early twentieth-century Progressive era in the USA. There were, for a short period, the seeds of a Nordic-style political philosophy sown in the USA. Not only was there environmentalism in the late 1800s, but a mild type of socialism was being promoted by the People's Party. However, neither environmentalism nor social democratic welfarism was to be. The USA was too divided, as it is now.

The More Recent History

To return to the recent history of the development of environmental assessment, following Rachel Carson's book, the American public began to take greater notice of their immediate environment than they did previously. There was a small minority, those old enough to remember, who recalled the 1930s when overexploited agricultural land resulted in airborne topsoil forming into dust storms suffocating east coast cities. This remained vivid in the minds of the older folk, especially if they lived in the cities choked with valuable soil turned to dust.

As industry developed full-bore after the war, polluted water became a confronting sight and a nauseating smell, as rivers and lakes were used by industry and unthinking citizens as the cheapest disposal option available. The skies of industrial cities darkened and smelt of a mixture of chemicals, which they were, as cities clogged with motor vehicles and factories funneled their unwanted particulate pollution into the local atmosphere. This atmospheric pollution was visible as it is today on a bad day in Bangkok or Beijing, Delhi or Dongying—not like the unseen greenhouse gases.

When in 1969, the offshore Santa Barbara oil-platform failed and slime-smothered beaches far and wide, choking resident sea birds with oily grime, it was the largest oil disaster in the USA. The public went from being concerned to frustrated and angry. The anger made it to the streets when the youthful counterculture discovered that environmental degradation was another ill of American society. In this case, the US federal government acted. While it had no idea of how to end the war in Vietnam, it could at least be seen to be doing something about the environment. It was not going to do anything as radical as start on the road to convert motor vehicles to a clean fuel, campaign against wasteful (conspicuous) consumption, or stop urban expansion. Yet, the step it took changed the prevailing paradigm. Readers could be surprised that the US President who introduced the most radical environmental law as of then (not only in the USA but also globally) was Richard Nixon.

Appendix 2: The International Association of Impact Assessment (IAIA)

The IAIA came into existence in 1980 when it became an incorporated body in the US State of Georgia. It held its first annual meeting in Ontario, Canada, in 1981. As a personal aside, I became a member sometime in the 1980s, and with friends and colleagues, Roy Rickson and Rabel Burdge, attended the sixth annual IAIA conference in Barbados, as a precursor to the three of us organizing the seventh conference at Griffith University, in Brisbane, in July 1988. At that meeting the IAIA awarded the recently formed Environment Institute of Australia (to become the EIANZ) the annual award for an organization. The IAIA held its 2019 conference in Brisbane, organized by Lachlan Wilkinson, who heads the EIANZ Special Interest Section on Impact Assessment.

The IAIA made its mark early on with the development of specific components of EIA, in particular social impact assessment and health impact assessment. In its official literature this organization states that:

> *The concept of 'environment' in Impact Assessment evolved from an initial focus on the biophysical components to a wider definition, including the physical-chemical, biological, visual, cultural and socio-economic components of the total environment.*

The notion of EIA developed as a counter to the rather narrow engineering and financial appraisal of major projects. There is an extensive literature following on from NEPA that indicates that the environment is not only the natural world, but also the social and economic world. The IAIA literature mentions *various types* of impact assessment, as noted.

These are all in their own right specialist components of EIA and must be undertaken by experts in the respective field. However, if each component sits in isolation to each and every one of the others, and to the others in total, this would be a regressive step in environmental science and management. EIA was born out of the need to integrate knowledge and research so as to arrive at conclusions that do not neglect anything important. We find the Brundtland Report (otherwise *Our Common Future*) asserting the same objective. In fact, it goes further and argues for dissolving what the report calls the *compartments* of sustainable development (environmental, economic and social) and uniting them. The Brundtland Report (p. 62) is but both honest and pragmatic in the need to merge environment and economics:

> *The common theme throughout this strategy for sustainable development is the need to integrate economic and ecological considerations in decision making. They are, after all, integrated in the workings of the real world. This will require a change in attitudes and objectives and in institutional arrangements at every level.*
>
> *Economic and ecological concerns are not necessarily in opposition. For example, policies that conserve the quality of agricultural land and protect forests improve the long-term prospects for agricultural development … the compatibility of environmental and economic objectives is often lost in the pursuit of individual or group gains, with little regard for impacts on others.*

The IAIA in association with the Institute of Environmental Assessment, UK, has published a set of principles for EIA. A most pleasing aspect is that they place considerable importance on the identification and evaluation of *alternatives* to the project being assessed. The joint report states:

> *EIA should be systematic … the process should result in full consideration of all relevant information on the affected environment, of proposed alternatives and their impacts … specifically the EIA process should provide for the examination of alternatives—to establish the preferred or most environmentally sound … option.*

The other aspect of EIA on which these two organizations make strong comments is public participation. A particular focus is on informing the public, obtaining public input at all stages, importantly from the onset of the EIA process and, as a consequence, obtaining:

> *Greater public acceptance and support than would otherwise be the case … (and) contribute to the mutual learning of stakeholders.*

2

Linking EIA to the Principles of Sustainable Development

Introduction

Whatever we seek to do, we need a goal. There is nothing out of the ordinary in noting this. Yet, there is a tendency to be fairly vague in articulating what our ends are. This applies to environmental management as much as anything else. As we shall discover, the principles of Environmental Impact Assessment (EIA) go some way in providing explicit goals—when not explicit, they were implicit in the National Environmental Policy Act (NEPA). To these we shall come. Here, we need to ask general questions. The practice of EIA seeks to provide science-based information that will allow decision-makers to make wise environmental decisions on major projects. Yet, this does not suggest an overall framework for environmental management. To illustrate our dilemma, let us attempt to answer the following questions: given a proposal to, say, open a new coal mine, what is the best decision we could make in the present context? Put aside how we are going to do the sums—environmental, economic and social—what are the parameters defining the present context? The parameters are time related, spatially defined, technologically fixed, environmentally constrained and subject to existing human values and attitudes (the best

T. Hundloe, *Environmental Impact Assessment*, Palgrave Studies in Environmental Policy and Regulation, https://doi.org/10.1007/978-3-030-80942-3_2

we can judge these). However, there is a broader, and ultimately more important question. What is the best decision in an overall context, that is, taking all reasonable predictions about the future into account? That is, we are going to remove, to the extent practical, the constraints we have identified. We need to be honest. There is no one answer. Yet, having noted that, we do not need a perfect, or even a less-than-perfect crystal ball to select parameters with which to work. Rather than measurements in space and time and predictions of technological advancements, we can operate within the guidelines of a set of agreed principles. These were formulated and published in 1987. We call them the principles of *sustainable development.* They are to be discovered in the book titled *Our Common Future* otherwise known as *The Brundtland Report* after the chair of the United Nations body which formulated the principles, Gro Harlem Brundtland, one-time Prime Minister of Norway and head of the World Health Organization.

When in 1987, the principles of sustainable development were published, EIA was provided with an explicit framework, something which it did not previously have. That framework was constructed around a small number of key principles. In aggregate, the principles of sustainable development are what we can call an *objective function*; in other words, they state what we aim to achieve. As noted, all applied scientific endeavor—and that is what EIA is required to be—is undertaken with a goal in mind. The goal is not simply descriptive or exploratory science, as one might do to ascertain if all swans and all polar bears are white. Interpretation and prediction are the fundamentals of EIA—what happens to x if we do y? Describing something can be—often is—a prerequisite step in making progress on the higher-order goal of assessing changes. Science is a step-by-step process. Undoubtedly, there is descriptive work in EIA practice. It can involve identifying animals in the location of the project, what they eat, what eats them and so on; or it could require investigating how any particular species fits into an ecosystem and putting that ecosystem in its place in the planetary ecosystem. For an example of a project with global ramifications, it might be a forest-logging proposal in one of the planet's remaining rainforests.

Environmental changes can be detrimental, positive or neutral with regard to our long term well-being. We care about our well-being, and many of us care about the well-being of the other animals with which we share the planet. Therefore, we ask: is a particular change, something we are contemplating doing—it could be clearing a forest and plowing up land to grow crops—good or bad? For whom? All of the human population, or simply a subset? For the other animals with which we share the planet? This is the evaluation which forms an EIA. If the project produces good outcomes (leave aside how we determine their goodness for the moment), for how long does the outcome remain good—the short term, the long term or ever-lasting, otherwise sustainable? Similarly, with bad outcomes. Answering these questions requires us to analyze causes and effects, otherwise *do* science. What do we do with what we discover? That depends on our common human goals, and, as noted, as a global society these were formulated, and published in 1987, and in the following years universally accepted worldwide. Unfortunately, I need to report that acceptance has come to be paid lip service in a significant number of cases. This is a matter that needs urgent attention. The effort put into getting agreement from a wide representation of the planet's people cannot be left to wither on a neglected vine.

Let us commence to explore what we are seeking to achieve with our sustainable development goals. Later in this chapter, we will discuss the precise principles, but first it helps to consider the broader issues. No authoritative organization, such as the United Nations, ran a global survey to ascertain if we humans wished to sustain human life on the planet. We need not venture into evolutionary psychology to know the answer is "yes". A range of more difficult questions follow this, obviously unnecessary, one. We could have been asked what level of material consumption would have satisfied us? We could have been asked what degree of psychological well-being—let us say, happiness—would be acceptable? Would our happiness require treating the other animals with which we share the planet as sentient fellow creatures? You can guess the type of questions we would expect to be asked.

To be realistic, we are a long time away—many decades, possibly centuries—from the ability to undertake this type of *democratic* survey of the global population. Obviously, we could not wait. We went to the next best practical alternative. It was achieved by the United Nations bringing together a large and very diverse group of eminent people, drawn as a representative sample from the global community. These people were given a formal title and a massive task. The title was the World Commission on Environment and Development. As noted, this body was chaired by Gro Harlem Brundtland. There were 20 other members: 4 from Asia, 4 from Africa, 3 from South America, 2 from North America, 1 from the Middle East and 6 from Europe. The result of four years of traveling the world, listening to a wide range of people and much deliberation was the concept of *sustainable development.* This became the global society's goal. The discipline of environmental science and management was the profession to do the hard work in meeting this goal. The procedures, the processes and the tools to be used for this purpose are bundled up in *environmental impact assessment.*

You, rightly, can point out that assessment per se does not mean we will meet the goal of sustainable development. Yet, by assessing projects which we are considering, for example, constructing an oil pipeline or building a power station, we will—should—be able to know if the projects meet sustainable development criteria. If it is found in undertaking an EIA that a proposal does not meet sustainable development criteria, we would expect that the proposed project does not go ahead. If it did contrary to an evaluation reported in an EIA, we could rightly condemn those who made that decision.

With the possibility of overdoing it, allow me another example of the importance of working to a social goal. Why do we measure the impact of polluted waters if we do not have a reason! Of course, we do, in fact, a number of goals. We want to maintain the health of the water because if it is polluted, human health deteriorates, people get water-borne diseases, fish and other marine life die, birds no longer feed in the water and the water body lacks aesthetic appeal, and maybe it smells as sickening as *The Great Stink* of London in 1858. I cannot let mention of this event go without telling the story.

In 1858, the Thames was so putrid that the curtains of the English Parliament, which sits virtually on the river's bank, had to be drenched in lime chloride to counter the odor, to allow the politicians to continue meeting in the building. Even then, the smell was going to drive the parliamentarians to remedial action. If only it was possible in all cases of environmental pollution and degradation to bring the consequences literally home to those who have the power to fix matters! To appreciate what drove the people's elected representatives to do what otherwise would have continued until the Thames became a cobbled-together artificial, walkable street of rotting animals, human feces and horse dung, allow me to describe a cartoon published in *Punch* on July 10, 1858. It was drawn by artist John Leech.

Construct this in your mind. Start with a small rowing boat on a narrow river, as the Thames is. The water flows very, very slowly, because it is composed of very little liquid in relation to the dead rats and cats, bloated upside-down frogs and scrawny dead dogs, all held together as floating islands by the material emptied from the bowels of humans and horses. With that in mind, picture the rower as the allegorical figure of death—skeletal like, crazed eyes, whatever little skin clinging to the remains of a once-human body, now yellow-jaundiced, and making a vain attempt to row as the bloated, grotesque dead animals, half-submerged, bump upon his boat. On the far bank sits the English House of Parliament.

The caption to the sketch is *The 'Silent Highway'—Man. 'Your money or your life'*. The money is to clean up the river. The parliamentarians meeting in the House of Commons need no convincing—for once pollution had figured out whom to target if it was to be eliminated. Eventually, the remediation was completed in what was one of the world's most notable examples of ecological restoration—and the saving of countless human lives plus an even larger number of other animals. Today, one can fish in the Thames and be lucky.

Setting the Goal

What we have in the clean-up of the Thames is a very specific goal—restore a natural environment in the interest of sustaining human, fish and bird lives, and—not to overlook the most important goal for the decision-makers—restore the work environment for the members of the parliament. Whatever one thinks about self-interest, in the right circumstance it can be put to a good cause.

We will come to the principles of sustainable development as formulated by the United Nations expert committee, but here we will deal with environmental goals by asking ourselves what we seek to achieve. The most basic question is what type of natural and social environment do we wish to live in? Or, as an alternative, somewhat different question, what development projects could we undertake while maintaining our global life-support system?

To put it starkly, can we keep filling the atmosphere with greenhouse gases, because this is what happens if we want ever-increasing numbers of cars, planes, ships, plastic toys and whatever, and still have a planet that provides for long and healthy human lives? Furthermore, is it possible to satisfy our material goals, particularly when they far exceed our basic needs, without diminishing our aesthetic and higher-order (secular) *spiritual* needs, those intangible things that make us human? These are much more difficult questions to answer than the one engineers have as their objective function: how to build a safe and functional bridge; or, the one financial planners have: how to build the bridge within a budget of x dollars? These professionals do have goals, but they are narrow and very easy to measure. Their narrow goals would be among the subset of goals within a broader objective function of, say, reducing vehicle congestion and the emission of greenhouse gases. Those broader goals would themselves be a subset of yet broader goals, such as facilitating a more productive workforce and protecting low-lying coastal housing from increased threats.

Take the hypothetical bridge as an example. It requires us to justify, otherwise determine the need for the bridge. There are many other, seemingly worthwhile things we could do with the human, material and financial resources devoted to building the bridge. To be reminded again, to ascertain the need for whatever project or policy is proposed is the point of EIA. I shall come to devote considerable space to the notion of the need for a project, as this is the fundamental issue to be addressed by an EIA. Need is determined by the *net* benefits of a project—alternatively, we could pose the question, will the project take us a step closer to achieving sustainable development? We will answer these questions below.

If we are to compare environmental practice to all the other professional pursuits humans engage in, medical practice is by far the closest.

At the most prosaic level, medical practitioners seek to maintain human lives in good health, as long as biologically possible. So important is this goal that the average person's expected life span is one of the three sub-indicators of the United Nations Human Development Index (HDI)—the longer the life span, the better. We are yet to go to the next step and formulate an agreed measure to convert life spans into something like a very enjoyable life span to the very end.

Medical doctors have a goal of seeking to prevent disease and injury, and when prevention fails, seeking to cure—while always doing no harm. As professional practitioners they take the Hippocratic oath. It is because environmental practitioners have analogous goals for the health of the planet, rather than for human beings individually and collectively, that some years ago I coined the term Earth Doctors to describe environmental practitioners. It should not need to be said that protecting the planet's life-support system is a necessary prerequisite in the goal of maintaining human health. It is time to outline the principles of sustainable development as brought to us in the manifesto *Our Common Future*.

Sustainable Development

The World Commission on Environment and Development undertook its paradigm-changing work in a world divided, particularly in terms of material well-being. This fact made its task extremely difficult—keep in mind it was asked to address and make recommendations for the global community. The title of its manifesto *Our Common Future* speaks to that. We need to set the scene the Commission faced, if ever so briefly. The most obvious divide—although many pay no attention to it, rather they focus on personal matters both trivial and important—is between the material conditions of those we have come to call the *North* and the *South*. The previous terminology was the *developed* and the *developing* world. I am not convinced that euphemisms such as this one, regardless of good intent, do justice to the poor of the world. If you think that they are developing, you are less likely to be concerned for them than if you realize they are stuck in poverty. Let us talk about the *poor* (or, if you like, poverty stricken) and the relatively *rich*, where the latter includes the world's middle class, whether manual workers, white-collar workers, owners of a small business or farmers. There remain the *super-rich*, the so-called *one percent.*

One divide is between the rich and the poor. Another is between the *present* generation and *future* ones. With the focus on the adjective sustainable, consideration of future states is imperative. Furthermore, we could—and should for ethical reasons—consider the relationship between the *present* generation and *past* generations. In doing this we will face some interesting ethical dilemmas.

There are various ways to describe what sustainable development is. I shall select a way that is straightforward and capable of being expressed in everyday language. Let us start with the disciplines sustainable development relies on, mindful that the practice of sustainable development is to be based on science with an added philosophical underpinning. The Commission makes the point that policy formulation by governments has to be based on science. This is easy to proclaim. How difficult it is when science is not respected and accepted! It would take us too far afield from EIA and sustainable development to document the views of those who deny humans are increasing carbon dioxide in the atmosphere, to those who believe vaccinations are dangerous, to those who believe there is a conspiracy between Jews and communists to rule the world. These folk are loud in their campaigns and far-reaching through social media. They have to be ignored if human society and individual humans are not to regress to a new *dark age* of searching for witches to burn at the stake.

The disciplines at the base of sustainable development are the sciences of ecology and economics plus the philosophical discipline of ethics—the three *Es*. The fundamental ethical principle is equity, both for the present generation and between generations. These three disciplines can be used to establish two philosophical, otherwise ethical, principles of sustainable development plus three operational principles. The ethical principles, to use the terminology used previously, are high-level objective functions. These principles are *intergenerational equity* and intra-generational equity. If you consult *Our Common Future* you will find that sustainable development: *meets the needs of the present without compromising the ability of future generations to meet their needs*. This is another way of describing intergenerational equity.

Central to sustainable development is the recognition that the natural environment of planet Earth is our *life-support system*. It follows that if we—and the other animals with which we share the planet—are to survive into the indefinite future, the natural environment has to be protected, that is, allowed to function as it does today (repaired where necessary). As nature is indifferent to human needs for survival, a completely different global ecosystem—one without us—could exist. However, we do exist and we want our species to continue to exist, whether this is purely an imperative of the human genetic makeup in a Darwinian world or a moral philosophical dictate need not concern us—either way, it is what it is.

Intergenerational Equity

Our scientific knowledge leads us to understand that the resilience of the global ecosystem is positively correlated to biological diversity, which is the key enabling principle of sustainable development. In a nutshell, the greater the number of species in an ecosystem, the greater the number of ecosystems in the global ecosystem, and going to the most basic level, the greater the number of genes (genetic diversity), the stronger, the more resilient when under threat is our world. We shorten the concept of protecting biological diversity to the protection of biodiversity. On this basis, the focus on adverse impacts on nature is a fundamental requirement in EIA. The EIA tool allows us to measure how much strain we can put on the system without breaking or simply damaging it, in the interests of maintaining it for our children, their children, their children's children and so on through time. The link between protecting the natural environment and intergenerational (inter-temporal) equity is, thus, established.

Once we contemplate—and we must do so—both population growth and scientific progress that leads to, among other things, innovation, establishing what we need to do to ensure intergenerational equity is very difficult. It is very easy to say *protect the environment*. Many do say this without providing a map of where to next. It can be very difficult to turn environmental protection into practical actions when much is changing around us. We are, undoubtedly, going to witness significant changes to the natural environment for the simple reasons the human population has not peaked, and the majority of the global human population is relatively poor and, understandably, seeks to catch up with the much more wealthy minority. We are witness to this dynamic in China and must expect India, with the world's largest population, and the poorer countries of Asia, Africa and South America to attempt to follow suit. On this point I shall introduce a subject to be dealt with in more detail later. It is the direct link between poverty and environmental damage. We find in *Our Common Future* words to this effect: *recognising that* poverty*, environmental degradation and* population *growth are inextricably related, these matters cannot be addressed in isolation*.

We have reasonably good estimates of the level at which the global population will peak and by when, assuming no great loss of life by a pandemic or a major war. What we struggle to forecast is the standard of living which will be achieved in the poor world at that time. Putting possible disasters aside, we can expect very significant land-use changes in sub-Saharan Africa, including major flooding of river valleys with the construction of hydroelectric power dams, vast monocultures and the development of enormous modern cities. Can we compensate nature for these changes? What of South Asia, will the extreme poverty of the *under classes* be eradicated in India, Pakistan and Bangladesh? How? By when? Because we forecast that the population of this region will be enormous, will the planet be able to feed them, and at rich country standards, or any standard? The people in these countries make our very inexpensive clothes, harvest the rice we import and much more while living in conditions that would have shocked Charles Dickens had he lived to experience them. These people deserve nothing less than a dramatic improvement in material welfare.

In taking intergenerational equity into account in EIA, we must develop reasonable scenarios of technological advancement. Maybe, at a global scale, we move rapidly to a solar, wind-powered and hydrogen economy. Maybe, there is another *green* agricultural revolution waiting to be stirred into life. There is much to ponder in determining what we should do—and can do—in the pursuit of intergenerational equity. We should note that in the early days of EIA, a complementary assessment tool called Technology Assessment had a short, fashionable life. Had it continued to exist, it would have been a useful adjunct to EIA. With its demise, EIA has to expand to incorporate its role. At a prosaic level we cannot assess the benefits and costs of a new coal-fueled power station without making predictions as to the roll-out of alternative energy sources. Get those predictions wrong and our conclusion will be wrong.

Obviously, assessing the impact of changing technologies should come to play a role, possibly a major one, in EIA. We have taken a small step along this route with EIAs related to renewable energy, particularly, wind and solar power generation. We have found that the land-use footprint of a solar or wind farm is not significant, but what is required at present is the need to make very significant upgrades of the existing electricity transmission system. We are witness to Norway showing the world how to establish a network of battery-recharge stations so as to develop a truly large-scale electric vehicle transport system. We have noticed that the UK has closed its last large coal mine and is being forced to address the loss of jobs in coal mining. Technological change is coming fast in the energy field, the comparative economics driving change and consumers reacting in response.

It is not only technical advancement needing serious consideration; the zoonotic coronavirus resulting in the disease we have labeled COVID-19 has generated previously dormant attention to the spread and evolution of zoonotic diseases. Given the global spread of these diseases by the large-scale movement of people by planes and cruise ships, will the result be a *less physically connected* human world? Or will we quickly forget about COVID-19 when we are all vaccinated? At a local or regional level, will the assessment of forest clearing require serious attention being paid to the transfer of zoonotic diseases? One would think so. Faithfully applying the principles of EIA in a sustainable development context takes us to a more holistic and forward-looking EIA than presently practiced.

Intra-generational Equity

Building in the principle of intra-generational equity—treating fairly people living today—in assessing the benefits and costs of projects is a most difficult undertaking. Difficulty arises in the preparation of EIAs when an indigenous group, if in the position to do so, seeks special treatment if the project is approved. The demand for favorable treatment could be linked to adverse legacies pertaining to unfair treatment of their ancestors. This means that their demands need to be dealt with in the EIA process, although it need not be the case that the environmental practitioners have to do that. The indigenous requests could remain in the domain of governments. Regardless of who is involved, meeting the ethical issue of intra-generational equity is an obligation of sustainable development. The difficulty I refer to is due to the implications of addressing income and wealth distribution on a project-by-project basis. What this would entail is to give greater weight to any benefits or costs of the project to the less well-off. It has been the convention that if adjustments to income and wealth are to be made, these are to be addressed by the fiscal powers of governments, that is by general taxation and subsidy policies. This convention is not followed to the extent it is claimed to be followed. Directly and indirectly major projects are likely to provide greater benefits to a particular sector of an economy than to other sectors.

I am going to give considerable space to a discussion of intra-generational equity, not simply because of its difficulty, but because the greatest challenge confronting environmental science and management is how to maintain a healthy global ecosystem while improving the well-being of half of world's population, the very poor, those living on less per day than the costs to you or me of two cups of coffee.

To understand the principle of intra-generational equity (otherwise known as intra-temporal equity), we can start by distinguishing it from intergenerational equity. With regard to the latter, the rationale is to protect the natural environment in the interests of long-term survival. Just as environmental protection is the basic requirement for inter-temporal equity, so it is for intra-temporal equity; intra-temporal equity is about the here and now. However, whatever the state of health of the environment, we are charged to seek intra-generational equity.

Think of it in terms of justice as fairness—the principle being that we all are entitled to a fair share of the planet's life-support system and its natural bounty, by the simple fact of being born on the planet. The planet does not care if you are born or not; or, if you are, what your material circumstances are. These matters are in the hands of humans. We can determine the social, economic and above all the ethical order of our local, national and, with much difficulty, our global society and economy. We can make it a little bit more equal or more unequal by the distribution of the benefits of a project. It could be made more equal by requiring that local workers have priority on the project, or that local firms are the first source of resources used in the project. An example of building intra-generational equity into major projects, such as mines and related infrastructure on land owned or otherwise controlled by indigenous people, is to approve the project—all other things being equal—on the basis that a disproportionate share of royalties go to the indigenous community. This is not uncommon.

As an ethical stance, the reason to fashion a more equal society is based on the simple idea that I can imagine myself in your position, particularly if you were very poor; and, on the basis of appreciating this, think about what would be fair to you. This was the starting position for one of the most eminent moral philosophers of the twentieth century, John Rawls. He made it his life's work to attempt to understand, from an informed, self-interested perspective, what type of society people would construct if they did not know their position in life when entering the world—that is, before they were born. This philosophical inquiry led him to propose a social contract which would be fair under given hypothetical circumstances. Rawls established the proposition thus (these are my examples): if you did not know if you were to be born in the slums of Mumbai or the suburbs of Silicon Valley, or if your skin color was to be yellow or black, or if you were to inherit a genetically determined disease or be healthy, what type of society would you construct if you had the power to do so? His answer was—and, I surmise, we would agree with him—a system of government that favored the poor, the marginalized and those in poorer health. Each and any one of us could be one of these unfortunate people, not through a lack of intellect or hard work (we would be forced to work much harder than the rich) but simply by being born.

If we are to build-in intra-generational equity considerations in EIA (something we are required to do if sustainable development is the objective function), the distribution of benefits from a project should favor the poor. Favoring the poor is the undertaking we made when we agreed to the principles of sustainable development. Interestingly—and unexpectedly for many—economics comes to our assistance in favoring the poor. There is a principle—a rule as the economists term it—which, if applied, would favor the poor. It is the Rule of Diminishing Marginal Utility. It appeals to common sense. In everyday terms, it states that the more you have of something—it could be money—the less valuable is the next unit (the marginal unit) you acquire. In other words, an extra dollar to a poor person is valued more highly than an extra dollar to a rich person. An extra two cups of coffee, if forgone and given as cash to a very poor person, would double his or her income for a day. You would say, *of course, this is too obvious to mention*! While that is the case, it is not explicitly relied on in government policy making, although it is implicit in various social welfare policies that favor the poor.

Of course, Rawls' proposition is but an interesting thought experiment. It can be nothing other than that because we exist, rather than being in the hypothetical position where we are able to make a social contract. In the real world, a historically determined distribution of nature's bounty has already taken place. The result is that the world is a terribly unequal place in terms of who gets what. We can do something about that if we think Rawls' conclusion is right. We have the option of favoring the poor regardless of who they are and why they are poor, and we can attempt to compensate for some earlier injustice. In fact, we could do both, but let us ponder the difficult case. There is a tough, fundamental question if we are going to address present-day poverty by compensating for past injustices. How far back in history should we go? It is one thing to require a mining company in Australia to provide disproportional benefits to local indigenous people, but should the same principle apply if the case involved the descendants of Scottish Highlanders who had their commons enclosed as they were pushed into tiny crofters' huts, and forced to feed their families by fishing?

This is not the book to enter into human history and explain how we have come to the present distribution of the valuable and good things in life. However, we know that over recorded history—and before then, in prehistory—great swathes of the planet were acquired by conquering armies, and huge masses of people were taken as slaves. In recognizing these facts, it would be impossible to resort to the principle of intragenerational equity to right wrongs committed in an ancient time. Let us consider this for a moment. Those who look no further back than to the so-called *opening up* of the Americas, the colonization and the terrible slave trade that followed, are missing much horrible human history—going back thousands of years. If nothing else, this makes the notion of repatriation for past injustices a matter of where to draw lines in history.

At what point back in history could it be feasible to consider reparation? We thought it a good idea immediately at the end of the First World War to make the German people pay damages to the victors. The immediacy of the event made this seemingly simple—there was no need to attempt to identify victims because countries, not individuals, were assigned that position, and the people of Germany as a whole, through their government, were made the guilty party. John Maynard Keynes argued at the time that if the victims of the war were to be provided with so much in reparations that the guilty could not pay, this would cause more harm than good—and it did with another world war.

To put the concept of compensation for very distant invasions into perspective, England serves as a prime example, although virtually any other country or region of the world would illustrate the same impracticality. We have no idea of whom to compensate for the colonization of England by the Romans in the first-century AD, or any of the other colonists who took over that country after the Romans left. Should those French living today in Normandy—assuming their ancestry can be traced back to William the Conqueror—provide compensation to the existing ancestors of the English who were alive in 1066, assuming they could be identified? You can draw your own conclusion.

I raise the issue of compensation—that is, favoring a presently marginalized group—because this idea does arise in EIAs where such groups are impacted by the project being assessed. For a good example, consider a Native American tribe likely to be adversely impacted by a major mining project. We have a very good idea of the remaining Native Americans whose ancestors lost their land to various colonizers—notwithstanding the treaties that were agreed. Their descendants could justifiably claim that their present economic status—where it is low—is a consequence of that past. These folk might have lost their land 400 years ago or as recently as 150 years ago. If they were to be compensated, various approaches can be used, as mentioned above.

There are many complex issues involved in using compensation to further intra-generational equity. Due to this, the determination on this matter should be made by governments, not the environmental practitioner. Where the environmental practitioner would have a role in such cases is in aggregating the benefits and costs of a project in monetary terms, as this is a key part of the EIA process. How does an assessor account for a proportion of mining royalties, as an example, going to a poor tribe? A sum of dollars, say $x, to that tribe is worth more than that $x to the community in general. If the assessor is game and willing enough to calculate marginal utilities of dollars, we would find that the benefit of the project is greater if an equivalent dollar amount is assigned to the poor tribe. The one thing I will say is that the EIA practitioner should not be influenced by those economists who assert that *interpersonal comparisons of utility (satisfaction)* cannot be made. These economists do not live in the real world!

To apply the intra-generational principle to the real world today, we are immediately drawn to the dramatic differences in life spans and economic well-being between the poorest of the poor in sub-Saharan Africa and South Asia and the relatively rich in industrialized countries—in other words between the *South* and the *North*, and between the super-rich in the poor countries and their poverty-stricken fellows. When in 1983 the United Nations established the World Commission on Environment and Development, its task was twofold: develop principles and practical actions by which to sustain the planetary environment on which all life depends, *and* foster development, otherwise *sustainable* economic growth, for the world's poor. It is the latter task which gave us intra-generational equity as a goal—treat all people in each and every generation fairly. This requires favoring the poor in each generation and seeking a convergence between the rich and the poor of the world. Just possibly, this process will in due course eliminate poverty and make redundant the Bible's adage that the poor will always be with us.

The Strategic Imperatives of Sustainable Development

The foundation of sustainable development as presented in *Our Common Future* established what its authors termed *strategic imperatives*. In terms of intra-generational equity they are: *reviving growth [for the poor nations], changing the quality of growth, meeting essential needs for jobs, food, energy, water, and sanitation*. The point is that poverty leads to environmental degradation and this leads to even greater poverty. If the task is to obtain the next meal for your family, then the last bird in the forest and the last fish in the sea will be taken.

Changing the quality of growth pertains to seeking sustainable methods to produce a good or service, for example, mini-hydropower systems or solar power electricity as opposed to coal-powered electricity. The reality is that in the poor parts of the world, where the massive infrastructure of coal-fired power does not exist, *jumping over* old technologies into advanced ones is an option, particularly if that is feasible at a small, localized scale. The rich of the world can help the poor do this! Village-style solar farms are not expensive, micro-hydroelectricity schemes likewise and there is much more of this kind of aid.

The principle of intra-temporal equity is not a sole North–South inequality matter, as it also applies to the industrialized countries. We can note in passing that in countries that rank high on equality, such as the Nordic countries, this principle should not be difficult to meet in practice, whereas in countries where inequality is high, whether the country is the USA, China, India, the UK or Russia, special attention has to be paid to the impact a project has on income and wealth distribution within that country. One can immediately appreciate the theoretical and practical difficulties this poses for an EIA practitioner. There are means of dealing with this in practice, some already nominated, others a matter for future discussion.

In Conclusion

Once we recognize that the principles of sustainable development provide the framework for EIA, we are required to answer what *sustaining* means in the practice of assessment of a project. This has to be addressed in the terms of our understanding of ecology, economics and society, the three sub-elements of sustainable development. This is our task in Chap. 3. For those who have not been introduced previously to the concept of sustainability, there are likely to be surprises. Some of the principles might, prima facie, seem to be contrary to what is thought conventional in the three disciplines. The discussion is primarily theoretical. This is a prerequisite to the following chapters in which the focus is EIA in practice.

3

Sustainability Perspectives: Ecological, Economic and Social

Introduction

In this chapter we continue our theme of putting EIA into a sustainable development framework. In a sustainability context, EIA is not simply applied descriptive and predictive science; it is that, but more. The altered state of the environment, if the project goes ahead, is to be compared to a defined and desired state of environmental well-being. Importantly, the dynamic nature of local and planetary ecosystems, expected technological changes and changes in human well-being are key factors in defining future environmental well-being.

Environmental well-being encompasses ecological, economic and social objectives. The defined desired state will be one we aim to preserve, that is, sustain, so that we humans, and the other animals with which we share the planet, enjoy long and healthy lives. This does not necessarily mean we maintain the status quo. Independent of the project we are assessing, there are various problems requiring attention: pollution, resource degradation and resource depletion. Amelioration is required before we can relax and sustain. In other words, there is some mending to be done before we start the task of assessing new projects.

T. Hundloe, *Environmental Impact Assessment*, Palgrave Studies in Environmental Policy and Regulation, https://doi.org/10.1007/978-3-030-80942-3_3

To sustain does not mean we stand still at some future point in time. As a species we seek to progress, the evidence for this cannot be denied. We make progress—most of the time—by inventing technologies of benefit to us, and by inventing ever better means of arranging our social and economic relationships with each other (in other words, in continually improving on the *science of government*). The latter is a major task and a project far from finished. One does not need to reflect for long to understand how much more needs to be done to ensure that there is never another Hitler or Stalin. The list of our faults and mistakes is too long to repeat here. However, the positive list is marginally longer and has extended rather dramatically over the past 200 years with the abolition of slavery, the universal franchise, and the formation of the welfare state as exists in the Nordic countries plus a few others which include New Zealand, Canada and Australia.

Some of the environmental problems we face are very serious and capable of derailing our sustainability goals. One such possibility is a serious overshoot on the containment and, following that, winding back of greenhouse gas emissions. Another is uncontrolled human population growth. We cannot dismiss the pessimists who paint a bleak picture; however, we cannot let pessimism lead to inaction. Furthermore, we must not let overstatement of environmental disasters open an opportunity to those who have a propensity to deny science. Getting the balance right is important. Science is neutral.

If we come to understand the impacts (ecological, economic and social) of projects that are potentially environmental problems, and on the basis of our assessment conclude that the overall impact is negative and say *no* to them, we are making progress. The converse is equally important. The optimists among us expect that there will be more beneficial projects than ones to be dismissed. To foreshadow a future discussion, the evidence to date is that, for reasons which will be identified, saying *no* is difficult.

The most pressing problems we face are poverty and atmospheric pollution by greenhouse gases. To the extent that we have not already analyzed these issues in detail, we will come to do that. In this chapter we go to these and the other *big* issues of EIA in a sustainable development context. Consistent with the framework outlined above, EIA is categorized into three interlocking components—ecological, economic and social. These three disciplinary perspectives are referred to as the three legs of the sustainability stool. All legs of equal length are essential for a stable platform. In discussing these *high order* concepts, we will leave the practicalities of undertaking EIA (foraging for evidence in the field, or searching for data on a computer screen) for future chapters. This high-level discussion is simply to make clear the overall purpose of EIA. We understand that the purpose of a knee replacement by a surgeon is more than to make for pain-free knee function. It is to improve the overall well-being of the patient. So is the distinction between a project-specific EIA (which might be to approve or not a coal mine) and the overall improvement of the planet's health and the well-being of the life it supports. The project being assessed should only be approved if it leads to an overall improvement. So let us go to the three sustainability perspectives.

The Ecological Perspective

What is sustainability from an ecological perspective? At first glance, ecological sustainability means to not interfere in evolutionary processes—in other words, do not mess with the broad sweep of natural change. As most natural change is very slow by human measurement of time, we could for practical purposes argue that *keeping things as they are if they are healthy* should be our goal, with the caveat, where degradation of nature already exists (it is not as healthy as it could be) our goal should be restorative ecology, as in the earlier example of cleaning up the Thames River in the late nineteenth century.

In the first instance let us deal with restorative ecology, before turning to assessing project impacts. We face a philosophical and practical issue when we come to undertake restorative ecology. Restore to what condition? Let us be clear that we cannot return the planet to a prehuman *state of nature*. On this topic there is much to be said. I shall keep it brief. Even if some Rousseauian ideal state of nature was a hypothetical goal—it could not be anything but hypothetical—we would have no template to guide us. What was the Earth like before *Homo sapiens* left the forests of central, tropical Africa and walked on two legs on the sweeping savanna, where large dangerous carnivores roamed and foreign forms of edible plants had to be identified by life-threatening trial and error? We do not know.

Still, we are capable of going some way in forming a general understanding of natural states prior to the massive changes wrought by the Industrial Revolution. With considerable effort and the help from other disciplines, botanists are capable of establishing what certain types of ecosystem were like then, on a case-by-case basis. Some were relatively natural. Australia would be a case in point, given its vast size and small indigenous population. On the other hand, Western Europe, the Middle East, and the highly populated parts of China and India were much changed well before the Industrial Revolution. Archaeologists and paleontologists are able to take us much farther back in time than anyone else. Archaeologists are extremely skillful in reconstructing from their discoveries of skeletons—or even a few bones—the prehistoric giants that provide much excitement to children. But, that is it. Our inability to recreate—or even imagine—a world without humans does not matter, other than as an interesting project for archaeologists and paleontologists, because we are not going to divorce *Homo sapiens* from the world of which they are presently a living part.

We have changed the planet in ways we cannot know—other than the changes in recent time—and we will continue to change it. This means managing—juggling—our environmental impacts within limits. These limits are formed around meeting the overriding goal of not diminishing the life-support system on which humans and the other animals with which we share the planet depend. In terms of relatively easy to measure and predict changes we can set realistic limits for each important ecosystem. For example, it is very easy to measure water quality and we have solid scientific evidence of how much of a particular pollutant water can receive before fish and other animals die. We know which chemicals, and in what quantities, produce acid rain. It is easy to measure particulate pollution and, for example, we know which air pollutants and at what levels asthmatics are likely to suffer. We know how much of a preferred habitat is required per adult koala and, with drones and on-the-ground surveys, can ascertain the requirements for a given population. The examples are endless.

It is when the issue is global change, with the increase in greenhouse gases being the classical case, that the best we can do with our present scientific knowledge is arrive at scenarios and suggest limits, such as a 1.5 to 2 degrees Celsius increase in average temperature. Even if we manage to remain within this limit, we are not going to sustain—in a strict sense—*the world as we know today*. In recognizing that, our scientists remain as confident, as present knowledge allows, that we and the plants and animals with which we share the planet will continue to exist in a not unsustainable way. Hopefully, there are no surprises.

We can manage our impact if we measure it, and we can restore existing damage, as well as temporary damage caused by the project we are assessing. We have adopted policies and laws pertaining to where and when to engage in restorative ecology. The EIA practitioner will need to ascertain if the project being assessed is covered by any such rules. A pertinent example is a mine-site rehabilitation. In industrialized countries open-cut mines are required to have their original landscape restored when the mining is complete. As many large mines tend to be in agricultural land—for example, grazing country—the post-mining requirement will be that the mine site can revert to grazing; the only impact being the loss of grazing revenue during mining and the rehabilitation period. There is no one-size-fits-all rule for mine-site rehabilitation, and landscape restoration is likely to be decided by local policies, on a case-by-case basis. In future chapters, offsetting damage will be addressed.

I turn to a particular sustainability matter that can be the subject of disagreement. It arises if it is argued that we should *freeze* evolution. This would mean attempt to stop a particular animal from going extinct through natural causes, or halting the process of succession as forest boundaries move. Of course, we have no idea if a species is on the brink of extinction through natural causes or human actions and, hence, we can set the default position to halt extinction. In the present era, extinction is most likely due to humans destroying habitat. However, with regard to forests we can see succession at play—maybe a natural phenomenon or maybe a reaction to the grazing of domestic animals. Being practical, we ignore the possible reasons and ensure the project we are assessing does not cause the extinction of a species, and with regard to forests, we let succession take place. Forest succession is most likely a response to something humans did in the past. Furthermore, and fundamentally, humans are playing such a significant role in extinctions that it would be inappropriate to speculate on natural causes of extinction. Best to avoid all threats of extinction and for good reason.

Many of us will be aware that projects that destroy natural landscapes are the cause of extinctions, and at a rate far beyond that which occurred before we expanded in numbers from very small hunter-gather tribal groups to ever-larger communities when we learned how to farm. Ecologist and evolutionary biologist, David Mindell in his 2006 book *The Evolving World* makes this very clear in the following quote (p. 165):

> *Earth is rapidly losing biodiversity. Estimates of the numbers of species going extinct are in the range of 1000 to 10,000 per year and rising. There have been other major episodes of species* extinction *in the past, such as the end of the Cambrian period 505 million years ago. In that* extinction*, climate and sea-level changes transformed habitats around the world … The current* extinction *episode … which equals or exceeds the others in its speed and taxonomic breadth, differs in its root cause. For the first time, large-scale* extinction *events are the result of one species—ours—as we multiply, disperse, and alter the earth's environments.*

A major practical problem from an ecological perspective is our rudimentary understanding of the role and influence of the very large number of living things we know little about—not to mention the ones we do not know exist (many underground). Further to these frustrations, we have the difficulty of understanding the vast range of interconnections between these known and unknown species. One of the things we did not know existed until very recently is coronavirus-sars-2, the cause of the disease that we have named COVID-19.

Of the things we can measure and model with some degree of certainty is the effect of carbon dioxide and the other greenhouse gases. We are rightfully concerned about climate change. Still, we need to be realistic and recognize that our models of impact are very much broad-brush scenarios—with nothing approaching the realistic probabilities we can assign to floods, based on good historical data. Regardless of the strength of our knowledge we are obliged to act on the best advice available and the most likely scenarios. This approach is analogous to medical practice where much is still to be unraveled, yet our doctors need to act today, not to wait an unknown time for greater certainty—then it could be too late.

Economic Sustainability

When it comes to sustainability from an economic perspective, we are forced to ask and answer what, as a society, do we want our economic system to do for us? In contrast to the functioning of the natural world (the matter we have just discussed), our economic system is a human creation. We can change it, but don't hold out hope for a radical change in the foreseeable future. As with any human creation, the nature and form of our economy is decided by the most powerful, and only in the most democratic and equalitarian nations can we expect the voters to be powerful. As we note by casting our eyes around the world, many forms of political economy exist. This fact alone does not impinge on the economic goal of sustainable development, although at a practical level one can expect a degree of difficulty in achieving this if a powerful decision-maker only pays lip service to sustainability.

There is the relatively free-rolling (tending to laissez-faire) American form of capitalism. At the other extreme is state-capitalism (capitalism where the government plays a significant role in setting directions) as in China. Somewhere in the spectrum is what is known as crony-capitalism (where big business links to big government) as in Russia. The outlier is the social democratic (if you prefer, democratic socialist) people-oriented, welfare-state capitalism, as in the Nordic countries. Regardless of the type of economy, the type of large projects most likely to be subject to EIA will be government initiated or, if not, government sanctioned. This will mean that it should be easier to achieve planned social and economic outcomes than if the projects were purely private enterprise concerns with the only government involvement the need to jump an EIA hurdle.

What we expect in general from our economy, and a new project in particular, will depend on the state of development of the economy. As noted previously, if the project is in a poor country and involves economic growth—as we would assume would be expected of it if it was to be sanctioned—that outcome, all other things being equal, will be a good thing. At this point I shall again quote from *Our Common Future* as it is not possible to over-empathize the state of poverty in the world and the primary need to address it. Recall that sustainable development was postulated around two key concerns, environmental protection and genuine economic growth for the poor—lifting them out of poverty. The latter is too often overlooked.

> *Meeting essential needs requires not only a new era of economic growth for nations in which the majority are poor, but an assurance that those poor get their fair share of resources required to sustain growth.*

There is to be no steady state economy for the poor—a steady state economy is one where there is no need for growth as it is producing both what are the essential needs of people plus meeting reasonable wants and desires. Sustainable development theorists spend much time and effort attempting to settle on wants and desires. We will come to discuss this.

As far as the poor are concerned, economic progress is essential. However, projects in the poor countries cannot focus singularly on conventional economic outcomes. They will need to meet environmental criteria. Consideration of ecological and/or social impacts is likely to make or break projects as much as economic ones. Imagine a poor country rich in underground resources and teems of iconic wild animals, a photographer's dream. There would be little point in approving a large, open-cut mining project, with a limited life, if it would destroy a fantastic natural environment that was the basis of a foreign-exchange-earning tourism industry—with a sustainable future. Countries need to make the best use of their natural resources, and this requires looking to the future—and, in the example here, making awkward trade-offs, awkward because the temptation to take the one generating immediate income from mining will be very strong. To be able to manage environmental impacts to allow both mining and nature-based tourism would be perfect for the poor country, particularly if the once-off mining profits could be placed in a sovereign wealth fund so to generate ongoing income for the nation's people.

An example of a potentially worthwhile project in a poor part of the world would be a large hydro-electric dam, an associated electricity-generating powerhouse, and the poles and wires of a distribution network. This relatively inexpensive and sustainable supply of electricity would have a dramatic positive health impact on people who have been burning cow dung in closed areas to cook meals. Electrification would help export industries modernize and, hence, generate increased foreign exchange for the country. Without electrification a poor country is condemned to ongoing poverty. Without a modern transport network, a poor country is forever poor. These points are so blatantly obvious that it is embarrassing to write them, yet given the fact that so little progress has been made in the poorest regions of the world, harping is not carping.

We could be involved in assessing a foreign-owned, export-oriented farming enterprise somewhere in Africa. It could involve growing flowers for export to rich foreigners to display on their dining room tables. A project such as this would need careful analysis before it could be deemed positive from a poor country's perspective. Maybe it would meet the required economic criterion, and be supported, if a large number of local jobs resulted, and considerable profits were retained in the country; maybe not, if it took valuable food-producing land out of production. In this, and most other examples of projects in poor countries, the question of retained local profits and employment must be primary factors in determining their economic worth. As a general rule, undertaking EIA in a poor country will require a more detailed economic analysis than in a rich country. There can be more to gain or more to lose in poor countries.

The key consideration is the long-term future of projects—in other words their sustainability. For example, producing fruit and vegetables for domestic consumption and the export trade is a sustainable activity, as long as the land is protected from soil erosion and the depletion of nutrients. This level of soil protection is possible. On the other hand, if the project involves extracting and selling a nonrenewable resource, as mining projects do, economic sustainability is only achieved, as noted above, if the profits and resource rents are invested in a sovereign wealth fund which provides ongoing income once mining ceases. The Norwegian fund is the standout, discussed in a future chapter.

Turning attention to the mature, industrialized economies, what do citizens want from their economy? What would they expect from a major project, say, a mine or a freeway? Given their needs and wants are met by the amount of income they earn, all other things being equal, they would want to maintain their present level of income plus obtain a personal gain from an increase in the nation's income and overall economic well-being if the project was approved and went ahead. Who would support a project that had greater costs than benefits!

If we take notice of the media, we would be led to believe there is only one benefit from new projects and that is job creation; or a combination of job losses and new ones created, as in the example of building a solar farm to replace a closed coal mine. This type of comparison is an essential aspect of EIA. I shall have much more to say about it in a future chapter. Here, I need to raise a matter that is usually neglected in assessing the future job market. Outside of the service industries, medicine and scientific work (such as searching for vaccines), modern societies are now facing the challenge of determining how to share the amount of work required to meet an industrialized society's human needs and wants. Already we are witness to increasing replacement of workers with automated machines in mines, factories, warehouses and supermarkets. Who has not noticed the automated pill dispenser in a modern pharmacy. The time is rapidly approaching when project proponents will be forced by reality to downplay their job-creating rhetoric.

I now come to mention the other major forces in play when we unravel economic sustainability. In the era in which I write, four factors, with the potential to diminish our economic future have to be built into our economic assessment of a project—they do not have to be associated with the project. That is, they can be exogenous. They are the depletion of nonrenewable resources, minerals and fossil fuels; the negative impacts of climate change; trade wars; and serious, generally unexpected, pandemics. To illustrate what I am referring to, think about how the price of a certain essential—at present—commodity is felt throughout the economy. The commodity is oil and its increased price is the concern. This is something we used to worry a lot about, given our experience of the oil price shocks of the 1970s. Here is the scenario: if substitutes for fossil fuels do not come on to the market in line with their diminishing supply, the price of fossil fuels will increase and given the reach of fuel prices deep and wide into mature economies this will cause significant flow-on effects. In this situation, economics is similar to an ecological system (or food web) with multiple links and feedback loops (which can go unnoticed until something unexpected hits). If you are an economist, you might prefer to think of ecological systems as clones of economic systems, or the converse. Either way it does not matter. I am reminded of the title of Donald Worster's book *The Economy of Nature*.

Put the matters raised above aside (we shall return to them). Where a project would result in overall negative environmental impacts, the assessor has to analyze practical and feasible alternatives. This is another matter that we will deal with in some detail at a later stage, but here I introduce the issue. Think of examples where the desired economic outcome of the project could be achieved by another means—hydro-electric power rather than coal-based electricity. Then there are cases where in altering the design of the project, or changing its location, there will be no negative impacts; for example, locating wind farms offshore rather than on land near villagers who object to the turbines' existence. If practical alternatives are not available, there is compensation (offsetting) to be considered before finally deciding against the project. As we will discuss in detail in a future section of this book devoted to environmental offsetting, it can be the case, such as construction of an airport in a coastal location, where the destroyed ecosystem is replaced by a *like for like ecosystem* created in nearby, otherwise degraded land.

What we are discussing here is what economists call externalities; this means the costs (beneficial externalities do exist) that are not accounted for in the price one pays. They are costs borne by others. A purchaser of electricity generated by a coal-fired power station does not pay for his or her contribution to the damage the build-up of greenhouses will cause. The role of externalities was overwhelmingly important—we could say the main reason—in the decision to develop EIA. Negative externalities were not included in the pre-EIA era when economists and accountants did the sums on a major project. Now they are the prime focus in evaluating large projects.

Moving on from externalities, we need to ask yet another question of what we want from our economy, particularly as consumers. Experts who write about this topic use the term sustainable consumption. This concept goes to a deeper level than what we might typically expect of economics—yet it relies on a psychological factor underpinning the discipline. This is the question: assuming all our basic needs are being met, do we, thinking rationally, take into account the degree of satisfaction we get from consuming ever more of the various goods and services we presently purchase? Do we fully value and appreciate the additional consumption of these goods and services? Would we be better off, for example, by consuming less material goods, and spending more time with family and friends, more time on the beach or in the bush (countryside), more time watching top-class television (rather than much of the mindless stuff served up), or more time reading, and experiencing top-quality concerts, theater and any of the other arts? This question is about valuing qualitative changes in our lifestyles. What is behind this question is the fact some forms of consumption place much greater demands on the environment—have greater ecological footprints—than others and are, possibly, more enjoyable.

The issue that I have introduced is not new. It has exercised the minds of some of the most eminent economists. In a nutshell, their argument is that *quality* trumps *quantity* and, in doing so, make the point that we could be, if we wished, on the road to a very much improved quality of life; the *good life* is there for the taking, and from their perspective is achievable without demanding more from a finite planet—actually, demanding less. First, there is John Stuart Mill. Writing in 1848 in the *Principles of Political Economy*, Mill proposed what he called a *steady state economy*. His thesis was that the materially well-off were not necessarily interested in increasing consumption of material goods, but rather they would prefer to have more of the pleasant things I mentioned above. That he would be thinking this in an era before the motor car, plane travel, television, universal electricity, sanitation services and the Internet is certainly interesting. Keep in mind, Mill was writing from the viewpoint of a middle-class intellectual living in the most advanced city in his time, London. From his perspective, these middle-class people were well served with material goods.

We should note that aside from the middle class of his day missing the opportunity to enjoy many of the nonmaterial services available, Mill was concerned about the intolerable conditions of the working class during the Industrial Revolution. He argued for an economic system where the distribution of the goods was divorced from the income earned. He did not use these words; rather it is my attempt to summarize his position, *let* capitalism *produce and* socialism *distribute*. Another economist writing about half a century later, the Norwegian-American Thorstein Veblen, went to another interesting, and in this case clearly irrational feature of human behavior. I refer to the imperative of *keeping up with the Joneses*. In his book *The Theory of the Leisure Class* Veblen brilliantly caricatured what we call conspicuous consumption. He only needed to look at the sprawling, grandiose mansions of the late nineteenth-century American *robber barons* to witness each trying to one-up their society rivals. He addressed the economic truth, which still goes unrecognized in the twenty-first century, that there is no point to a zero-sum game. And, if all of us were able to engage in the game, we would gobble up the Mother Earth's resources leaving no possibility of restoration.

In the same period as Mill was writing, Karl Marx in *The German Ideology* published in 1845 looked forward to a future when capitalism, which he condemned to the waste bin of history once it had achieved its historical goal of producing a superabundance of goods, would have solved *the* economic problem. Put at its simplest, a superabundance meant no need to arrange the means of production and distribution. Pure communism would have arrived. The following quote taken from Marx's writing describes a true communist society. I can recall it being much quoted by idealistic university students in a past era. It illustrates the appeal of the end of scarcity:

> *In communist society, where nobody has one exclusive sphere of activity but each can become accomplished in any branch he wishes, society regulates the general production and this makes it possible for me to do onething today and another tomorrow, to hunt in the morning, fish in the afternoon, rear cattle in the evening, criticise after dinner, just as I have a mind, without becoming hunter, fisherman, herdsman or critic.*

It would seem that the pure communist society, ever so briefly described by Marx, is a steady state economy; however, Marx was a technological optimist with no view that the world's population would grow as large as it has with the consequence that the increasing material demand on a finite planet might not permit a superabundance for all. The good society, which our next economist suggests is rapidly approaching, would also require the planet to produce much more than it can—or so it would seem.

Come to 1930, and read John Maynard Keynes speculate on the powerful forward thrust of a capitalist economy that would have run its course in 100 years after he wrote—we are less than 10 years away from that at the time of my writing:

> *Assuming no important wars and no important increase in* population, *the economic problem may be solved in a hundred years … the economic problem is not … the permanent problem of the human race … The strenuous, purposeful money-makers may carry all of us along into the lap of economic abundance … it will be those people, who can keep alive … the art of life itself and do not sell themselves for the means of life, who will be able to enjoy the abundance when it comes … we shall use the new-found bounty of nature quite differently from the way the rich use it to-day … we shall endeavour to spread*

> *… that work there is still to be done as widely as possible … a fifteen hour week … We shall be able to rid ourselves of many of the pseudo-moral principles which have hag-ridden us … by which we have exalted some of the most distasteful qualities into a position of the highest virtue. The love of money as a possession … will be recognised for what it is, a somewhat disgusting morbidity, one of those … semi criminal, semi-pathological propensities which one hands over with a shudder to the specialists in mental disease.*

What these most eminent economists were writing about is what we call today post-scarcity economics (sustainable consumption), a situation in which minimal human labor is required to provide the *good life*. The world these economists describe has not resulted—yet—but we in the rich countries could, if we willed it, share the amount of necessary work far more widely. We could also share the food produced much more widely across the world. We could end poverty today if we wanted to. The more of us there is the future, the harder the task.

None of this suggests how the poor are to cope. Our economic system is not designed to feed the world and, we cannot ignore the fact that the system only provides employment for the poor if they are willing to work for much less than we will. I make reference to China, India and other developing countries where wages for workers are a long way below those in the USA, which has some of the lowest wages of the industrialized countries.

To revert to the consumption theme, we can note two fundamental points. First, over-consumption in *keeping up with the Joneses* is expensive. As noted, it is a zero-sum game. It also makes little sense if we bring into play the law of diminishing marginal utility (as discussed previously). It bears repeating: in simple terms the more one has of a certain thing, including money, the less satisfaction (utility) derived from the next unit acquired. You, I and the Joneses keep purchasing more but are obtaining ever-diminishing satisfaction from the additional goods and services.

Now put these economic perspectives in terms of assessing a project. If we in the rich countries are rather rapidly moving to a steady state economy, there will be projects we ought to think about more deeply than we have up to now. Maybe their touted benefits are of little or no value. We should, as assessors of these projects, be mindful of diminishing marginal utility. Would we, being rational economists, value another stadium—without asking would we value it more than another hospital? We could ask, is there an objective way of weighing a project's benefits and costs by applying the law of diminishing utility? There is—in theory at least. As noted previously, it is to weigh benefits to the rich much lower than benefits to the poor. In other words, weight gains or losses proportional to wealth. A billion dollars spent on a stadium that will be used only by the rich is in terms of the Rule of Diminishing Marginal Utility worth less than that same billion dollars spent on a hospital used by the poor. The major practical problem is that economists have not been able to agree on how to determine the weights.

This brings me to the much-neglected issue of the twentieth century. Well-meaning people become angry about many things, because they see them happen before their eyes, so to speak, such as the brutal killing of George Floyd. Otherwise gross injustices go unnoticed. This is the case for the poverty in the very poor world. There remains today and, one must expect, will remain into the foreseeable future, the need to promote massive economic development in the poor countries. Think deeply about the justification of projects in the rich countries—ask how important are they? Be ever grateful if projects in the poor countries are going to help their people gain material benefits which are presently denied them. We could—and some of us do, notwithstanding objections—promote building multi-purpose dams in poor countries and waste recycling plants in rich countries. Would that not be fair? In future chapters we will come to understand how the various conundrums we have introduced in this chapter can be dealt with in practice in an EIA.

There is a completely different economic fact to consider in environmental assessments. It is our ability, quite limited that it is, to look into the future. The types of projects most likely to be subject to an EIA are likely to have a long life span. Water storages fit this category, the longer their life the better. Most mining projects have relatively long life spans. The future of the use of coal is the subject of a future chapter, but it is important to note that as a consequence of international action to curb climate change and the decreasing cost of alternative electricity sources (and potentially the replacement of metallurgic coal for smelting), much thought is being given to the likely future of coal. The expected economic life of a coal mine or coal-fired electricity power station will make a crucial difference to the results of coal-based EIAs.

We should always keep in mind Joseph Schumpeter's notion of *creative destruction*. This process epitomizes capitalism, with its incessant take-up of scientific discoveries, innovation and discarding of the *old*. Select your own example of what product has been superseded in your lifetime: the fax machine, the wall telephone, the camera and the typewriter. If you were working in an office a quarter of a century ago, you would have spent time delivering your handwritten script to the typing pool, correcting the typed draft and resubmitting it.

We tend not to prepare EIAs for things like the smart phone, but would it not have been a fascinating project! For example, there is in the manufacture of these multipurpose tools the use of rare earths and rare metals, which at present are mainly supplied by China. This is about to change, as I shall explain below. Because these things are called *rare* it does not mean they are, and China is the major source at present because some years ago the price of the rare earths fell significantly and the rest of the world could not compete with Chinese wages and poor labor conditions in the mines.

There are not just innovations to celebrate, or worry about, in predicting the future, there is international politics as played out in trade wars. We thought, numerous times in the past, the days of trade wars were over, but as I write it is obvious they are not. It is common to use the term *trade war* to describe the ostensibly poor relationship between the USA and China. Of the particular products that the USA is working furiously to obtain domestically rather than rely on China are the rare earths and metals.

On the positive side, what could dampen, or even halt, any future trade war is the interlocked nature of the world's major economies. If the investors in country x have a major financial stake in country y, the former would need to do some simple mathematics before setting out to damage the economy of the latter. This is a positive result of globalization. It is somewhat analogous to the strategy of symbiotic mutualism in ecology, where interdependency leads to mutual benefits. An example, common to anyone who delights in colorful coral reef fish, is the relationship between blue-streak cleaner wrasse and larger reef fish. The former eat the parasites on the bodies of the larger fish, and both benefit. An example of mutual benefits so fundamental that without it humans would not exist is between plants and humans. We exhale carbon dioxide, which plants take up to produce the oxygen we breathe.

There are a number of strong global influences at play in the economic sphere. Some will argue that these are not the concern of an EIA expert, but should be left to the proponent of a project—it is in the proponent's interest to get these right. I happen to disagree, based on evidence of projects that have failed because unexplored economic conditions changed, and the result, among other things, is a legacy of pollution cleanup. An EIA assessor has to be, at least, as capable as the proponent's economist—and more open to possibilities that the proponent does not wish to envisage.

Here is an example of what could happen, a major export-oriented project for which a country does not have a monopoly, could have its future decided by what happens under trade deals, whether unilateral, multilateral or determined by the World Trade Organization. Put simply, without a monopoly or cartel arrangements, countries are competitors in global markets. Competitors cannot control what each does. Even when cartels are formed with the aim of generating monopoly profits through the control of supply, it only takes one member to walk away for the cartel to collapse.

It should be clear from our discussion that the economic component of an EIA is—should be—a very serious, scientific-based to the extent possible, treatment of not just immediate economic impacts but rather the probabilities and possibilities of future economic conditions, with and without *the project*. This is no easy task. Would someone asked back in the 1950s to undertake an EIA on the commencement of international passenger air transport take into account the possibility of a pandemic bringing that industry to a halt 70 years later? I would suspect not. Unknowns aside, the general point is that economic analysis is—should be—a substantial matter in environmental assessment—something it is not in a typical EIA. Generally, it is very poorly done. As I shall explain in a future chapter, we need economics to help us decide on whether or not the project is justified. It pays to remind ourselves that there would be no project to assess if there was not an economic driver, be it well -conceived, poorly conceived or just plain brilliant.

Sustainability and the Social Perspective

Our next sustainable development topic is what we seek to achieve with the third leg of the sustainability stool, the social context? This one is the most difficult of all because of the open-ended nature of *social*. Some EIA-related laws make it either mandatory or at least a matter of some consideration, to assess health impacts and cultural impacts separate from social impacts. However, the standard has been, and remains in the general theory, that these should be subsumed under the general category of social.

How broad is the social? One could—probably, should—start by assigning any human need and desire that does not neatly fall into the economic component to the social category. Then at the interface between the economic and the social we could, if so desired, leave to a separate subcategory, socioeconomic impacts. Job creation—or job destruction—would fit here, as it is both an economic matter and of psychological consequence, not to overlook its effect on health, crime, drug dependency and other social ills. Employment creation is the one topic that EIA practitioners do not overlook. Certainly, the general public is broadly interested in the level of employment in the nation, and at regional or local level, the interest is elevated. The media is prone to run employment stories—in particular, a propensity to focus on jobs foregone if the project is not permitted to take place. And, in these circumstances, a proponent will cite employment creation as the reason to support his or her project.

It is an unfortunate fact that EIA assessors, who rely solely on the proponent for data on expected employment numbers, can too easily overestimate the number, as we will come to document in a case study. It is incumbent on the EIA practitioner to undertake their own assessment of employment numbers. We will put employment aside as a topic in this chapter and discuss other social factors. Once we enter into conceptualizing what we want to achieve in social terms from a project, we are in the realms of moral philosophy, ethics, anthropology and sociology. Space does not allow anything but brief comment on any particular disciplinary perspective, given each perspective could be a book-length treatment.

Where appropriate, specific disciplinary perspectives will be weaved into the following commentary.

One point of commencement—there are others—is to ask and answer who or what are we humans? This is followed by what do we need for survival and reproductive success, and then what are we seeking in a Maslowian hierarchical ascent from life-sustaining needs to self-actualization? In terms of what we are, two fundamental facts need to be recognized so that we do not become involved with divisive unscientific nonsense. The first is that, as any school child with a basic understanding of biology knows, there is only one human species *Homo sapiens*, and our ancestors came out of Africa and started to spread around the planet about 200,000 years ago. Major migrations—colonization from the point of view of our fellow animals—occurred later as our numbers grew and tribes sought new land. Eventually they would come to fight each other for resources. The really big fights were to be far, far into the future.

There is evidence that *Homo sapiens* interbred with Neanderthals and with the latter's distant cousin Denisovans. The most important fact that comes from this is that it is scientific nonsense to talk or write about multiple human races. The fact that so much inhumanity is associated with racism should be sufficient reminder to take every opportunity to correct this divisive, ill-founded belief. Certainly, do not write in terms of different races in an EIA if you do not want to be deemed scientifically illiterate. Certainly, write about racism if it is–but hopefully, not—a topic which cannot be denied in assessing the project, but do not use the plural races.

The second point is that we are social animals and have been grouped into tribes for most (all?) of our time on Earth. It is impossible to say when family, then clan groups, formed into tribal clusters; and, then as numbers continued to grow, formed into large and more complex groups, what we might call societies and, as complexity increased, what we would know as civilizations. All the evidence points to farming, and production of food surplus to the needs of the farmer's family, as the turning point from tribal groups to more complex social groupings.

I shall discuss EIA in the context of social justice in relation to existing tribal groups before getting to issues of local concern when a major development brings significant changes to an existing community. In terms of intra-generational equity, we have come to pay considerable heed to the legacy impacts of the colonization of the past few hundred years. Earlier periods of colonization are neglected. We need to recognize that human history is one of colonization upon colonization—often involving invasions. Very few know much—if anything—about the colonization undertaken—and recorded—throughout history. This is a shame as there is much to learn from history. It brings context to present discussions and debates on matters such as ethnicities and identities.

EIA and Tribal Societies

If we are undertaking EIAs in remote parts of the world, we would be aware that a number of tribal people remain, generally—but not universally—as marginalized people. We tend to hear more about people still living a tribal lifestyle, if they are living in the industrialized countries, than those who are marginalized in the developing and poor countries. The former include the Inuit of far-north America, while the latter tend to be out of sight and out of mind; in this context, one can think of the tribal people in the Amazon rain forests, in parts of India, and in the far-flung outer islands of Indonesia. There are many more examples.

There is not one story, but many, in describing the relationship between tribal people and projects that impact their lifestyles. Some tribal groups are in a very good position. This tends to be the case where national governments take seriously the United Nations Declaration on the Rights of Indigenous People. The Norwegian Sami, who have their own parliament, head the list of those who have rights which favor them—notwithstanding that the Sami are not indigenous. A not well-known fact is that the Sami were not colonized by the Scandinavians. The latter were in Norway a long time before the Sami came. However, the Norwegians do not treat them as interlopers but welcome them. The Sami in Sweden and Finland are not far behind in their relationship with the general society, while those in Russia are the least powerful of all Sami groups.

Let us consider the case of existing tribal folk and their relationship to major projects subject to EIA. This is an important aspect of EIA as tribal societies will have a significant interest—and say—in the EIA process if it is on their land. If circumstances are favorable, they will seek benefits, whether employment contracts or special royalty deals, in the process of deciding on the future of a project.

North America

The situation for the Canadian First Nation, Inuit and Metis peoples is generally sound, well-established and rigorous where land-claim agreements have been settled. An exception is the confusion that can occur where a treaty was not signed, as in British Columbia. Property rights are most often at the top of indigenous claims when large projects are proposed in their area. There have been controversial EIAs in Canada. For example, there have been major legal challenges to proposed extractive industry projects, particular where long pipelines are to traverse tribal, or tribal-claimed, lands. The legal questions are many. For example, has the *Duty to Consult* during the undertaking of an EIA been at a level a judge of a relevant court might deem appropriate? Who are to be consulted and otherwise involved? Who *owns* land if a treaty does not exist? How much legal force do treaties have? These questioned should be answered with reference to the existing law. Then, there is the situation where some tribal groups oppose a project while others support it—another avenue for legal disputation. Many of these legal arguments fall outside of the EIA process, unless the contention is that the EIA law has not been followed. The Canadian government has made an attempt to resolve a number of these issues. Under the recent establishment of the Department of Crown-Indigenous Relations of Northern Affairs, co-management plans have replaced aspects of EIA requirements. Each of these plans would require perusal to determine the scope of joint arrangements; however, EIAs will still be required for major projects.

The situation in the USA is not significantly different from that in Canada. The rights and economic interests of Native Americans are central to the social impacts of projects that are in, or traverse, tribal land. Here is a little piece of fascinating history. Close to 150 years ago, gold was discovered in the Black Hills of South Dakota. The Black Hills were reserved for the Sioux Nation, and as a common feature of many tribal societies, this was a sacred country. Gold was a magnet for miners and the

US government was keen to have it exploited. Imagine if NEPA had been in existence in the 1870s.

It was not, and this is what happened. The government felt obliged—as it legally was—to gain access to the gold by negotiating to purchase the land from the Sioux. The Sioux were not interested. Today, that would have been the end of the story—unless the government had reserved rights to underground resources. Put that possibility aside. When the Sioux declined the offer, the government ordered them to leave their land. Expect that would not have gone over that well with the Sioux. It did not. They refused to leave. The Sioux War was fought. It was to be Custer's *last stand* and Sitting Bull's victory. However, that moment of glory did not last, and rather than the war bringing the situation to a close, it led the US government to adopt another strategy. The Sioux were chased off their land, until war-weary and starving from wandering farther and farther from their traditional lands, they surrendered. Something similar happened to the Apache, although under Geronimo, they held out until 1886. Progress has been made since those days, but far too late for the Native Americans. Today, some of the most contentious matters arising under NEPA involve Native American issues.

In the USA, more so than any other country, disputes over EIA processes and recommendations end up in the courts. This process has had some benefits when judges determine legal rights, and sort out definitional issues under NEPA. The following chapter takes us to a discussion on EIA and the law.

Australasia

In Australasia (Oceania), there are significant differences between New Zealand and Australia, and between these two countries and the other Pacific nations, in the involvement of indigenous folk and resolution of indigenous matters during the EIA process. For reasons to be explained, the handling of tribal social impacts in Australia can be messy—it is very much a case-by-case matter. In the New Zealand (Aotearoa) case, the 1840 Treaty of Waitangi between the Maori and the colonizers became a constitutional document. It has served the people of the country well, particularly as specific agreements under it have been reached. For an example of its operation in the modern setting, we can point to the Treaty of Waitangi *(Fisheries Claims) Settlement Act 1992*. Under this statute, 20 percent of the New Zealand allowable fisheries harvest is set aside for Maori fishers. Clear, unambiguous! In Australia, the EIA process would involve ascertaining if Native Title rights existed and, if they did, who held them. Only when that was sorted out, could any indigenous social impacts—positive or negative—be addressed in an EIA.

As there was no binding treaty agreed by First (Indigenous) Australians and the British government when the penal colony was established in 1788, the matter of indigenous rights was, at the best, very haphazard until a High Court decision in 1992, known as the Mabo Decision after the Torres Strait Islander, Eddie Mabo, who took the case for indigenous rights to that court. In 1993, the Native Title *Act* came into operation. This law allows indigenous people to seek Native Title over unallocated (vacant) Crown land plus a few other areas such as certain parks, reserves and some coastal and marine areas. Approximately, four out of five legal claims for native title have been successful. However, what a successful claim means in terms of rights is a case-by-case situation. Furthermore, there is the situation of *coexisting* rights, most relating to grazing leases, where camping, hunting and certain cultural rights are allowed while the grazier goes about his or her business. Only in the Northern Territory is large-scale indigenous freehold land ownership allowed in Australia. It is held by Land Trusts in common, not as individually owned land. Of course, more generally, indigenous people as individuals or companies purchase residential, commercial and farming land anywhere in Australia, as any other Australian citizen can do.

The Australian history is slightly more nuanced than this brief summary, and worth noting here because it could have been much different. In 1770, Captain James Cook took possession of the east coast of Australia on behalf of the UK government. All he had to do to achieve this was plant a flag in soil on the northern tip of Australia. The UK government held the view that there were not any indigenous leaders—or a political organization—to represent the people with whom a treaty could be signed. To be fair to the British, how was Cook or, when the penal colony was opened in 1788, the first British Governor, to decide whom to approach as a representative of the very large number of tribes on the Australian east coast, let alone the inland and western tribes?

Treaty-making would have been a tribe-by-tribe exercise. It has been estimated that in the order of 500 different dialects existed at the time of the British arrival, and about half that number of languages. Given the convention of assigning indigenous *nationhood to* a language group, no realistic solution presented itself for Cook if he had entertained making a treaty with anyone other than a tribe at his place of landing.

The British Governor of the new colony, called New South Wales, was given certain orders by the UK government. One order was that there was to be no slavery, consequently no slaves—putting aside that the prisoners transported to Australia were slaves! The order pertained to the indigenous people. It did not hold except in a strict legal sense, as some indigenous people came to be worked in near slave-like conditions. Another order to the Governor pertained to how the British were to treat indigenous women if they married them. They were to treat them well; otherwise the punishment was to be severe.

When Cook planted the British flag, the Latin legal term terra nullius, roughly meaning vacant land, was implicit in the decision by the British government to accept Cook's action. Of course, Australia was not vacant, as Cook had recorded the presence of people. The only reason that Cook's act could have been appropriate was if Australia had been deemed *res nullius*. Some argue that terra nullius originates with *res nullius* where the latter translates to land no one owns, even if people live on it. We can accept that definitions change, a classic one is determining who are one's peers in a trial by jury—on the basis of the *magna carta*, members of the nobility were to be judged by nobles, no one else. Regardless, Cook was supposed to consult with the people he met on the issue of any claim to territory. This did not occur—no treaty as such was entered into.

We can note that, in 1835, about half a century after Cook's flag-planting, explorer and farmer, John Bateman entered into a treaty with local First Australian (Indigenous) leaders for land at Port Phillip Bay, present-day Melbourne. The Governor of the (then) colony of New South Wales quashed the treaty. Had that not occurred, we can but speculate on the possible counterfactuals.

With this background in mind, an environmental practitioner working in Australia has a duty to establish if there exist any indigenous rights or claims in land that are likely to be impacted by a project undergoing assessment.

Social Sustainability in Developing Countries

How can an environmental practitioner do justice to social sustainability in undertaking an EIA in poor countries? This topic deserves a book in its own right, but even it would not do justice to the wide range of circumstances one could find oneself in. I shall do no more than illustrate the complexity by noting a handful of different situations that relate to tribal matters. They are matters to which most of us would not be accustomed. And that is why it is important that a practitioner is sensitive to cultural and religious differences.

Many developing countries have their own EIA process and guidelines. Fortunately, they tend to be built on NEPA as their model, but can vary significantly on social matters. One needs to be ever mindful of tribal, ethnic and religious rivalries—and a politics that has its basis in these. If the project is being funded by the World Bank or one of the regional multilateral banks, these institutions have EIA standards based on NEPA, and as a result, one can be expected to give serious attention to the impacts on tribal groups. Private-sector international aid agencies are, likewise, reliant on NEPA-style assessment of their projects. Otherwise, whether or not an EIA is undertaken—and how rigorous it is—will be determined by local laws or policies. These will not necessarily place any weight on social matters where they relate to tribal people or the otherwise marginalized. There are countries where tribal people are not recognized by their governments. The reasons vary and cannot be pursued here, except for mention of an example.

In the mid-to-late 1980s, my doctoral candidate, Mark Hoey, was in the highland rainforests of northern Thailand researching methods of conservation farming to replace *slash and burn* agriculture. His thesis was one of the first to put environmental issues into a sustainable development perspective, as it had only recently been formulated with the publication of *Our Common Future*. Hoey came up with a practical, workable solution, and when he left Thailand on the completion of his research, a handful of tribal farmers had adopted it.

The tribal people, colloquially referred to as the *Hill Tribes*, who were at the center of the research, were not accepted as citizens of Thailand, even though there were over half a million of them and their ancestors had been in the country for generations. The consequence of this was that, notwithstanding the agronomic and economic benefits of conservation farming, not to overlook the protection of rainforests, the Thai government extension staff, who were tasked with spreading the concept of conservation farming throughout the Hill Tribe community, had no serious interest in the project when Mark Hoey returned to Australia, and the project withered on the vine, so to speak. Tribalism is hard to deny.

For an outsider, ascertaining tribal associations, ethnic relationships and asserted *race* can be difficult. That recognized, in undertaking EIA one can find oneself in a position where parties to the assessment will claim to be of a particular *race*. Best to leave it at that. However, for the curious I am obliged to clarify, to the best I can, how confusion can arise. Who is and is not a member of a tribe or a *race* depends on the rules that some—not all—people desire to live by. If a person has had children with someone outside of his or her tribe/*race*, the claim of one partner—determined by his or her ancestors—can override all else. This can be based on conventions or cultural rules. In the classical case, if one has a Jewish mother, one is supposed to be a Jew.

There is one well-known, much-celebrated example of how sensible people deal with mixed descent without claiming superiority of one or other ancestor—and upsetting the other. It is the case of the Metis in Canada. Instead of selecting First Nation or European (likely to be French or Scottish) descent, they have their own formal recognition, as a creole people, on par with the First Nations and Inuit aboriginal people. How realistic and inclusive! Far better than the *one-drop rule* that was used in the southern US states to assign children of a so-called *mixed union* to the group with the lower status in that period, the African-Americans.

Interestingly, the one-drop rule has come from being a racist concept in the USA to being a means of asserting pride in being a First (Indigenous) Australian. Folk of mixed descent in Australia, who in some other countries would go by the description of creole—a point Professor Henry Reynolds, a very strong sympathizer of Australian Indigenous people, was taken to task for suggesting—are not called creole. There seems to be no question of dichotomous choice and no desire to recognize *mixed* descent such as the Metis.

An environmental practitioner who is likely to deal with matters of interest to aboriginal people in other places around the world is best advised to *do as they do in* Rome—because there is little consistency around the world. When humans come to discard the idea of multiple races, we will find it much easier. The issue then—as it should be—will hinge on intra-generational equity regardless of other human constructs such as race.

There is one other topic to be brought under the scope of social considerations in the pursuit of sustainable development. Religion can play a significant role in intra-generational equity. Consider, for example, the unofficial but still widely practiced Indian caste system, based on the ancient Hindu religion. Environmental practitioners are not in a position to change that. However, not to be aware of it is to get a distorted view of Indian society. As we will come to discuss in a future chapter, shipping mammoth amounts of Australian coal to India does not benefit the lowest group of people in the world. The so-called Indian *untouchables* are not even assigned to a caste—they are below all castes.

In terms of personal identities, and special interests in the outcome of an EIA, the wisest thing a practitioner can do is ask questions—and on the knowledge gained, attempt to establish a degree of empathy with those you are dealing with. Do not be surprised by the answers. Let us assume we have an EIA to undertake in Africa. We are likely to find that people can have simultaneously multiple identities and corresponding interests. To give an example, I can be a Zulu-Nguni (on the basis of ethnicity), a Christian (on the basis of religion) and a South African (on the basis of nationality). Association with any of these attributes can be positive in the sense of belonging and desiring certain outcomes from the project—say, a large multipurpose dam. But, wearing one of *my metaphorical hats*, and being an *other*—an outsider—I might be against the project because it would flood ancestral land. History shows that being an *other* can lead to being marginalized, and possibly needing special consideration in an EIA.

We have covered some territory in getting here. Time to summarize. As a general observation, in undertaking an EIA, none of the above should trouble us in a practical sense—some of it will challenge our ethical perceptions. However, there are exceptions. If a particular group is marginalized (e.g., living in slums, or a tribal group reliant on the resources of a natural forest), and the project will make these people worse off, effort will need to be put into researching, documenting and recommending compensatory action for the benefit of the marginalized people. The intra-generational equity principle means that poor groups of people must not be worse off with the project, and, in fact, should be made better off. Of course, if the project is to bring electricity to those cooking with cow dung and their children studying with the light of mobile phone, the project would be applauded, and we as assessors should be pleased.

There is one situation where ancient tribal culture is a matter to be ever mindful of in undertaking an EIA, and that is if a cultural attribute could be damaged or destroyed by the project. This could be the flooding of an ancient site behind a dam wall, the excavation and destruction of artifacts by mining, or the redevelopment or expansion of a city. With regard to artifacts, I am frequently reminded of the fascinating ancient finds by those digging under an old established city, such as Rome or London. We care about and learn from the discovery of these discoveries. And so it is with artifacts of any human society. Care is called for.

In the situation where heritage and religious sites and artifacts could be in danger of degradation or destruction from a project, specialists practitioners, particularly those skilled in archaeology and history will need to be involved to provide guidance, whether it is to not proceed with the project or change the manner it is undertaken, and possibly its design. As EIA practitioners, we can face difficult cultural, ethnic or religious values and attitudes if the project involves very sensitive symbols. Our role is to be agnostic except in protecting World Heritage—because *world* heritage means precisely what the words say: whatever it is, it belongs to all of us. That is difficult for some to accept. I present a brief discussion on this matter in Box 3.1.

While it would be the exceptional development project that would entail entanglement in such controversial and difficult matters as the examples I have given, they illustrate that once we move beyond the safe boundaries of ecology, social science and economics—the terrain can become irregularly irrational. Most bread and butter EIAs will, in terms of social impacts, need to cover little more than demographic changes—the project results in a town's population doubling in size, and what that means in terms of the provision of social infrastructure such as schools, medical services and policing. Particular attention would be paid to the

Box 3.1 A Digression on Heritage and Religious Sites, Monuments and Artifacts

Ancient and not so ancient sites, buildings, monuments and artifacts are part of human history. In general, as a world community, we have been very scrupulous in protecting these things. This was far from being the case in the past. As we know, the tombs of the ancient Egyptian pharaohs were robbed, often soon after they were built. There have been many examples of degradation and destruction of heritage values since then.

For some years now, through the United Nations, we have awarded special protective status to those places, monuments and artifacts, of world heritage value, this under UNESCO World Heritage listing. At a national level, most countries have written laws to protect their unique heritage. Yet, degradation and destruction occurs due to inadequate policing, occasional errors and willful destruction by opposing religious groups.

The saddest state of affairs is when one religious or ethnic group destroys or damages the historical heritage of other religious or ethnic groups—because, they assert, their religion or their pride demands this of them. It is not only religious and ethnic groups, some determined atheists, as was seen at times in so-called communist countries, destroyed religious icons of heritage value. However, as rational humanists, most atheists are keen on protecting heritage for what it tells us about the human journey, whether it be uplifting due to its beauty and intellectual achievement, or valuable due to the historical story it tells—and this will often be of some atrocity—hence secular humanists are not known to destroy statues of even the most evil.

One would find nothing in entering Hagia Sophia to remind one of some horrendous crime to one's fellows. It does not represent the Crusades or anything of their nature. It was built in AD 537 as a Greek Orthodox cathedral. But then look more carefully. When Istanbul fell to the Ottoman Turks in the fifteenth century, the Muslims set about converting it into a mosque, and destroyed altars and mosaics depicting Jesus, Mary and Christian saints. When they were not easily destroyed, they were plastered over. Hagia Sophia is a UNESCO-listed World Heritage site. Even atheists cannot be but moved by its beauty, degraded as it was by an invading army of a different religion to its founders.

Today, some people destroy statues, say, of slave owners, and we can understand their emotions. Yet their action raises difficult questions. Where do you stop, given slavery has been with us from Biblical times, if not further back? We learn nothing if we erase history. I assume we do not go to the footing of a statute and pay homage to a concrete construction, but in walking past we might glance up and be reminded of an atrocity. That is of value. We make progress by reflecting on how barbaric some of our distant ancestors have been—and that is not confined to slavery. It is not difficult to find examples of the most horrible abuse in all the cultures for which we have records.

Box 3.1 (continued)

Because of the great mixing of people (ethnicities, cultures and religions) over thousands of years, how far back do we go in an attempt to identify sinners and saints? There is no possible end to that endeavor for those who would start the search. However, we can identify something positive that all of us can do that is productive rather than destructive and divisive—say *never again*. Surely, we do not want to enter into one of those *slippery slope* problems we can find ourselves in without thought. Would we be willing to bulldoze the Colosseum where it is estimated 400,000 people were killed in the *blood sports*, as Christians were fed to the lions and slaves killed each other for the entertainment of the Roman spectators? Notwithstanding that horrible history, Christians, rather than bulldozing the Colosseum, are happy to visit it as a World Heritage site, to be reminded of Roman power, genius and brutality. We cannot let past injustices continue to cause hurt. This was what Nelson Mandela so brilliantly recognized. He could have been extremely bitter, angry, set on revenge after all those years in prison. Yet, he was so much wiser than to harbor those destructive dispositions. As South Africans of all skin colors realized at the end of apartheid, truth and reconciliation are the only sensible and meaningful ways to find closure and create a better future.

benefits, if any (such as jobs or royalties), going to marginalized indigenous folk, if they have a formal interest in the project. Undertake an EIA in rich countries, particularly if there are no marginalized people involved, and as a social scientist, you will have all the necessary data and tools at your fingertips—demographic projections, ratios such as medical doctors per 1000 population, and likewise for teachers and police. You will be required to do some serious research on indirect and induced impacts. These we will come to. This work is both fun and challenging. As a gentle warning, you do not want to be the consultant to recommend a large, permanent residential development in some lonesome county to house a team building a dam that they will complete and be gone in two years.

EIA or SEA to Meet Sustainability Criteria?

Is project-based EIA up to the job of meeting sustainability criteria? Is not SEA needed? I have argued above that if EIA is to fulfill its promise—adequately analyze the matters it is intended to—there would not be a need for a separate tool called SEA. That noted, I wish to recognize the intellectual efforts involved in developing and promoting SEA. This work has been far from wasted. It has drawn attention to shortcomings in EIA practice, and, in particular, it has made clear the benefits of long-term planning. I shall quote from the contribution made by Robert Gibson and his colleagues (2010):

> *While project-level assessment processes have led to more environmentally informed and generally more transparent and participative decision-making … they have typically not been able to deal with larger or underlying concerns—about* cumulative effects*, broad objectives and* alternatives … *In advanced practice, SEA is intended to ensure positive contributions to sustainability, as well as mitigation of adverse environmental effects; to enhance openness and credibility of strategic level decision-making; to provide earlier, clearer and more reliable guidance for planning and approval of particular projects … and to improve the overall efficiency and fairness as well as the effective quality of decision-making.*

We shall pay particular regard to SEA in the following chapters. We will revisit some of the difficulties and attempt to resolve issues identified in this chapter, but in the main we will put EIA under the microscope as never done previously. The intention is to make it work for us.

In Conclusion

The principles of sustainability provide the objective function for environmental management. The measurement tool we call EIA should—will, if treated appropriately—take us in the right direction. As we have noted, there are some difficult issues needing to be addressed if we are to make good use of EIA. It is obvious that if sound environmental planning—call it SEA—has established the type and degree of development to be allowed in particular locations, a project-specific EIA should be a far less demanding task than it is in the absence of a strategic overview. But, we have not got SEA. It is much written about, and some limited attempts are made to practice it. A vast literature on SEA has produced little in practical results.

One reason—not the only one—for this is a philosophical reluctance by *neoliberal* governments to engage in planning, which SEA involves. In their eyes, planning suggests socialism. Ironically, there is not a government worldwide, including the most ideologically neoliberal, which has not given support to private industry by providing major infrastructure in terms of roads, rail, ports, electricity generation and supply. This is socialism to benefit the major corporations as much as citizens. If some of this infrastructure has been privatized in the past few decades, this does not refute the truth that governments have played a fundamental role in industrial development in the past. While a distaste for planning remains strong, we are going to need to rely on EIA to do much work for us.

The next chapter goes to the theory and practice of EIA in various countries. Notwithstanding the fact that over 100 countries have some form of EIA (and quite a few complement it with a limited application of SEA), only a handful will be selected for discussion. I have already noted that NEPA established the general EIA framework and, importantly, listed the matters to be assessed in an EIA, hence, attention has to be paid to the USA. I have noted that Australia, quickly followed the USA as a very early adopter, and has earned accolades for its practice. On the other hand, Canada, to quote Robert Gibson (2012) *once considered a leader in environmental assessment* was in retreat in EIA theory and practice until very recently. Gibson came to this conclusion before the most recent changes in Canada, and only time will judge whether that situation is being turned around. I am making these points to explain, in part, why I shall come to rely on Australian examples to illustrate the warts and all of EIA. The other reason to choose Australian examples is that it is in this country that I have practiced most and been privy to the best and worst of EIA over its near 50-year life span.

4

EIA Laws and Policies: From NEPA to the World

Introduction

As already noted, from the time EIA had its genesis in the USA in 1969, it has been adopted by a majority of the world's nations. The concept has evolved as a consequence of adaptations to suit the political and administrative systems of the adopting governments. Furthermore, an evolution of ideas, influenced by practical experiences and theoretical considerations, has had an effect. In this chapter, I have selected a small number of countries, with the aim of illustrating differences and similarities. We are not yet at the stage where we can assert with complete confidence that there is a *best practice* or ideal model—one that all can seek to emulate.

A major reason why there is no *one* standard is that EIA remains, 50 years after its coming into being, under the influence of governments, rather than standing beyond government dictates. In other words, EIA practitioners are not yet considered professionals with the authority to fashion and manage their practice. We expect professional associations to be the developers and guardians of their practices. Practices should not be at the whim of governments, which means they can—and do—vary through time, and country by country. Travel the world as an EIA

T. Hundloe, *Environmental Impact Assessment*, Palgrave Studies in Environmental Policy and Regulation, https://doi.org/10.1007/978-3-030-80942-3_4

practitioner and you will discover that governments have different approaches to EIA, and as governments change and with that, political ideologies especially with regard to environmental management, EIA practice can be forced to change. This would not be the case if EIA was in the hands of the environment profession, as, for example, the engineering and medical professions stand above political control—something that has to come for the EIA profession. One of the most obvious features in our attempts to manage the coronavirus, which causes the disease COVID-19, is that the most successful results have been in countries where the formal decisions are made—transparently—by the medical experts, not politicians.

To achieve uniformity of EIA theory and practice is the goal of EIA practitioners. They want it to become a tool for professionals to use, and for professionals to refine, if need be, as experience with its use mounts. I shall discuss in some detail in a future chapter the matter of professionalism. I shall not deny that government management of EIA is required at present, due to vast differences in the structure and content of university environmental degrees. We are still in the stage with EIA, to borrow a saying from Chairman Mao, of letting *a hundred flowers bloom*. I contend that we have had enough time watching the seedlings grow and by now should be able to identify the prettiest, and plant its seeds to produce vigorous and rigorous EIA. But that has proven not to be the case.

Sometimes we get it right the first time round and need not have spent time dreaming that—maybe—we could do it better, if … if only! What I am claiming is that it is difficult to go past the original NEPA and its clones. Before discussing NEPA, it will assist us if brief attention is paid to the role of law in the development and evolution of EIA. One of the advantages—some would say, disadvantages—of government designed procedures and practices, as is the case for EIA, is the scope for legal challenges of decisions made by governmental operatives, including ministers. This is possible under administrative law, opening up litigation by disgruntled parties. This can be a good thing. Yet, we could surmise that there would be far less need for litigation due to nonperformance of professional practice if environmental experts were in charge. We do not see governmental officials needing to tell medical practitioners how to perform their professional duties in operating theaters. Furthermore, in jurisdictions where specialist environmental courts can become involved in the EIA process, there is another avenue to take professional environmental matters out of the hands of experts—unless the judges themselves are highly qualified environmental scientists and managers. This situation differs around the world.

It is important to note that EIA laws change, sometimes in concert with the recommendations of the environmental profession, at other times on the lobbying of those who wish to weaken the procedures and practice. During the drafting of this book, EIA law in Canada changed, the existing law in Australia was under formal review, and President Trump signaled his intention to make dramatic (watering-down) changes to the American federal law. However, with Trump no longer being president, we can expect that the American federal law will not be watered down. If one was to scan the global scene, one would expect to find many more examples of change occurring. This we can overlook, as our focus is on a *general* theory and a standard practice. Sooner or later the profession will come to dictate its own business, and a general theory will prevail.

The Law Shaping EIA

Anyone familiar with NEPA will have noted that practice under it has been subjected to many legal challenges—far more than is the case in other countries with EIA laws. To a large extent this is because Americans are more prone than most to litigate. Furthermore, in the early days of EIA, it would not be surprising that there was recourse to the legal process to determine the meaning of key terminology. In particular, words that trigger an EIA, such as *major* and *significant, irreversible commitment, the human environment*, and *short term and long term*, have been subject to legal determination. This has been beneficial—at least for American practitioners. So much American EIA law has been established in cases relating to NEPA that one can talk and write of *NEPA jurisprudence* as a separate field of law.

Interestingly, to a greater degree than one would expect, US courts have ventured into the field of science. Anderson (2011) notes that the legislative history has been largely about matters outside of the expertise of the judiciary. When it comes to matters scientific—some quite complex, requiring a PhD in a specialized field to understand—judges are invariably laypersons. This is a matter that the environmental profession needs to challenge—assert its domain. As with all science the appropriate, long-established check on accuracy and guardian of methodological purity is peer review. I recognize this can be undertaken by specialist tribunals, commissions or courts (whatever they happen to be called) as long as the personnel are appropriately trained to untangle the scientific matter in dispute.

An issue to be mindful of is, when matters are settled by case law, we can expect that a principle or dispute over the meaning of a definition is not set in stone. In the short term, decisions are made and precedents established, but in future cases fresh judicial eyes have a tendency to find a need to revise and sometimes rescind and rewrite the law. This means uncertainty, frustration and cost. As already noted, the intervention of lawyers in fields of science is far from desirable. Far more constructive to allow scientists to sort out any problems. That stated, the law has a role in deliberating on procedural matters. The most important procedural matter in terms of EIA is in guaranteeing the public's right for involvement in the EIA process. In legal jargon the issue is *standing*, or *stare decisis* in Latin.

Nothing is more fundamental to EIA than the fact it is designed to open up for public scrutiny much that was hidden from public view pre-NEPA. Without public scrutiny of EIAs and involvement in the EIA process through public comment and consideration thereof, we are not dealing with the EIA concept as established by NEPA. In other words, EIA does not exist if there is no formal public involvement. The American courts have been good in safeguarding public involvement. The courts have kept EIA alive, and for this we must be thankful. It is a different situation altogether if courts are specifically established to do the work of scientists—unless their judges are qualified in the tasks that they are asked to resolve. I am not referring to tasks pertaining to procedure (these are for judges) but of scientific facts.

The Problem with Environmental Courts

Even with specialist environmental courts, problems can occur if these bodies are called on to settle complex scientific disputes. Depending on the enabling law, such quasi-legal bodies, to a greater or lesser extent, can involve themselves in adjudicating on matters of science; for example, will an aquifer be subject to intrusion through underground mining, and what impacts will that have on water quantity and quality for farmers relying on pumping underground water? This is a highly technical matter and requires considerable investigation by a hydrologist. We should not expect a judge to adjudicate on conflicting professional views on this matter. Only the weight of expert opinion should guide us. If courts are allowed to enter into environmental disputes, we must expect that interested parties with an objection to a project will make use of any legal opportunity available to them. This is welcomed if the judge is suitably qualified. We need to recognize that objections to particular projects are not necessarily related to scientific matters.

While there have always been a *not-in-my-backyard (NIMBY)* responses to developments, this is becoming more common with projects such as the construction of high-voltage power lines, building wind farms and, intriguingly, the roll-out of the *5G* cellular telecommunications networks. These have generated unsubstantiated health fears, which epidemiologists have difficulty dampening. If the folk best qualified to adjudicate on these matters cannot resolve them to the satisfaction of a worried citizen, what hope would a lay judge have? Very serious mistakes are possible—in fact, probable. I refer readers to an old example of court proceedings, but due to its comical exchanges in the court, it is worth reading (see Hundloe, 1978).

Selected Countries: The US National Environmental Policy Act, 1969

As previously noted, environmental impact assessment came into being with the *National Environmental Policy Act of 1969*, commonly referred to by its acronym NEPA. We find in it the first use of the term *environmental impact statement*, referred to as an EIS. As a federal law, NEPA is confined to actions and policies by the US federal government. As an aside, this is similar to the case in all federated nations, such as Australia and Canada, where there is a federal environmental assessment statute and the States/Territories/Provinces have their own. The situation is different in *unitary* countries such as New Zealand and the UK, where there is one law for the whole of the country. In federations, if a project, say to construct a water storage or a solar farm, is to fall under a federal law, either federal money has to be involved in its construction or federal approval is required. The separation of powers between jurisdictions within a country is determined by the nation's constitution.

The *Preamble* of *NEPA* is a broad indication of the objective of the law (the language is of a past era):

> *To declare national policy which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man.*

One could spend time, which would hinder our progress at this stage of the book, discussing the meaning of various terms in the NEPA *Preamble*. Prima facie, it is a pro-environment statement of intent. That noted, the preparation of an EIA and its initial public release, at a draft stage, and then its final release after taking into account public comments, does not mean that a finding of an adverse environmental impact will stop a project from going ahead. An EIA is a source of objective information, nothing more.

It is very important to recognize that identification of adverse impacts need not mean the project is prohibited, but the finding of adverse impacts—particularly at the draft EIA stage—can result in action to mitigate these impacts through changes to the project or compensatory measures. Public response to the draft EIA is powerful in this sense. I suggest that the public's input at this earlier stage is more likely to make a difference, if that difference is modification of the project, rather than public comment at the release of the final EIA. By the second stage, much has been firmed up. We should not rule out that public reaction can also be powerful in a political sense. If serious adverse impacts are identified in an EIA, public reaction might swell, and as a consequence sway a government to ban the project. That noted, there is no obvious evidence of this having happened—because, to my knowledge, no EIS arguing for the negation of a project has been published. I might be proven to be wrong. I shall wait for the evidence to be produced.

The USA's northern neighbor, Canada, followed suit in 1973 with a policy for EIA, then Australia, New Zealand and Colombia, all in 1974. The latter was the first country in South America to introduce EIA. There was not a rush to introduce the concept around the world; and as with the Colombian case, it was not necessarily advanced industrialized countries which were early adopters. I was teaching EIA in Indonesia in 1981—its EIA legislation had recently been enacted—when its previous colonial master, the Netherlands, was only introducing EIA. It was not until 1984 that Japan introduced the concept; the UK did in 1988, Germany in 1990 and Slovakia in 1994. In 1985, the European Union (EU) produced a *Directive for EIA*. The approach taken in the UK was based on that of the EU, but with one enabling law for England and Wales and another for Scotland and Northern Ireland.

At the time of writing, more than 100 nations, that is approximately half the world's nations, rely on EIAs, and even in countries without their own EIA law, these countries can find that if foreign aid or investment is involved NEPA-style EIA comes into play. There is no need to spell out the whole content of NEPA. The interested reader can go to the actual statute. I recommend this as worth doing. I suggest to commence with the original 1969 law. For those who would like to scrutinize the history of legal cases, there is a great deal of material available; however, there are two books I recommend: Fredrick Anderson's 2011 edition of *NEPA in* *the Courts* and Steven Ferry's 2019 *Examples & Explanations for Environmental Law*.

The part of NEPA which is of direct interest to us is in the subheading: Section 102 (2) (c). However, before going to it, let us note the overarching principle. It is the intent of NEPA as stated in Section 101(a):

> *to create and maintain conditions under which man and nature can exist in productive harmony.*

Maintenance of environmental quality is not the only objective. NEPA, in Section 102 (2) (e), sets a task of improving the global environment. To facilitate this, there needed to be in the law an *action-forcing* mechanism. This mechanism is the requirement to produce an EIS. The law states that the assessment has to be undertaken by the integration of natural and social sciences, and specifically by developing methods by which (previously) unquantified environmental impacts are given the same weight as financial and technical ones, see Section 102 (2) (a). This is *the* fundamental change from the pre-NEPA days.

An EIS is the public report of the investigations and analysis of a project's environmental impacts—with *environment* broadly defined to include humans and their well-being. An EIS/EIA is to apply to major projects. We should note that in its original form, an EIA was to be undertaken to analyze proposed new legislation if through its enforcement there would be impacts on the natural environment. This requirement was not to be, with only projects (developments) subject to EIA. One of the fundamental principles was to assess alternatives to the proposed project. The theory being that there could be less damaging means of meeting the objective, through changes in design, through changing the location or by radical changes to the means of meeting the goal that the project sought to meet. A pertinent, contemporary case is the goal of generating electricity. Today we have many means. If as a proponent you propose a coal-fired power station, you must expect to be asked to compare that to solar, wind, classical hydro or pumped hydro, and in some places in the world, tidal and wave power might require analysis. This requirement is not the end of the matter. Any indirect effects have to be included, as well as cumulative impacts, plus growth-induced impacts, such as changes in land use and population increases due to project. We shall come to deal with these in some detail below and in following chapters.

It is illuminating to reflect on a special feature of an EIS/EIA, one determined during the Presidency of Jimmy Carter. This was ten years after NEPA came into existence. This particular matter went to the ease of public participation in the EIA process. If an EIA was to inform the public, and entice public comment, it had to make potentially complex science understandable to lay audiences and, most importantly, in a concise form. The Carter administration had become aware of the extraordinary, seemingly ever-increasing length of EISs. Only recently, in 2019, a senior member of the Carter administration, Nicholas York, reminded us that Carter administration believed that an EIS was to be a *concise*, *readable document, which decision makers and the public could and would read*. During the Carter presidency (in the early1980s), it was considered that the average EIS should run to 150 pages and a complex one to no more than 300. This was to prove wishful thinking. We will come to note the enormous divergence from these proposed standards, as assessments grew and grew in length without, in many cases, adding any value.

The Standard Content of an EIA

Here is an appropriate place to sketch out the issues that were to be the standard matters to be dealt with in an EIA. We will explore these in greater detail in following chapters. In summary, an EIS/EIA has to include (the terms are those in the statute):

- Analysis of the *need* of the project
- An assessment of the impacts of the project
- Identification of any *adverse environmental effects* which cannot be avoided should the project go ahead
- Assessment of *alternatives*, including the *no action* alternative, of the project
- Assessment of the *interrelationship* between *local short term* uses of the environment and the *maintenance* of *long-term productivity*

- Identification of any *irreversible* and *irretrievable* commitment of resources should the project go ahead.

The dictate to cover these matters in an assessment of major projects—most importantly taking account of previously unquantified impacts—introduced a new paradigm that will in due course change the way we humans view our relationship to the planet—for the better!

Canada

Canada, understandably as a next-door neighbor of the USA and suffering from acid rain blowing in from that country, was early in introducing EIA. This happened in 1973 via its Environmental Assessment and Review Process; then, in 1984 the *guidelines* issued for the EIA process defined its reach *to extend well beyond individual projects* (Noble, 2009). This was an early call for SEA. The 1984 guidelines provided the basis for Canada's formal EIA instrument until 1992 when a new law, the *Canadian Environmental Assessment Act, 1992*, replaced it. In 2003, this act underwent amendment. Of significance, in 1990, the Canadian government made SEA a separate procedure to EIA. It was as a consequence of failures in EIA practice that SEA came into being. These were the days when the British Canadian expert, Barry Sadler, was consistently beavering away at improving EIA and promoting SEA. For this he deserves the thanks of all who have put their efforts—and faith—in making EIA the paradigm-changing concept that it is.

From the beginning of EIA, the matters that became the focus of SEA were clearly intended to be fundamental components of the former. Robert Gibson and his colleagues (2010) in their review of the situation in Canada state the obvious:

> *SEA is … a response to the limitations of environmental assessment procedures focused on the project level.*

In the early days of EIA in Canada, the Canadian law put the focus on the *natural environment*, meaning the bio-physical-chemical environment, and paid only limited attention to the socioeconomic environment. In this it differed from NEPA, and the Australian law and practice which had been put in place at about the same time. While the early Canadian EIA law allowed for consideration of the *need*—or justification—for a project, the positive impacts of a project were not central to the assessment, and hence, need was not at front and center of assessments. In a radical shift in 2019, the Canadian EIA law came into line with that of its southern neighbor's original law. This happened just as, ironically, the then US President, Donald Trump, was seeking to destroy some of the fundamental EIA principles that had been in place for 50 years. With the defeat of Trump in the 2020 Presidential election, this did not happen.

The recent changes in the application of EIA in Canada made central the assessment of the overall benefits and costs of a project—that is, the issue of need. Under the revised law, an EIA is tasked to answer the question: is the project in the *public interest?* In the previous statute, the test was would the project have *significant adverse environmental effects*, and *environmental* was narrowly construed. The brand new statute has a change of name. It is the *Impact Assessment Act, 2019*.

Under it, all socioeconomic impacts, both positive and negative, have equal weight with impacts on the natural environment. Furthermore, the assessment has to answer the question: does the project make a positive contribution to sustainability (sustainable development)? How does it affect indigenous people? Does it make a positive contribution to Canada's global and national climate-change goals? One issue remains vague, and that is the extent to which an assessment has to go in analyzing alternatives to the preferred project. However, overall, the Canadian EIA law is now a neat fit to the original NEPA standard, and in encompassing sustainability goes beyond it. Finally, we should note that EIA and SEA coexist in Canada. Recall that SEA is designed to have environmental factors considered at the conceptual stage of policy and program formulation and planning. Given the relative newness of the new law, we cannot judge the extent to which it has improved the practice, but the change of wording is welcome—and the promise extremely significant. Maybe, all the hard work Barry Sadler put in for those long years has paid off.

Australasia

Australia was another of the first nations to follow the US lead, with the 1974 *Environment Protection (Impact of Proposals) Act*, since 1999 amalgamated with other key environmental laws into the *Environment Protection Biodiversity Conservation Act*. New Zealand did not have a statute similar to that of Australia but by 1974 had a policy known as the *Environment Protection and Enhancement Procedures*; then in 1991, the *Resource Management Act* integrated environmental assessment with land-use planning in a strategic, sustainable development framework. This omnibus statute was heralded as an improvement on the usual approach of separating planning laws and impact assessment laws. Due to this approach, the New Zealand scheme tends to get landmark status. It was that country's means of overcoming the faults of project-specific EIA in practice.

The Australian Situation

In Australia, EIA was introduced in a radical new national law, a statute of the Commonwealth parliament. Today, that original law is a major component of the *Environment Protection Biodiversity Conservation Act 1999* (amended since 1999). The 1999 law reconfigured the original Commonwealth environmental law by amalgamating environmental impact assessment with a wide range of biodiversity conservation matters which fall under the Commonwealth government's jurisdiction, as well as adding a few other related environmental issues of national importance. Of overarching significance, included in the new statute were the principles and practice of sustainable development, known as *ecologically sustainable development* in Australia. The insertion of *ecologically* was to make clear that without a sustainable ecosystem, all else—economic and social well-being—would not be possible in the long term.

The *Commonwealth of Australia Constitution Act 1901* limits the national government's powers to a relatively small number of matters which are set out in *Section 52*. All other powers, and many that are crucial to environmental management, remain with the States; or, in the case of the mainland Territories, have been assigned to them. The overriding significance of this jurisdictional separation of powers is that the lower level of government controls land, the minerals in the land, rivers and tributaries, forests, local marine environments, the local atmosphere, cities, transport, railways, plus a few other matters of direct importance to the environment, as well as the obvious means of exercising power, that is, through their own courts, police forces and on-the-ground managers (such as national park rangers).

Not every federated country is the same in terms of national and subnational power sharing, and one would need to consult the relevant constitutions of the country one was interested in. The lower level of government, that below that of States and Territories, we can broadly call local government; however, in Australia this ranges from very small indigenous communities, to sprawling outback shires, to city governments, the latter with obligations to provide services to large populations. If we turn attention to local government on a world scale, there is great variety of forms and powers assigned to it; for example, local government is much more powerful, with considerably wider scope, in the USA than in most other nations. In nations with a unitary national government, local government is the level immediately below the national government.

In the case of Australia, the Commonwealth government has been able to *extend* its environmental powers, at the expense of the States. This has been by a broad legal interpretation of certain of the Commonwealth's *Section 52* powers. Examples of these *extended* powers are: where the Commonwealth enters into international agreements, such as in its obligations to UNESCO for the protection of World Heritage properties—think of the Great Barrier Reef; where the Commonwealth power over foreign trade requires seafood to be harvested sustainably if it is to be exported; where the same export powers meant the cessation of the mining of mineral sands on Fraser Island. There are many more examples.

When Australia became a federation of States (and eventually added Territories), the States were left with their own constitutions. These constitutions were granted by the Imperial United Kingdom parliament during the period of colonial government (from 1788 until 1901). As such each State and the two self-governing Territories (the Australian Capital Territory and the Northern Territory) have their own EIA legislation. There also exist forms of EIA powers exercised by local government authorities. However, as these bodies are the creation of State governments, their powers are determined by the immediate higher level of government.

These jurisdictional differences matter little as generic EIA concepts are in practice throughout the nation, although, unfortunately, terminology differs. Importantly, where a project (such as mining for the purpose of overseas sales) involves both State/Territory and Commonwealth environmental approvals, there is an agreement between the two levels of government that only one assessment is required. This is most likely to result in the Commonwealth government *delegating* certain powers to the relevant State or Territory government. Not all powers will be delegated. This formal agreement goes by the title of the *Intergovernmental Agreement on the Environment (IGAE)*.

The New Zealand Situation

There is much in common between New Zealand and Australia. Why not note a little unfamiliar history. When the Australian colonies were about to form a federated nation, New Zealand and possibly Fiji plus some other South Pacific islands had the chance to form one multi-island nation. Another wee bit of history that goes to suggest how close New Zealand is to Australia is that the first game of Australian Rules Football, a type of football unique to Australia, played at night (i.e., under lights) took place in New Zealand.

In terms of our topic, what does have relevance is the very significant difference between the systems of government in New Zealand and Australia, and the fact that a treaty was signed between the indigenous people of New Zealand and the British. New Zealand has what is termed *unitary* government. There are no States or Territories. Yet, the starkest difference is the treaty with the Maori, agreed in 1840. Although some years after this agreement war broke out between the two groups, matters came to be finally resolved peacefully and a genuine bicultural society exists today. This, as we have discussed in a previous chapter, makes EIA processes simple as there is no uncertainty as to Maori rights. We have noted how this applies to sharing marine fisheries resources.

In New Zealand, there is a focus on *sustainable management*, on comparing *benefits and costs*, where costs must include costs to nature. The law relates to projects, policies and plans if they fall under the 1991 *Resource Management Act*; otherwise policies and plans of government are excluded. In the New Zealand's offshore Exclusive Economic Zone, an area of interest for mineral and gas exploration, environmental matters and their assessment are subject to specific legislation.

United Kingdom

When EIA was introduced in the United Kingdom (UK) there had been a form of environmental assessment going as far back as 1947, when the *Town and Country Planning Act* came into being. This law allowed a planning authority to take environmental factors, as they were understood then, into account. Notwithstanding the then revolutionary nature of this concept, there was no formal, or even informal, mechanism available for the planners to use; hence, it is difficult to find evidence of its success. The UK statute introducing formal EIA came into being in 1988, based on the 1985 EU Directive. Now that the UK has left the EU, there are likely to be changes made to the existing law.

An important feature of EIA practice in the UK has been the very limited attention to social, economic or socioeconomic impacts. This can be attributed to EIA falling under town and country planning provisions, in which it is the common practice to separate the disciplinary elements rather than seek interdisciplinarity and integration. Town planning has a long history of multi-objective planning, with *integration* viewed as a trade-off exercise left to either a planner or, most likely, a politician. In this regard, the degree of subjectivity is considerably greater than in standard EIA practice, where integration of ecological, economic and social impacts reduces the need for trade-offs.

With the relatively recent integration in the UK of sustainable development principles and SEA as overriding policy initiatives, EIA should have improved. The theory is that SEA will be sustainability-driven in assessing land-use plans and programs. SEA was introduced in England in 2004 (the other parts of the UK have their own versions) with the proclamation of the *Environmental Assessment of Plans and Programmes Regulations 2004*. However, sustainable development in the UK had not always lived up to its promise. While it was introduced reasonably early on, in 1994, there is evidence that it was difficult to get relevant bodies to embed sustainability in decision-making. As a consequence, in 2012 a National Policy Planning Framework was drafted, and became effective the next year. Its aim is to give *more balance* to the three pillars of sustainability.

Germany

A special feature of continental European countries is the sharing of borders, and, hence, transboundary impacts come to the fore. This obviously adds another layer to EIA procedures. Germany, situated in the heart of northern Europe, has terrestrial borders with eight neighbors and additional ones if transboundary seas and the Danube River are taken into account. To deal with transboundary impacts in Europe, in 1991 UNECE established the *Convention on Environmental Impact Assessment in a Transboundary Context*. It came into effect in 1997. As a consequence, Germany has bilateral EIA agreements with several neighbors.

There is another feature of the EU system that is significant. It is the requirement for SEAs as complements to the traditional EIAs. Germany has a specific SEA law introduced in 2007, the *Law on the Introduction of Strategic Environmental Assessment*. As in other countries EIA laws are reasonably regularly updated. In 2011, Germany revised its EIA/SEA law.

In Conclusion

This chapter completes the first section of the book. A wide canvas has been covered with introductory material. The most important matters that have been raised will be expanded on in the following chapters. However, new material will be introduced and discussed in much detail. Considerable focus will be on the Australian EIA practice. There is a good reason for this. It is that Australia's EIA law has remained a relatively strict replica of the original NEPA. At the time the Australian law was introduced, the nation had the most environmentally friendly government in its history. This was a Labor Party government headed by Prime Minister Gough Whitlam. The nation's Environment Minister was Moss Cass, a medical doctor. As an aside, I should mention that I first met Moss Cass a very long time ago but in recent years have met with him in his home city of Melbourne to discuss the history of Australia's EIA law.

To view Australia as a *poster child* for EIA is to recognize that while governments of different ideological persuasion come and go, environmental assessment has not deviated from a strict adherence to the original principles of the EIA concept. Malcolm Fraser, who followed Gough Whitlam as Prime Minister, was leader of a conservative government but did not interfere with any of the environmental laws of the country, and in fact used them for good cause. When sustainable development became a public policy issue after the release of *Our Common Future* in 1987, the then Labor government headed by Prime Minister Bob Hawke was an enthusiastic supporter of that concept and made a considerable effort to put it into the nation's major policies and laws. He went as far as to establish a permanent quasi-SEA organization named the Resource Assessment Commission. Unfortunately in this case, it did not survive a change of prime minister—the prime minister who laid it to rest was of the same political party as Hawke. I shall leave that for you to contemplate.

When the original EIA law was incorporated into the 1999 law, the original principles were retained, and the EIA process was assisted by the identification of parts of the country, such as the Great Barrier Reef and other World Heritage Areas which were privileged under the amended law. This privilege also applied to endangered fauna and flora species. The

Environment Minister at the time of the redrafting was Robert Hill, a genuine liberal in a conservative political party going by the name of the Liberal Party. Hill was an excellent minister for the environment.

In the latter part of 2020, the original NEPA with its Section 102(2)(c), the internationally acclaimed model for an ideal EIA/EIS, was threatened with gutting in its homeland. Writing in the online magazine *Grist* (June 10, 2020), Rachel Ramirez proclaimed the possible future:

> *Trump thrashes 50-year-old environmental law.*

A number of key features were in line to be discarded, including, attention to climate change, consideration of flow-on, indirect and cumulative impacts, as well as of impacts beyond the nation's borders. It did not happen, and will not with the new President, Joe Biden.

Part II

Tightening the Nuts and Bolts of EIA

5

If We Don't Need The Project, Don't Build It

Introduction

Do we need the project? This, obviously, is the ultimate question we expect an environmental impact assessment (EIA) to answer. Before there was EIA, this question was answered on narrow engineering and financial grounds. Was the project technically feasible? Was it affordable? As already explained, EIA was formulated for the very purpose of expanding the breadth and depth of our evaluation; in particular, to ensure that the previously unaccounted environmental, economic and social costs—and benefits—were included. If a project is to be supported, a convincing case has to be made at the conclusion of an EIA. Assessing if a project is justified is a matter of seeking to establish the *need* or not for the project.

The paradigm-changing nature of EIA is based on three ideas: (i) a project has to be justified taking into account *all* its benefits and its costs; (ii) any important unquantified costs and benefits have to be quantified to the extent feasibly—implying the methodology to do this has to be sound and the relevant data available and (iii) the public (any interested party) is to be involved in commenting on the EIA, preferably at two stages of its preparation, the draft and final stage. Justification requires an

T. Hundloe, *Environmental Impact Assessment*, Palgrave Studies in Environmental Policy and Regulation, https://doi.org/10.1007/978-3-030-80942-3_5

analysis of *need*. As this is such an important topic, I devote three chapters to it: this introductory one, followed by a special one relating to mining and another dealing with a range of wider issues.

NEPA Introduces the Idea of *Need*

The word *need* was introduced in the *National Environmental Policy Act* (NEPA) and was adopted in EIA laws in other countries copying NEPA. To make clear the fundamental importance of establishing the *need* for a project, EIA statutes and guidelines refer to *the no action alternative*. In other words, what are the consequences of not undertaking the project? If the consequences of no action were to be adverse impacts on, say, the health of millions of people by not building a water treatment plant, the no action alternative would be dismissed. That is, we need to build the plant. Notwithstanding that decision, we might have questions to answer on how to achieve that goal. What type of water treatment? Where to build it? On a global scale, there are many examples where need undoubtedly exists—a string of modern hospitals throughout sub-Saharan Africa, or a network of renewable energy electricity-generation projects in any of the poor countries of the world. It is a real pity that these projects are not on the drawing board ready to be assessed.

Because the word *need* is used with abandon—even the richest of the rich will argue they need more—*we* are left with putting meaning to need. The dictionary definition, in this case *Cambridge English Dictionary* is:

> *to have to have something … very much.*

The phrases *to have to have* and *very much* distinguish *needs* from *wants*, the latter pertaining to something desired but not essential. Billionaires want, they do not need. Dictionary definitions are a start, but for EIA purposes we need to go beyond dictionary definitions.

Illustrating Need by Way of an Example

In EIAs we will encounter questions such as: is the proposed freeway needed? How do we determine this? In arriving at an answer, our next question is likely to be: who will benefit from the project? At first glance, the obvious answer is motorists who presently have slow journeys on congested roads. Are there other beneficiaries? Are there losers? What if the new roadway bypasses small towns that rely on passing trade? If the objective is to reduce congestion, are there other ways of achieving this result? For example, encourage commuters and transport businesses to use other transport modes. If we build a new or expand an existing freeway, won’t it eventually become choked with vehicles unless population growth and vehicle ownership come to a halt? What if rail transport supplants trucking goods and hence a large amount of heavy traffic is removed from the roadway?

In passing, I should warn you that you will be very lucky to read an EIA that treats the matter of need as I have explained in the previous paragraph. The most serious failure—and failure it is—in EIA practice is the cursory, at best, treatment of need. I shall return to this and related matters, but here continue with the freeway example as it is a common one and easy to explain using simple mathematics. I shall use an Australian example and rough costings of a freeway between where I live and work (Brisbane, the capital of the State of Queensland) and the city of the Gold Coast (the place of my birth, and a world-renowned holiday destination). The freeway/highway between Brisbane and the Gold Coast is one of the busiest in Australia. It carries in the order of 150,000 vehicles per day, of which 12,000 are trucks. Collisions and breakdowns cause delays, and as traffic increases, as it does because of population growth in this part of Australia, congestion becomes worse. For commuters and holiday-makers, delays are an annoyance but do not result in lost income. It is a different matter for truck drivers.

Let us assume that traffic engineers have calculated that in the future each truck driver will on average lose one hour in making the return journey if no extra lanes are built. With 12,000 trucks losing one hour each, that is 12,000 hours per day or 60,000 hours per week (assuming a five-day working week). If for the sake of illustration, each hour lost costs $100 in foregone productivity, the weekly loss is $6,000,000. Again, for simplicity, let us assume this loss occurs for 50 weeks per year. The annual foregone productivity (loss of time to earn an income) equals $300,000,000, approaching one-third of a billion dollars per year. This will continue to increase if nothing is done about eliminating the congestion—the *no action* alternative. To eliminate the congestion, one extra lane would suffice (probably not adequate, but makes the mathematics simple). One extra lane over a 100-kilometer stretch would cost about half a billion dollars. While this is more than the yearly loss, within two years the new lane is justified, as the lost income over two years is $6,000,000,000—considerably more than the cost of the upgrade. In this simple, hypothetical case *need* has been established, all other things being equal. This caveat is important. In a real-world situation, we would allow a significant number of years to pay for the new road works, not two years. And yet there are, as noted above, other potential solutions. These and the caveat that all other things remain constant (no environmental damage or increased noise, as examples) can be important—in many cases they will be.

The *Ex-ante* and *Ex-post* Determination of Need

What I have illustrated in the above example is what I have termed the *pre-EIA establishment of need* (known as the *ex-ante need*). This is what I term advanced *screening*. In the EIA literature, *screening* is the very first task: it is to determine if the project warrants undertaking an EIA. Some projects will pick themselves for an assessment. Virtually any major infrastructure or manufacturing project will qualify for an assessment: mine development, energy production, highway construction, dam building, large-scale monoculture, port development, airport construction, aquaculture, cement works, mineral refining, shipbuilding and so on.

Reverting to the freeway example, based on the conventional knowledge that freeway and highway construction eventually introduces greater levels of traffic to an area, which results in increased noise, in road kills of animals, and is likely to involve removal of vegetation some of which might be of high conservation status, one would automatically call for an EIA. My concept of advanced screening is a step in the EIA process that blends screening and basic *scoping*. Conventional *scoping* is the process of determining the potential impacts, which on the basis of preliminary knowledge of the project will be assessed—noting that as investigations are undertaken, unforeseen matters will be added to the list. With a project such as improving traffic flow, we know, without any analysis, that there exist potential alternatives (rail or tolls) and, therefore, at the commencement of the EIA, we would undertake very basic analysis to help determine the matters which should be paid most attention, and this in the context of the alternatives.

Assume that we have arrived at the conclusion that something ought to be done to improve traffic flow—the no action alternative is costing too much—that is, initiate a project of the type to be determined as warranted on the basis of an environmental economic cost–benefit analysis. However, this tentative conclusion has been arrived at without going to the crucial step of accounting for any unquantified costs. We expect there might be some, but first things, first. Before going to the quantification of these likely unquantified costs—maybe there are some unquantified benefits—we will undertake a desktop analysis of alternatives. Building a rail line for the purpose of moving the freight is a logical alternative. Again, putting aside any adverse impacts on fauna and flora, and any likely social impacts, what is the construction of a rail line to cost? Let us assume that the rolling stock exists, just as the freight trucks exist, and assume the costs in fuel and labor are the same for both modes of transport—to make the comparison very easy. Is a railway construction less expensive than the road upgrade? This will sharpen our investigations. We will do the sums on these two options. Our job as environmental impact assessors will be to provide to the organization commissioning the study, likely to be a government agency, our preliminary results. Assuming that a freeway upgrade and a rail line are the only feasible options, we have the broad parameters for an EIA.

What I have outlined here is screening potential alternatives at the earliest possible stage, not waiting until near the end of the EIA process and then write a paragraph on alternatives. This is very common and one of the most serious shortcomings in the EIA process as presently practiced. We shall return to this matter in a future chapter. What I have outlined is the rational process to be followed where there are likely to be alternative means capable of delivering the same outcome. Not all projects are this straightforward.

Let us digress and explore the advantages of SEA in the determination of need. If we could undertake SEA rather than be forced to undertake an EIA, we could rule out certain projects immediately on the basis that they would be inconsistent with the desired overall state of the local or regional environment; for example, another major open-cut coal mine in the area would overburden the groundwater system. What SEA does acts as a screening tool. Here are some other examples, a road-building authority has anticipated long-term demand for quarry material. This, under SEA, would rule out a proposal for urban expansion within the proximity to identified, potential quarry sites. A proposal for yet another large tourism resort in an area where the cumulative impact of increased human numbers would mean building new hospitals, schools and other *lumpy* and, hence, costly social infrastructure would be ruled out. There are many other possibilities where an SEA would be a blunt but effective screening tool.

However, with or without SEA, there are likely to be borderline cases, or ones where alternatives are not obvious at first glance. Another method of screening has been proposed by Baban Ingole (2007). He suggests establishing need should be done at the very beginning of the assessment by what he terms a *rapid assessment technique*. His preference is an environmental cost–benefit analysis. He uses the adjective *environmental* to give attention to the fact that this is not an old-style cost–benefit analysis in which the hard-to-measure environmental impacts are neglected.

Ingole puts the case thus:

> *Environmental assessment provides a rational approach to sustainable development. It … enables … carrying out environmental cost-benefit analysis at the initial stage.*

By utilizing this method, the assessors will have a reasonable idea of the need or otherwise; but, only if the benefit to cost ratio is positive will they commence with a comprehensive assessment, otherwise they will curtail the project at this stage. If the decision is to proceed to a full-blown EIA, at its completion we will have to undertake a *post-EIA establishment of need* (otherwise known as the *ex-post need*). It is only at this stage will we have all the necessary data to be able to make a science-based decision to go ahead with the project or not.

In the above example of a transport project it was very easy to rely on a relatively straightforward economic approach to provide a guide to *ex-ante* need. However, we must be mindful that it is not immediately obvious that economics can be used in all cases for this purpose. In fact, in some situations, it would be plainly wrong to rely on economics. Here is an example, a project which has its prime focus on saving of lives, the introduction of driverless road vehicles. These contraptions are supposed to save human lives. Some folk are willing to put a monetary value on human life. Life insurance firms come to set their premiums and payouts on this basis. They are betting on when you will die. Gruesome stuff!

Surprisingly, there are economists who fall into the practice of valuing life. It is unprofessional for economists to do this. It breaks the most fundamental philosophical justification of market economics—override this principle and let dictators reign! That principle is simply this: the one and only ethical justification of a market economy is *consumer sovereignty*. Take away that justification and there is no case to be made for this type of economy. Libraries are full of books making this very point. In lay language consumer sovereignty means that the only person who can value a purchase, or the payment for work, in fact, anything, including his or her life, is the person in question, the *sovereign* person. You own your own life. Once we accept this principle, the only consistent way to value human life is to ask the absurd question: what sum of money would you require if you were to be killed?

On the issue of valuing human life, do not be persuaded that the value of a human life can be measured by reference to insurance data or expenditure by governments on health care. What people who are insured do—and many are not insured—is ascertain what they can *afford* as premiums, which has no relationship to the amount they desire their surviving partner or family be compensated if they were killed in an accident. What governments spend on health care—hospitals, vaccinations, subsidies to the poor—is what they think is politically acceptable, not an amount based on some estimate of the value of lives. We will come to have a better appreciation of the value of human life when the story of the coronavirus (COVID-19) pandemic is written. We will have evidence for a study that has never before been undertaken. I have far too little data at present, and I have no crystal ball to allow me to predict how the so far most successful countries—New Zealand, Australia and a handful of others—will be in controlling the disease.

The EIA Is Completed, What Next?

With the digression on economic valuation out of the way, I shall revert to explaining the EIA process. At the conclusion of the EIA assessment phase—the fieldwork has been completed and numerous modeling exercises have been undertaken—we are to write the report (call it an EIS or EIA) and present a conclusion. This is when the *ex-post* decision on need will be made. At least three options will be available to the final decision-maker. Number one, the project is beneficial all things considered, and can go ahead. Second, the project can be approved on meeting certain conditions, for example, design features are changed or if adverse impacts are not able to be mitigated, they are offset, a subject discussed in detail in future chapters. Finally, the third option, the project cannot be justified, all things considered. It does not meet *ex-post* need.

If the second option happens to be the one chosen, it should be the case that conditional approval for the project should not be given; rather the decision needs to be made on the assessment of the amended project. When conditional approval is given, we have a serious shortcoming of EIA, if, as is often the case, the public is not informed of the details of the conditions, and, hence, have no means of ascertaining their effectiveness. The promise of providing the public with enough information to allow it to judge the project, the crucial promise made by Moss Cass when he introduced EIA in Australia, is not met in this circumstance.

Just as importantly, the question has to be does the government authority agreeing to the conditional approval have sufficient information to be confident that the conditions will be met—for example, will the offset deliver on its promise? The situation that should be avoided at all cost is to allow the project to commence—the first sod of dirt is dug—on the basis that a condition will be met when that is unknown, or is based on the word of the proponent.

Need Is a Public Matter Not a Private One

Before delving further into the concept of need, we must clarify a matter that if left unresolved could cause confusion. It is that we must keep in mind that EIAs are undertaken for projects where a government has the final say. We are not dealing with projects where a private individual or company has unstinted property rights and, hence, there is no requirement to justify a project to anyone other than his or her family, a bank or shareholders. To make this clear here is a real-world example. A grazier is running tens of thousands of merino sheep; the price of wool is enough for him or her to cover all costs, including making a decent income for the effort involved; then the price of wool drops. The grazier still has the same need—to keep the bank happy, to pay operating costs and to earn a decent income. Noting an increase in beef prices, the grazier meets his or her needs by moving out of wool into beef. This is no hypothetical issue. Since the collapse of wool prices back in the late 1960s, Australia's sheep flock has been gradually halved and replaced by increased numbers of beef cattle. This has happened without any requirement to undertake an EIA, as it is the grazier's right to make this sort of change. In other words, environmental assessments are not intended to interfere with private property rights. That noted, there can be confusion when the subject is an ore or mineral and the question of ownership is not clear in the public's mind. This is the focus of the next chapter.

In Conclusion

This introductory chapter on the need for a project illustrates how the assessment of projects changed with the introduction of EIA. No longer should the public be in the dark until the day the bulldozers arrive and the trees fall and the animals scatter. Whatever the project, a residential estate, an airport, a mine or a wind farm, no potentially significant impact—desirable or undesirable—is to be overlooked and unquantified if it requires government approval.

6

The Special Case of Mining

Introduction

We cannot imagine life without the products taken from Mother Earth's crust. We scrape away, we dig deep, we probe until we discover, then set out to recover, oil and gas to burn, minerals and ores dug, into products we turn. Our homes, machinery, airplanes, ships and computers are made from mined resources. Our motor cars, washing machines, trains, planes and cranes are fueled and lubricated by once-living plants and animals, now fossil fuels. The escape from the heat or from the cold provided by air-conditioners and oil-heaters is reliant on materials and fuels kindly given up by Mother Earth. The tools of trade of the physicians and surgeons are products made from mined resources. We need these things, big and small, crafted out of nature's underground gifts because we have come to rely on them. Our ancient forbears improved their lives by making hunting and gathering easier with the basic stone and, eventually, the metal tools they fashioned as spears and axes. When they came to farming about 10,000 years ago, metallic tools such as hoes vastly improved productivity. Today we cannot imagine broad-acre farming without

T. Hundloe, *Environmental Impact Assessment*, Palgrave Studies in Environmental Policy and Regulation, https://doi.org/10.1007/978-3-030-80942-3_6

massive, air-conditioned tractors and harvesters, or a 1000-head herd of dairy cows milked without using robotic machines.

There will be little or no argument that we—given our present lifestyles—do not need to mine for the purposes given above. There are, however, some forms of mining for minerals or stones that do not meet the need criterion, rather the mining is to satisfy wants—wants that only the rich can afford, such as the gemstones (emeralds, opals, rubies), diamonds and ornamental gold and silver, worn as jewels.

Recall two of the matters to be dealt with in an EIA, as stipulated in Section 102(2)(c) of NEPA, *irretrievable and irreversible* actions. In terms of human life spans, our mined products are non-renewable, and they are exhaustible—unless they are recyclable. Metals have this potential and hence are continually recycled. Very valuable things are never discarded. It is said that the first gold ever mined is today in use somewhere in the world or in safe storage. Obviously, burning coal, oil and gas is a different matter to our recyclables. Mining these resources fall under NEPA and NEPA-clones. Substitutes are required to replace these energy sources as they are depleted. We have their substitutes as already mentioned. Mining of various ores and minerals, for example, iron ore, turns mountains into holes of immense size and depth. This transformation of land has various consequences that can entail the cessation of farming, hence lost income to farmers unless compensated. Mining entails the destruction of habitat for whatever animals it has been home. In the industrialized countries there are laws that require the land to be returned as near as possible to its original form. More likely than not, this will be a matter dealt with in an EIA.

Many of the controversial projects that are subject to EIAs—and this anywhere around the world—are mining projects, or related activities such as the construction of pipelines and development of ports from which to export the mined products. As noted at the conclusion of the last chapter, there can be with mining, issues related to the ownership of the resources (private versus public), and there is, inevitably, the matter of meeting sustainable development criteria in exploiting a nonrenewable resource. The income dries up with the last shovel load and oil-can squirt extracted. There is no such thing as sustainable mining—but there is a solution by which to generate a sustainable flow of income that was initially based on mined resources. Having put EIA into a sustainability framework, this solution is to be addressed in an assessment of mining. Then, there is the matter of climate change if the mining is of fossil fuels to be burnt to produce energy. These unique features of mined resources and their uses require a special consideration of need.

Country Examples

Canada is a world leader in the production of a range of minerals. On a global scale it is number one for potash, second for uranium and niobium, third for nickel, cobalt, aluminum and the platinum group of metals, and fifth for diamonds. Mined products account for approximately one-fifth of the nation's merchandise exports. The mining sector is a major employer of indigenous workers. Canada has an excellent reputation for its environmental management and the involvement of indigenous people in mining.

As with other common law countries, the original situation in Canada was that the right to what is underground went with ownership of the land. When Canada was settled by the French, the British and others, the settlers obtained leases from the crown. However, it was not long before the right to mine was removed, and ownership of land was restricted to land above ground. That is, mining rights were separated from the land. When the Dominion of Canada was established by the *Constitution Act* of 1867 (amended when British Columbia and Prince Edward Island joined, respectively in 1871 and 1873), the provinces retained ownership of crown land and underground resources. Today, the provincial governments are the owners of all underground resources except those in federal territory in northern Canada and offshore. There have been occasional disputes between the provinces and the federal government over ownership of underground resources. This is not unexpected in federations.

The Canadian Government's policy on mining warrants our attention due to the explicit explanation of what it seeks to achieve. It is explained in the official documentation as follows (Government of Canada, 1996):

> *within areas of federal jurisdiction, maximise the benefit for Canadians of their mineral resource endowment by ensuring royalty rates and mining taxes are set at an equitable level, taking into account the industry's need to realize a return on its investment that is reflective of the risk taken and opportunity costs involved, and bearing in mind that Canada's mineral endowment is largely a public owned resource.*

The exploitation of minerals in Canada is to occur under the Canadian Government's interpretation of sustainable development, again quoting the official source, decision-making is subject to:

> *the need to integrate environmental, economic and social considerations.*

The concept of integration is to be applauded, yet as always the crucial matter is the rigor in which it is undertaken. If one reads relevant EIAs and related governmental reports, one is likely to discover that oil pipelines are constructed to meet the present and future *public convenience and necessity*—nothing more fundamental than that.

Canada, as with all rich democratic countries except Norway, does not invest its mining royalties and taxes in a sovereign wealth fund, with the exception of a tiny one, the Alberta Heritage Savings Trust Fund. If intergenerational equity, as a fundamental principle of sustainable development, is to mean anything with the eventual depletion of nonrenewable resources and the consequent loss of a flow of income, the establishment of a sovereign wealth fund is necessary. The only excuse for not having one is a very strong belief—or expectation—that future generations will be much richer, and that our descendants will find a means of replacing the income no longer produced by mining. They can look after themselves! In a world threatened by climate change, a richer future is far from a realistic belief. Our descendants could be poorer—maybe substantially. The issue is a matter of risk aversion.

The concept of a sovereign wealth fund concentrates the mind of the economists who are part of an EIA team assessing a project to exploit a nonrenewable resource. They will pay great attention to both the amount of money generated from the extraction of the resource and also its rate of flow over future years. The sooner substantial royalties and mining taxes commence to flow in significant amounts into a sovereign wealth fund, the larger the holdings in that fund, and the greater the sustainable income it will provide. Canadian environmental advocates assert that the flow of income from mining to its citizens falls far short of that in Norway—this amounting to an implicit subsidy to the Canadian mining companies.

Turning attention to Australia, on the global scale the Australian mining statistics are overwhelming. Australia is number one in exporting coal; it has the world's largest reserves of uranium; it has in the order of one-third of the world's iron ore, lithium, zircon, bauxite, about one-quarter of industrial diamonds, and ranks very high in gold, zinc, and, fortunately for the future, has substantial rare earth resources. As an aside, it is worth noting that China is at present the major market for the Australian mining sector.

The Australian mining industry provides a perfect example to explore EIA in practice. Here, I shall concentrate on the vexed issue—although it should not be vexed—of how real and perceived ownership of resources impinges on EIA. Mining occurs in rural locations where it can—it does not have to—conflict with farmers' interests. Furthermore, indigenous land rights are most likely to exist in the areas subject to mining applications. These factors inevitably raise issues of whose rights have preference, as well as to the distribution of benefits. We have discussed the intra-generational equity issues in relation to indigenous rights in a previous chapter.

Given media reporting, the public impression is likely to be that the ores and minerals are the property of the prospective miner. However, miners are not graziers with property rights. What miners can be given under lease arrangements are rights to explore and rights to mine. In Australia, as in Canada, what is underground in any particular jurisdiction is the property of the citizens of that jurisdiction. Recall the State and Provincial governments have their own constitutions under which they (as *the Crown*) own the land in their domain. This public ownership is the situation until the mineral or ore is assigned to someone (person or company) by the parliamentary representatives of the people living in a particular State or Province, that is, by a government. It is to be noted that this assignment of rights—and the enormous financial benefits that flow from it—takes place without public scrutiny or comment. Assigning mining rights is one of the most important things governments can do.

The situation in New Zealand is different. Gold, silver, uranium and petroleum are owned by the New Zealand people, and about one half of the coal and metallic and nonmetallic minerals is also owned collectively; the other half is owned by private landowners. The US case is different yet again, even though it derives from the same English common law (Louisiana excepted, with its French colonial origins). As a generalization, it is that, with the exception of offshore oil and gas (owned federally), mineral and coal rights are owned by the private sector. There are differences state-by-state, and in western parts of the nation, the federal government retains large landholdings. Furthermore, like the other common law countries, there is what is called a *split estate*—surface rights are separate from underground rights. John Dobra (2014) of the Fraser Institute provides a succinct survey of the differences between the Canadian and US mining regimes.

Focusing on government-owned ores and minerals, it is the practice in the industrialized countries that the mining and the sale of the minerals and ores are tasks undertaken by private businesses. The resources are allocated under various conditional arrangements(leases) to mining companies. These arrangements include such matters as paying royalties, taxes, and meeting environmental standards, including the rehabilitation of mined areas. Obviously, governments have the right to determine whether or not mining is allowed. To put the question of being allowed into EIA language, on the basis of an assessment, the government will know if the project is *needed.*

The split estate situation can lead to conflict. Farmers, indigenous folk and environmental activists, all with an interest in what happens on the surface of the land (not to overlook the potential to deplete or pollute underground water), might demand that a government prohibits mining. On the other hand, there can be circumstances that suit the landowners, including indigenous ones, for the mine to be approved; for example, payments from the miners might be of such magnitude that landowners are more than happy to see mining proceed. Yet, it is not unusual to find that not all parties are satisfied with the deal struck.

Royalties and Taxes

Governments have a monetary incentive to permit mining. They are keen to obtain the money they can get by the way of royalties and taxes; and, notwithstanding the small number of workers in the mining sector, governments do not wish to be seen denying jobs by disallowing mining. The money earned by governments from allowing mining is the citizen's money, which the government will either spend on behalf of its citizens or return to the citizens via tax cuts. Smart governments will not do either of these things, rather put the royalties and taxes into a sovereign wealth fund, with the aim of sustaining the flow of income that otherwise disappears when the mine is exhausted. If so-called *sustainable mining* has a realistic meaning, it is the perpetual flow of income from wise investment of mining taxes, rents and royalties. In Australia, similar to Canada, there is only one very tiny sovereign wealth fund based on mineral exploitation. It exists in Western Australia. We can note in passing that governments in the USA are not keen on sovereign wealth funds based on the exploitation of minerals and oil and gas. There is a small sovereign wealth fund in Alaska and tiny ones in Wyoming, North Dakota, Alabama, Utah, Idaho, Louisiana and West Virginia.

Deciding on whether to mine or not can be a difficult decision to make at any particular point in time. The mining of coal is the most complicated, given the uncertainty that exists at present with regard to the future of coal. In case of all mining, governments ought to undertake a cost–benefit analysis, but with great caution, because there are many variables open to change over the lifetime of a mine. Minerals and ores sold on the world market have their selling prices determined by global demand and supply. In a genuinely competitive global environment, one would have no concerns. This benign situation does not prevail; rather, there exist cartels that set about increasing prices by restricting supply, as happens occasionally with oil from the Middle East; then there is the situation where one supplier is in a dominant price leader calling the tune; and, there is the control of oil supply as an international political tool.

Governments and mining companies have an eye to the future in their decision-making. The expected price in the future has a major influence on both government release of in-ground resources and on the mining companies' interest in obtaining the rights to mine. If a mining company anticipates an increase in price, it will seek to obtain the right to mine while the price is low, and wait until the price increases before commencing to mine. A government with the same view of the future would, if wise, hold on to the minerals, expecting to obtain a higher royalty rate in the future. This is not the only option for a government. It could allocate the right to mine when the price is low, but set its royalty rate as a percentage of the sales price or profit, both of which will be higher in the future if the price increase eventuates. So far, relatively simple.

To make matters more realistic, consider the prospect that in response to global warming forecasts, serious doubt arises as to future demand for coal and natural gas. Oil will be in a similar position when alternative fuels are available for transport. The prospect that these underground resources become what are called *stranded assets* becomes a serious concern for governments depending on royalties and taxes, and for private mining companies seeking profits. The possibility of resources being left stranded is a bind. If governments and mining companies expect a short life for their mined resources, before alternatives replace them, they have an incentive to mine now and face the danger of over-supply if others do the same. With over-supply, earnings are reduced, and consequently royalties and tax receipts fall. There has to be a way to reduce uncertainty where large investments are to be made and governments rely on significant royalties and taxes. The answer is SEA whereby an overview of the situation allows for an informed decision, taking into account sophisticated scenario modeling. This would be a government task.

Strategic Environmental Assessments to the Rescue

It is obvious that an environmental assessment should be undertaken at the stage a government is contemplating assigning a right to mine—not at the stage where a mining company has spent a significant amount of money on the assumption that the minerals will be its to mine and sell.

This is an extremely important matter. At the time of investment, certainty is required. In search of an example of where SEA would be very beneficial, it is hard to go past regions where multiple mines are likely to be opened, due to the concentration of an underground resource. At the time of writing, there is no better case than the Galilee Basin in Queensland, where eight coal mines are proposed. Without any consideration of the cumulative environmental and economic impact of these proposed mines, mining companies have been granted access to the coal. Each mine will require an EIA. However, in being granted mining leases the companies have an expectation that an EIA is simply a notional requirement. This ill-timing of process is a major shortcoming of the existing EIA system.

The Galilee Basin region in western central Queensland has, if not the largest, one of the largest, coal deposits in the world. It is also a region of endangered flora and fauna, and to add to the controversy, cattle grazing is the long-established activity in the region. Beef exports dominate Australia's agricultural sector. Furthermore, with the increased demand for organic foods, it is noteworthy that Australia has five times more certified organic beef farming land than any other country in the world. At the time of writing, only one mine, the very controversial Carmichael coal mine, commonly called the Adani mine after its owner, India entrepreneur Gautam Adani, has gone through the project-specific EIA process and been approved, with conditions applied. This proposed mine is subject to detailed discussion in a future chapter.

The only point I make here is that a prudent investor would consider the probability of all the proposed Galilee coal mines, or, certainly, some of them becoming stranded assets. The major reason to assert this is the rapidly changing economics of electricity generation. For domestic electricity generation in Australia, it is already a better economic option to build solar and wind farms than another coal-fired power station. These renewable forms of electricity generation, and hydropower, including pumped hydropower, are likely to outcompete coal in any country with sufficient sunlight, wind and water. The fact that the coal from the Adani mine is to be exported, if it is mined, does not alter the fact that the prospect of coal mines becoming stranded assets becomes more likely every day.

An SEA is certainly warranted in the case of coal mining in Australia, and this would apply to other major coal-producing countries. Without planning, governments are putting their faith in prospective miners doing their own long-term assessments and making wise investment decisions. Of course, one could argue that this is precisely what businesses do. And this is indeed true, but introduce the uncertainty of global and, one could add, national climate change policies which are going to favor renewable energy sources, and it is the task of governments to, in as much as they can, provide certainty to investors, and that requires planning for the future. For those who could be tempted to think this is socialism, ask business leaders if they would prefer certainty or not. A plan cannot be prepared without data and modeling, and that is what an SEA is.

Even the most environmentally friendly nation will continue mining until a new technology makes it unnecessary, or the minerals are depleted. We expect this with coal. On the other hand, steel and aluminum have little competition for use in manufacturing and building, and at present have an indefinite life as mined and refined resources. But that will mean at some future date recycling of these materials will be necessary. As these resources run down and price trends up, recycling will become the economic option. It pays to keep in mind that things of considerable value are not discarded. Do not forget, that still in circulation is the first nugget of gold ever found—or in a Viking's grave.

In Conclusion

The present system of giving considerable power to mining companies does not fit well in a world undergoing the rather dramatic changes that climate change policies and technological advances are having. There are other ways. To use Australia as the example, at present, there are two levels of decision-making, and two players in the search for economic minerals and ores. In the first instance, governments fund and undertake what is called *pre-competitive* geological research and, following that, the private mining companies use the results to undertake the more detailed on-site geological investigations. When the mining companies spend their money doing this work, they develop an expectation they will be allowed to mine what they find. In fact, this is what they are encouraged to do by governments. It is purely an ideological decision that governments remove themselves from the process at the early stage. There is no logical reason for this—it's simply *the way it is done.*

Contemplate a scenario where government-paid geologists (they need not be public servants, but could be private consultants) undertake *all* the geological processes, right through to proving-up the ore or mineral body. Only when this has been completed and a government through an SEA has decided that mining should occur, would a government seek bids from the private sector to do the mining. Something like this is done in a number of countries and the mining companies are comfortable with the concept. As a contractor to the government, a miner has a guaranteed income. It is hard to better that.

7

Whose Need and at What Cost?

Introduction

The *need* concept deserves considerable discussion at various levels, if for no other reason than establishing the need for a project is the ultimate goal of EIA. As stated previously, it is undertaken at two periods in the EIA process, the very beginning, and then when all the analyses are done and a recommendation is to be made on the overall viability of the project. It is not until the completion of assessing *all* impacts, both positive and negative, that we will know if an ex-post need for the project exists. There are situations where the *ex-anti* stage can be bypassed, going straight to a full-blown EIA—this because if *x* is going to happen *y* is a perquisite (see Box 7.1).

To recap, establishing the need for a project is recognized in EIA policy and law in countries as diverse in political culture as the USA, China and Norway. In the USA, it was established in NEPA and given force by the Council on Environmental Quality. In China we find it expressed in economic terms in the Law of the People's Republic of China on Environmental Impact Assessment in which Article 17 requires:

T. Hundloe, *Environmental Impact Assessment*, Palgrave Studies in Environmental Policy and Regulation, https://doi.org/10.1007/978-3-030-80942-3_7

> *An analysis of the economic gains and losses of the environmental impacts that may be caused by … [a]project.*

Notwithstanding the explicit requirement to prove that a project is justified by determining its need, this is so poorly treated in most EIAs that one would be forgiven to think that need had been established *a priori*. Some would argue that the requirement to establish need is deliberately downplayed, or skirted over, with the hope that a vague or misleading statement of need will not be challenged. The question of need leads us to consider two key issues: who needs, or wants, the project to go ahead? Otherwise, who benefits from it? The second question is what is the real cost of the project? Otherwise, in the language of economics, what is the social cost of what is to be produced, say, electricity? Social costs influence—in fact, can determine—need. In seeking answers to these questions, we are denying the proponent's right to assert need; that is to view the project through the proponent's eyes, where costs to nature (e.g., particulate atmospheric pollution or an animal's loss of habitat) are not costs to be met by the proponent, where any human health costs (e.g., lung diseases) are disregarded, and where sustainability is only a consideration for the life of the project. Need is to be established with regard to society's net benefit, of which the proponent's benefits are an element.

What Do We Really Need?

Even where need is dealt with explicitly, and the case made for the project is reasonable—that is, prima facie, one could conclude the project is justified—the assessment can fall short if there is a better (environmentally, economically and socially) project able to satisfy the same goal and this has not been assessed. In formal EIA terms we are talking about *prudent and feasible alternatives*. Some might call for unrealistic alternatives. These can rightly be dismissed. Consult a wide range of published EIAs and you will discover nothing but a cursory treatment of alternatives to the proposed project. In EIA, need is not to be divorced from the means of achieving it. This can be explained by example.

One of the most controversial projects in North America is the Keystone XL Pipeline which will be finally completed when the various stretches of the pipeline are connected. The pipeline will be used to transport oil extracted from tar sands in Canada to refineries in the USA Gulf Coast. The project has had a long life, commencing in 2008, of stops and starts (in part due to legal challenges). The proponent's justification for the project goes along these lines: there is demand by the southern US refineries for heavy crude oil, as there are declining supplies from most foreign sources; and Canada is a reliable and stable source compared to the others, such as Venezuela, Saudi Arabia and Nigeria. These statements are *prima facie* true, but ask a more basic question, what is the purpose of keeping the Gulf oil refineries supplied with crude? That answer is likely to be obvious in the eyes of those who are wedded to fossil fuels; yet the pipeline's environmentalist opponents are of the view that if the pipeline is completed it will *lock in* burning fossil fuel for a long time into the future, with the result being a serious increase in greenhouse gas emissions, and this when energy needs could be supplied by nonpolluting, alternative sources. I am not attempting to resolve this matter here, simply use it as an example of a case where alternatives would have been worth assessing. It is too late for this project.

How the need for a project is viewed by a project proponent has to be understood. It is as straightforward as this: a proponent, usually a large corporation, needs the project because it has estimated that it will be profitable. Businesses exist to make profits—the more the merrier. Of course, a business must have customers—ultimately you and me. Without consumer demand, there will not be sales and profits. This is all too obvious. However, it is a little more nuanced than this if one considers what it is precisely the consumer wants. The pipeline transports a product that when refined produces gas(petrol) to power cars and diesel to drive farm machinery, or it could be the energy to drive generators to produce electricity.

If the consumer product is fuel for a motor car, does it matter if it is petrol, hydrogen or electricity derived from nonpolluting sources? As consumers we might not care, other than in terms of relative costs. Opponents of fossil-fuel energy sources do care about the source of fuel. Consider the provision of electricity: it could be produced by a hydro-electric source, a wind farm, a solar farm, a geothermal process, a nuclear power plant or a coal-fired powerhouse. Given modern lifestyles, we need electricity—and as I have argued in an earlier chapter, our poverty-stricken fellows who are presently denied modern lifestyles need it urgently. We can rightly assume that people do not care how electricity is produced, although they care about the cost. The need is recognized, but not necessarily the need for a fossil-fuel source.

Let us take the example of motor car fuel. We might question the quantity we need. It is possible we need less than we are presently using. When gas prices were hiked dramatically twice in the 1970s, fuel-efficient motor vehicles replaced the fuel-hungry ones. The same motoring service was achieved at less cost. Consider domestic electricity demand, a radical alternative in the assessment of need would be to evaluate the impact on our lifestyle and well-being if we reduced electricity demand by what is known as demand management. We might discover that no additional supply is required. No need to dig the mine, transport the fuel and build the power plant.

The problem with asking an energy business to consider alternatives to its chosen project is that it would be rare that the business would have alternatives in its portfolio. It would be unusual for a coal company to also be a renewable energy supplier, and willing to switch to the alternative option if that was proposed. It is more likely that a completely different business, a renewable energy company, gets the job if the alternative is preferred on economic and environmental grounds. In this case, there is a clear incentive for a project proponent to neglect mention of alternative means, or if it did, treat them in a very cursory way and downplay them. Only if the likely alternative is part of its business portfolio will it be given serious consideration. This is a major reason that in most EIAs need focuses on meeting a consumer's demand by relying on the technology or the source controlled by the proponent.

Box 7.1 No requirement for an *ex-ante* assessment: if "x" then "y"

The development of a port is proposed. Why? Maybe the need for it is obvious.

Australia is a major food-exporting nation on a global scale—most of its farmed production is exported. At the *top end* of Australia (the north), both agriculture and aquaculture are planned to expand dramatically, to meet a growing Asian market for food. These farming endeavors would be laudable, assuming that they were well planned and executed, and sustainable. Scientific studies suggest this is the case. Australia would be playing a role in feeding the world.

However, unless a new port near to the new agricultural pursuits is built, the cost of transporting produce from the farms to a distant existing port, say, Townsville, would make the project unviable. In the Australian monsoon season, this road could be impassable. A new port, much nearer to the new agriculture-aquaculture operations, would be required if this project was to be viable. An EIA would be required for the port development.

The background I have sketched out here would be more than adequate to justify the port project ex-ante, that is, consumer demand for the agricultural products is known to exist and scientific research has found no environmental problems with establishing the industries in the area, but a new port would be required. An EIA would concentrate on matters such as the precise site of the port, its impacts on local biodiversity and any necessary mitigating measures and offsets.

What Does the Project *Really* Cost?

I have made the concept of need seem simple and given the impression that a proponent of a project is capable of determining what is needed—a freeway, an airport, a coal mine or a tourist resort—because it is obvious that consumers (users) will avail themselves of whatever the project delivers. At one level that is true or should be true. The proponent will, or should, know its business. It is given that all projects depend on meeting the requirements of customers. However, this is not necessarily the end of the story. It will, in certain circumstances, be just the beginning of a hidden part of the story—the out of sight, out of mind costs.

Those of us—you and I—living in a newly created residential area where koalas used to reside—I am back in Australia—might be content, pleased with our manicured surroundings and the birds and lizards who visit our little manor. I did not mention koalas visiting. They have gone. The local koala population decreased because there are less eucalyptus trees on which to feed, and the adjoining eucalyptus area was at its maximum carrying capacity when the displaced koalas became refugees seeking a home with their neighbors. The new arrivals could not be fed due to the koalas' food souce being fully committed.

You are a visitor to British Columbia, heading through the Rockies to Banff. You have come a long way, from tropical Florida, to see brown bears. You are lucky, you see two in the hundreds of miles you have driven east from Vancouver. Many decades ago, you had been to this part of Canada, brought by your parents as a child during a school vacation. There were far more brown bears then. There is something else which has seemed too shrunk, in this case in size, not in number. After visiting Banff you have headed into the far north, another place you had been fortunate to visit as a child. Was it simply a feature of a child's particular perceptions that the glaciers you saw that long time ago are nowhere as big today? Big is something which small children understand. Sad to say, perceptions aside, the glaciers are actually smaller today. You are witnessing the beginning of a change in climate. The beauty of the glaciers is somewhat diminished due to their smaller size. This is disappointing, and you will be likely to tell others—and eventually, the number of big-spending visitors to Canada noticeably decreases.

These losses in enjoyment do not register in any accountant's profit and loss statement—not for a long time, at least. They are not mentioned in the annual report of the companies with all their pretty-colored, upward-sloping graphs—of questionable meaning. The nation's national accounts also reach skywards—these are the measures economists rattle off without telling the public what they really mean—leaving us to think things are on the improve. Stop! They do not take into account the loss of koalas' habitat, the fewer brown bears and the drip-by-drip shrinking of the glaciers. Nature has no price in the monetary accounts—except if it is represented in visits to a zoo, or a smart eco-tourist operator can entice folk to visit and enjoy wild places. That sounds good, but there are far too few eco-adventures to account for the magnitude of losses around the globe.

With these thoughts in mind, we are now coming to ascertain if a project is genuinely needed—*all* costs included. This is why we have

EIA. When *all things* are not taken into account, we are back in the era when Rachel Carson wrote *Silent Spring*, back in time before NEPA became law and with that a new paradigm. We will keep asking whether or not EIA practice has met its promise. If the project has been subject to an EIA and significant environmental costs remain to be borne by society as a whole, EIA will have failed us. There remains the possible savior; the environmental costs might be able to be offset. In certain circumstances this could be the solution, in other circumstances not so. It is going to be an enormous task to offset the load of greenhouse gases we have put in the atmosphere since the beginning of the Industrial Revolution. Offsetting is a subject for later chapters.

An EIA focuses on the needs of the project's beneficiaries as well as the needs of nonbeneficiaries. The nonbeneficiaries are likely to require a healthy environment suited to their specific needs, as koalas and brown bears do. Let us explain need as a mathematical exercise, but rather than expressing the formulae in mathematical terms as economists have a propensity to do, I'll spell it out, step by step out in English and save you the necessity to translate. See Box 7.2.

Box 7.2 The Need Formulae

A private benefit = *benefit to the project proponent = profit to proponent [both the* proponent *and its customers are* beneficiaries*]. Any* external costs or benefits *are not included.*

A private cost = *costs paid by the project proponent [the* proponent *has to recover all his/her private costs, including making a profit].*

A social benefit = private *benefit [as above] + additional benefit to others [the latter's benefits could be tangible, such as, a neighboring farmer's crop being pollinated from a fruit orchard established by the* proponent*, or intangible such as heightened feelings of goodwill in knowing an environment has been restored in the process of the development]. The* social benefit *is greater than the* private *benefit, therefore = overall gain. The project is definitely worthwhile if the social costs are less than the social* benefit*.*

(*continued*)

Box 7.2 (continued)

A social cost = private *cost to the* proponent + *costs to* non-beneficiaries *[an upstream factory putting polluted water into a stream killing fish downstream thereby putting commercial fishermen out of business].*

The calculations are as follows:

If the private *benefit is greater than* private cost, *the project* proponent *will want the project to go ahead, but the government will need to know about any social costs and social benefits before making a decision.*
If the social benefit *is greater than the social costs, that is a net benefit, the government will approve the project.*
If social benefit *is greater than* private *benefits, the* proponent *might seek a subsidy from the government or the beneficiary due to the provision of the extra benefits.*
If social costs are greater than private *benefits, the government will reject the project—unless there are* social *benefits large enough to cover the difference.*

In Conclusion

If we were to describe the importance of EIA, it is that it requires *all* costs and *all* benefits to be measured. The type of measurement undertaken—the measurement tool used—is an issue. Obviously, this is simple if economic measures are able to be used—and accepted by the public. This will not necessarily be the case. We will need to think of surrogate measures of benefits and costs, for example, environmental health, or ecosystem resilience, or sustainability indices. We have a chance to explore this matter in the coming discussion of offsets. Whatever the measures are, the result of these calculations must be made public at two stages of the EIA process, when a draft has been prepared and then when the final EIA is realized. A warning is necessary, a project that does not meet the *net* benefit criterion might still be allowed to go ahead, but at least the public will be informed and can use its influence in whatever manner is appropriate in a democracy.

8

Maslow and the Need to Survive

Introduction

So far, we have been discussing the notion of need with reference to highly developed countries—as would have been obvious. In these countries it has been necessary to distinguish between needs and wants. It is much easier to make sense of need in a poor country. There is no better place to start than with Maslow's hierarchy. At the most basic level we humans want to survive, and for as long as we can in good health. On this point it pays to remind ourselves that in Australia, New Zealand, Japan and the Nordic countries, the average expected life span is approaching the mid-80s. In sub-Saharan Africa, there are countries struggling to get to and keep their average at 50 years or a little above. At a more general level, there are billions of our fellow humans who do not, or struggle to, meet their basic human needs of food for survival, clean water to prevent water-borne disease, clean air to prohibit life-destroying lung diseases, and simply have adequate shelter. What does this mean for EIA?

T. Hundloe, *Environmental Impact Assessment*, Palgrave Studies in Environmental Policy and Regulation, https://doi.org/10.1007/978-3-030-80942-3_8

Where Good Projects Are Needed

Any project that brings electricity to dwellings in which wood-fired cooking fills the air with particulate pollution is needed. We are in parts of sub-Saharan Africa or parts of South Asia. To be rid of *three-stone stoves*, as they are called in Africa, could mean building dams for hydro-electricity schemes to provide electricity to the villages. We know dams have adverse impacts on the ecology of rivers, and they can inundate villages. However, we can predict the reduced morbidity and mortality that will result from ridding dwellings of particulate air pollution—the benefits in human lives saved and human health regained are very high from eliminating indoor wood stoves. If there is a trade-off involved, where do we stand? I know where I do. Generations ago, we of the richer parts of the world rid ourselves of this source of particulate pollution by building dams or mining coal and uranium to produce electricity. These three options had very different environmental impacts—however, we can put that aside here.

There are various other sources of pollution responsible for the illnesses and early death of people in the poor countries. Water pollution is a prime example. We have excellent epidemiological data on the illnesses and shortened life spans of slum-dwellers in countries such as Indonesia, Thailand, Bangladesh, India and a host of African countries. Any project that sewers the slums, cleans up the rivers and replaces three-stone wood or dung fires is a much-needed project. We are dealing with the need to survive. As a practitioner you are likely to be pleased with the prospect of involvement in an EIA in a poor country, particularly if the project aims to improve the conditions of local people and their country's economy. There will be challenges but the benefits to the poor—and your sense of satisfaction on top of helping and learning more about your fellow humans—will be worth it.

Practicing EIA in a Developing Country

As an environmental impact practitioner it is not unexpected that you will be given the opportunity to practice in developing countries—sub-Saharan Africa, South America, the Pacific or Southeast Asia. EIA is practiced throughout these regions. If you take the opportunity, expect major trials and tribulations—plus wonderful learning experiences.

My first overseas job as an environmental practitioner was in the early 1980s when I was invited to Indonesia to teach the principles and practices of EIA. Only a year or two earlier, the Indonesian government had followed the USA and Australia in introducing an EIA law. The country had no trained experts to administer the law, or professionals to practice EIA. I was their first teacher. I report this to make a number of basic points about working in developing countries. The matters I mention are not taught in environmental degrees in our universities. This is not a criticism as much as an oversight, due to the limited experience of lecturers.

If one is to work as a generalist environmental practitioner in a poor foreign country, considerable learning about the local culture is required before one is truly competent. It is a different matter if you have, for an example, a specialist task rather than a generalist one. As a pollution specialist in a modern Jakarta laboratory, you will analyze water samples without the requirement to know much about the people, their culture or their economy. Your major issue is likely to be the annoyance of not obtaining the samples on the day you expect them. However, the matters I will mention are crucial to the success or failure of a generalist environmental practitioner who is overseeing a major EIA. There is an old-fashioned term *culture shock* that appropriately describes what foreigners experience once they exit the five-star hotels and shopping malls and go to work. In the following paragraphs I am going to use Indonesia as an example of what to expect in a vastly different culture to the one you know best.

Indonesia is a country comprised of many different cultures, religions and languages (the figure, depending on the detail of classification, is between 300 and 700 different groups). While Indonesia is the country with the world's largest Muslim population, Bali is predominately Hindu, some of the eastern islands have significant Christian populations, and Irian Jaya is predominantly a place of ancient religions (some would call them *pagan*). There is an economically powerful Chinese-Indonesian population, which on occasion has been subject to assault on ethnic and class grounds. While the Indonesian Constitution recognizes all people and religions as equal, there have been, and continue to be, demands by what can loosely be called *tribal people* for specific legal recognition of their asserted tribal rights; while the relatively powerful Muslim fundamentalists work to undermine the secular nature of the country—somewhat successfully as much money is poured into the country from Saudi Arabia for this purpose. Expect religious tension. Awful terrorist attacks on foreigners have occurred with much loss of life.

As you might expect given the cultural and language diversity, to form the modern country of Indonesia was a mammoth challenge. A new, universal language (Bahasa) was created; five religions and Confucian philosophy were recognized as the six official *religions* in a formally secular state (although, as noted, this is presently being threatened); and in the early days of the republic, a mild form of socialism including a social welfare program was promised. This political philosophy lost its hold after an anticommunist coup in 1965 in which, probably, one million people lost their lives in the vicious murder of suspected communists. These are matters one has to be mindful of in working in Indonesia. Furthermore, there is an economic class dichotomy at play—with the fabulously rich in their high-fenced mansions with their servants, in contrast to slum-dwellers scavenging massive rubbish dumps for salvageable and saleable discards.

My Indonesian EIA projects were standard developments in the modernization of the Indonesian economy (an industrial estate and a new airport). The details are not of significance. I want to tell you what was of significance—to me at least. I left Indonesia after two successive assignments with one thought about what the country *needed* most. It was not the projects I was tasked to use in teaching my Indonesian students. If I had been the Indonesian government, my number one priority would have been the removal of the slum-dwellers' outdoor, shack-toilets which perched higgledy-piggledy along the 14 canals that drain Jakarta. I imagined toilets connected to modern sewers, and the effluent treated before discharge. This is what was required to replace *drop-in-canal toilets* clinging to, teetering on, the banks of the canals that flowed through Jakarta, collecting not only human bodily waste but also the plastic bottles and wrappings that have become associated with life even in the poorest communities.

The canals-as-sewers conveyed enormous overloads of human excrement, runoff hydrocarbons from the roads and tranches of consumer and industrial plastic discards. The canals feed into the fishing ground that is Jakarta Bay. The shellfish harvested from it were not to be eaten when I was in Jakarta that many years ago. During my time there, water-borne disease was rife in the poor urban communities of the country.

Let me go to the present, 40 years after my EIA work in Indonesia. Following is the headline of *The Jakarta Post* on February 22, 2019:

Don't consume fish, mussels from Jakarta Bay: Expert.

The expert in this case warned of various degenerative human diseases, the ones I was aware of so many years before. It appears that not a great deal had changed over four decades. The need I identified still remains unmet.

I am not the first person to identify sanitation as an essential need in crowded, poor communities. In a poll undertaken for the medical journal *Lancet*, sanitation was considered to be the most important contribution to the remarkable progress of human welfare in Britain's history. This finding led author Michael Blastland, in his 2019 book *The Hidden Half*, to report some fascinating data on the lack of sanitation for the poor. Blastland notes that on a global scale more than one billion people simply squat in a field to relieve their bowels. I would add, squat in city streets and their feces wash into urban drains and watercourses. To address this matter in India alone, Blastland tells us, would require the construction of one toilet every 18 seconds, every day until 2025.

Need! What is need? One should start with the basics, the bottom of Maslow's hierarchy. There should not be too much argument about justifying a project if it provides a substantial benefit to the poor.

Where Need Is Simply Fair

Jeremy Rifkin in his 2009 book *The Empathic Civilization: The Race to Global Consciousness in a World in Crisis* simplifies the Maslowian hierarchy into survival values, materialist values and quality-of-life values.

Once survival is made possible, people rightly seek improved material living conditions. On accomplishing the desired material comfort, the so-called *self-actualization* stage sits at the top of the pyramid.

We struggle when we try to move societies up the slope of the pyramid. In fact, there is much talk and ink used in developing and sprouting fancy names for development goals, but very little on-the-ground achievement. Interestingly, where success has occurred as in China, what has been achieved, the people of the nation did themselves—not with the advice of World Bank experts or pet aid projects from the rich world.

Here is a challenge for all of us in considering the meaning of need. Given the technological skills we have today, given our excellent manufacturing capabilities, our food-producing ability, and given our immense container ships, should not every citizen of the world, whether in the poorest parts of Africa, Asia or South America, live at the standards of the middle class of the Japanese, German or New Zealander! This is not a question.

Now you might conclude that if the planet's total human population of near eight billion was to live as we do, the planet could not cope. I am leaving the emission of greenhouse gases out of consideration. Even without introducing climate change, we face a diabolical problem. We can make the question much harder to answer by suggesting the human population will not peak and level out until it reaches ten billion in about 2050. These extra people will seek to survive, and on noticing the material well-being of the world's middle class, believe that they are entitled to similar material well-being. They need, and are entitled to, more than simply survival conditions. Environmental historian Clive Ponting is one who is extremely pessimistic. In his *A Green History of the World*, he writes:

> *Even if current European and American levels of consumption were to be stabilised, it must be extremely doubtful whether the rest of the world (over 80% of the people on the earth) could ever repeat the process of industrialisation and attain these levels.*

In Conclusion

Ponting's assessment is a dire, dismal diagnosis. We, the rich, keep promising the poor something better. If we cannot deliver, what are the consequences? Your guess is as good as mine. That aside, EIA can help in pointing to the optimum means of achieving a goal. For example, electrification of villages need not require the construction of a massive hydroelectricity scheme. What of, in the appropriate circumstance, village-level solar power, wind power or micro-hydro? Of course, someone would have to champion these alternative methods of development—the type of development called for in *Our Common Future*.

9

Distorting Need

Introduction

We have noted that what a proponent wishes to do—has a self-asserted need for—does not necessarily align with what a community requires or would want from a project; or, for that matter, what a government would want. We have noted that the way our economic system works there are certain costs to others not paid for by producers or consumers of a particular good or service. These we call externalities. Their existence is one reason why what the proponent wants from his or her project will not coincide with what society wants. There are other reasons for this mismatch. If the profits go overseas, if the jobs created are few, and if another project might be more in tune with the nation's needs, it is obvious that needs do not align.

We have explored how to assess project proposals, and that is to ensure that *all* costs and benefits are accounted for. Furthermore, we have noted that transparency—the full disclosure of all relevant information—is at the heart of the EIA, because without this, public participation would be rendered useless—a worthless, waste of time, a sop to public opinion. What is the point in commenting on draft and final EIAs if not all the

T. Hundloe, *Environmental Impact Assessment*, Palgrave Studies in Environmental Policy and Regulation, https://doi.org/10.1007/978-3-030-80942-3_9

relevant data are included, if some of the costs or benefits are not included! There are other ways EIA can fail. An important one is where the EIA consultants are too reliant on information, data or modeling provided by a proponent and the proponent's material is inaccurate or not complete. In the ideal world, an environmental practitioner should be able to expect reliable data from the proponent. However, one must be realistic, a proponent is interested in having his or her project approved and, hence, we cannot rule out a propensity to boost the project's benefits while diminishing the dis-benefits. This puts a consultant in an unenviable position of having to check the information provided by the proponent. Neglect that, and inevitably someone will discover any errors.

Then there are situations where projects become a proverbial *political football* with one group of politicians promoting the project—and taking the proponent's claimed benefits at face value—with another group of politicians attacking the project—and seeking support from a diametrically opposed group. This can become awkward for the EIA consultants, because at the end of the day their analysis will favor one side or the other, and the consultants—unfairly—will be blamed in part, if not in full, by the side that does not get the result it wants. Someone is going to be disappointed.

To explore the issues raised above, I have selected an Australian case. However, it could be a controversial project in any industrialized country where the EIA system is a standard NEPA-type clone. There are various reasons for selecting this particular case study. In no order of priority, it is contemporary; it is a proposed coal mine with the coal to be exported; the proponent is a powerful political and economic figure; significant benefits are promised; the employment to be generated was significantly exaggerated by the proponent and not challenged until the EIA was put under scrutiny in a law court; and, the project, notwithstanding the findings of the formal assessment, has powerful supporters and strong opponents. Finally, I have on-the-ground knowledge of the mine site; I have walked the land, I know the landscape, the flora and the fauna, and the rail route the coal trains would take to a port sitting on the boundary of the Great Barrier Reef.

The Proposed Adani Coal Mine

As noted previously, there is a project in Australia commonly referred to as the Adani mine. During my writing of this book, the company, after operating for ten years in Australia under this name, changed its name to Bravus Mining and Resources. Some assert that this is to overcome the negative perception of the previous name. I shall continue to call the company by its original name to ensure no confusion. The Adani coal mine project is, probably, the most widely reported environmental dispute in Australian history. For that reason, there need not be a detailed discussion here. Only one aspect of the story will be dealt with in this chapter.

First the background. The Adani business is owned by a very rich Indian entrepreneur who has a dominant position in the energy business in his country. In mid-2019, approximately eight years from the time his firm produced an EIA, followed by a supplementary EIA, and finally a court case, his project was approved, with conditions applied. The court case dealt with the major unresolved issues identified in the EIA. During the court case, a major error was discovered, throwing into doubt other findings. If there was one mistake, there could be more. Furthermore, it was clear from the EIA that certain environmental offsets were going to be required, but over the many years between the publication of first EIA and the court case, it had not been possible to secure offsets. Now, many more years later, the offset situation remains unresolved.

When the Adani firm and its influential Australian supporters were challenged as to the need for this project, the response was that there were about one-third of a billion poverty-stricken Indians without electricity. This seems to be the case. These people are so poor that they cook on wood-fired or dung-fueled stoves, their school-age children use the light of a mobile phone to do their homework, while the more enterprising steal electricity from wires overhead, on its way to power television sets in middle-class homes. It was argued that the coal mined in Australia and shipped to India to be burned in a power station was going to bring electricity to people living on a couple of dollars a day. Apparently, the Adani firm was going to make an investment of tens of billions to give electricity away—the poor had no possibility of paying for it! We need to recognize that this claim was not made by the consultants responsible for the EIA, but by the proponent and his supporters. Notwithstanding that, the controversy as to who was to benefit from burning the coal could have been forestalled by explicit treatment in the EIA under the *need* heading. It was not. That serious omission is a consequence of deficient terms of reference for the EIA, and lack of application of standard EIA principles by the government agencies overseeing the process.

Without a doubt, the poor in India need electricity. Given that they cannot afford to pay for it, what evidence do we have that Mr. Adani is another Gandhi or Mother Teresa, willing to make sacrifices for the poor? The public record does not support the notion of the Adani firm as a charitable organization. Rather, the Adani firm likes to be treated as a pauper needing a handout. For example, over the years, the Adani company has sought a number of subsidies from Australian taxpayers. The company played hardball with the Queensland government on the issue of royalties. Having started arguing years previously for a royalty deal, at the end of 2019, the Adani company was still battling the Queensland government over the extent of royalties. The Queensland newspaper, the *Courier Mail* (of 30/11/2019) reported:

> *it is still not known how much money the Indian miner will pump into the Queensland economy.*

And then two weeks later (on 13/12/2019), the same newspaper reported another failure—very minor in the context of all the other shortcomings, but indicative of a less than scrupulous attention to detail:

> *Adani … failed to inform the Department of Environment and Science of the names of the researchers working on the black-throated finch … by the deadline.*

It was not until October 1, 2020, that ABC News was able to report that an agreement on royalties had been reached. This agreement should take pride of place as a parody of transparency. The following is an extract from the news story and is based on a direct quote from the responsible Queensland Government minister:

> (The Queensland government has signed a deal with the mining company Adani to defer payment of royalties on its Carmichael mine … for an unspecified period of time … [W]hen the company would start to pay royalties and how much were commercial in confidence.)

The Queensland citizens are the legal owners of the coal. Their government is obliged to represent their interests. The government can claim that it has done the best it can in negotiating the deal with the Adani company. This is not in dispute, but that does not excuse refusing to tell the owners what they are going to earn from the sale of their coal resource. One question is: who benefits from secrecy, the Adani company, the Queensland government or both? It is difficult to understand how the Queensland government benefits. Is it the case of the mining company playing hard ball?

Let us go to the fundamental issues of EIA. There are two basic rationales for EIA, one is to determine the need for a project, which can only be done by counting *all* the benefits, including royalties earned, and subtracting *all* the costs; the second is to provide the public with *all* the relevant information—that entails doing so in the draft and final EIAs, allowing for periods of public review, and consideration of public comments. If these conditions are not to be met, we do not have EIA. Are we entitled to accept the treatment of the Adani mine proposal as an EIA? Possibly not, on the grounds of nondisclosure of royalty payments, the major benefit to the owners of the coal.

There is another unresolved issue with regard to the final approval of the Adani. It pertains to finalizing, if possible, environmental offsets for an endangered bird. On the basis of the *ongoing* research into offsets for the black-throated finch, we do not know if the mining company is able to meet the conditions on which the coal can be mined. The mining company has to find new habitats to compensate for those that the birds will lose when mining occurs. I shall return to this issue in a future chapter.

Not only is the mine being justified on the basis that it will, when the coal comes to generate electricity, benefit the desperately poor in India, but it is also supposed to create 10,000 jobs in Australia; that is, 10,000 potential jobs will be lost if the mining does not take place. Some media outlets told us that the threat of job losses changed the result of the 2019 Australian federal election. The opposition party was portrayed as being opposed to the mine. If this analysis of the election result is true, the pro-Adani propaganda was very successful—assisted as it was by the media's willingness to convey the false claim of 10,000 jobs during the election campaign. What is difficult to explain is the media—and anyone interested in the proposed mine—had known since 2015 that the actual number of jobs that would be created was one-sixth of the claimed number; that is, less than 1500 jobs were at stake. This was admitted by an Adani representative in a 2015 court case.

In the next chapter, I shall have more to say about how the EIA process failed in the Adani case, but here I shall emphasize the failure to justify the need for the mine. If the Queensland State government is vague about the extent of royalties, the Commonwealth government cannot know the extent of corporate tax to expect from the miner. And let us note once again that the ultimate responsibility rests with the Commonwealth government due to the fact it is a proposal to export coal. Keep in mind that the only benefits Australians get from this mining deal are royalties and income taxes. By allowing the mining to take place without knowing the extent of benefits means that the Commonwealth government and, some argue the Queensland government, have failed the Australian people. Here we should recall that when Australia's EIA law was introduced in 1974, the Commonwealth Minister responsible, Dr. Moss Cass's, promised that EIAs would inform Australian citizens of the need—the benefit and costs—of a project.

As I write, not only do the Australian citizens not know if the mine is justified, but they are not going to be told. The owners of the coal are not going to be told how much or, looking at the glass from the opposite angle, how little money they will get from permitting the mining of the coal.

As a person with a long memory exclaimed: *Moss Cass, where are you when we need you?*

In Conclusion

Undertaking an EIA is a process and the result, which some call an EIS, is a tool to help us decide if a project (a dam, an airport, a tourist resort, or mine) is worth pursuing—all reasonable pros and cons considered.

Obviously, we would not wish to pursue a project that had an overall negative impact on society, therefore the benefits have to trump the costs; or if greater than the benefits and not able to be mitigated, must be able to be offset.

We might believe—even assert—that we need *x* or *y*, or both if we are greedy, but if our perceived needs come at a cost to society and to the natural environment, we cannot claim we have justified our project. This remains the case in regard to the Adani mine.

There are various requirements for good quality, professional EIAs: the qualifications and experience of the consultants who are engaged by the proponent; the interest of the proponent in having a thorough assessment; the financial resources committed to the task; the difficulty of the task—some matters cannot be resolved given our lack of scientific knowledge; the terms of reference for the task; and, the diligence and expertise of the government staff overseeing and assessing the EIA. In terms of an adequate treatment of need, the essential starting point is to make clear in the terms of reference what is required and ensure that this requirement is met. If this is done, we would expect a considerable improvement in EIAs. We would have a far better understanding of what benefits projects provide and what costs they incur. The lack of specitic detail in terms of reference for the Adani project meant the consultants were not required to explore and report on its overall need.

10

Project Alternatives and Other EIA Principles

Introduction

In dealing with how to determine the ex-ante need of projects, we have discussed the major issues but some only in scant detail. Some of them require detailed treatment, while for others a clear statement as to their meaning will suffice. In this chapter, we will commence with the requirement to consider alternatives to the project. For example, should the potential impacts of alternatives get as much attention as those of the preferred project?

We will have to sort out boundary problems on two dimensions, temporal and geographical. Consult any set of EIA guidelines and they will refer to short-term and long-term impacts. There are different ways of defining these terms, but a fundamental point is that sustainability means indefinite time. The geographical boundaries of a project can have a *make-or-break* outcome—approval or disapproval. The basic question is, do we limit impacts to the nation-state where they occur? For example, if Australia and Canada sell uranium overseas, as they do, should the disposal of uranium waste overseas be a factor in an EIA on Australian or Canadian uranium mining? Alternatively, should the project approval be

T. Hundloe, *Environmental Impact Assessment*, Palgrave Studies in Environmental Policy and Regulation, https://doi.org/10.1007/978-3-030-80942-3_10

conditional on the waste be returned to Australia or Canada? What of the burning of Australian coal overseas? Are the greenhouse gas emissions a matter to include in an EIA? In climate change jargon, these are *Scope 3* emissions.

Then there is the requirement, as set out in the standard EIA literature, to assess both direct and indirect impacts. How far should we follow through on indirect impacts? This can—it does not have to—take us to life-cycle-analysis, from cradle to grave. Some assert that it should be cradle-to-cradle. Recently a new term has entered the language of industrial ecology—itself a relatively new concept—the circular-economy. The term is a good metaphor, as what is suggested is akin to continuous recycling and reuse which is nature at work without a prod or a poke. Note that life-cycle analysis requires setting boundaries, otherwise we will exhaust ourselves in analysis-paralysis.

Project Alternatives

Assuming one is following the near-universal EIA requirements, the assessors have to answer this question: Do feasible and prudent alternative means of meeting the purpose of the project exist? This is a question government agencies should be required to answer every time they identify the need for new or upgraded infrastructure, be it water supply, electricity supply, transport infrastructure or anything else normally undertaken by governments. This suggests governments should be actively and continually engaged in a form of SEA. In fact, the best-organized governments do just that, although not calling their planning SEA. In comparison to governments, it is a different matter for a private concern seeking approval for its pet project: it is a *pet* project, and alternatives are not countenanced. We have already noted this with the Keystone XL Pipeline.

In the example of a port referred to in a previous chapter, it is clear that an alternative makes no sense—using air transport to take bulky agricultural produce overseas is far too expensive. To look for alternatives would be wasteful of time and money—not prudent and ruled out on (economic) feasibility grounds. However, as mentioned previously, there are other projects for which it is easy to identify alternatives. Coal-fired electricity generation is one. Given the importance of electricity generation for modern everyday living and industry, it provides an interesting example of the role of alternatives in EIA.

As a consequence of the concern about climate change resulting from burning fossil fuels, alternatives to coal and gas should be common features in EIAs dealing with coal and gas production. What form of electricity generation suits a particular country can be debated; however, where Mother Nature has been kind, the choice tends to be obvious. There are a small number of fortunate countries, such as Norway, Iceland and New Zealand, where nature has been very kind. Norway obtains virtually all its electricity from hydropower. In the case of Iceland, it is three-quarters hydropower and one-quarter geothermal. New Zealand gets three-quarters of its electricity from a combination of geothermal, wind and hydropower. Canada is also relatively fortunate with two-thirds from hydropower, supplemented with nuclear, coal and non-hydro renewables. Even the UK, which is wet and cold, has choices to supplement its major reliance on gas, at 40 percent; wind power is at a healthy 20 percent followed by biomass and solar power.

The provision of electricity will depend on the resources of the country, or the resources of near neighbors if it imports electricity. If a country has plenty of coal, as Australia does, the preferred option until recently has been coal-fired power stations. Mountains, so to speak, of coal are not the only abundant energy source in Australia. The country also has plenty of sunlight, and in recent years, as the cost of photovoltaic solar cells has dropped dramatically, Australia on a world scale has the most households per capita with solar panels on their roofs. In fact, when it comes to alternative sources of electricity, Australia is very fortunate as the alternatives are numerous. The Australia of the future will rely on a combination of sources: hydroelectricity, solar farms, wind farms plus very big batteries. One could put nuclear power plants in the mix, even though the Australian public is not in favor of them, but they will not be needed, yet Australia is going to have nuclear-powered submarines, which might result in local processing.

The USA, also a large country with a variety of natural environments, similar to Australia, has a very wide choice in electricity generation. At present, fossil-fuel generation (natural gas and coal) dominate at about 60 percent, with nuclear power coming second at just under 20 percent, wind and hydropower produce small amounts, while utility-scale thermal solar power and household photovoltaic solar power are still very small components of the total. In the order of 6 percent of American households have solar panels compared to over 20 percent of Australian ones. The State of Queensland is the stand-out global leader with approximately 30 percent having solar panels installed.

The beauty of using electricity as an example is that the ex-ante analysis rests on two major grounds and we have data on both. On greenhouse gas emissions, each of the alternative electricity sources trumps coal-fired and gas-fired generation, and today all except nuclear trump coal on economic grounds. With the *ex-ante* matter resolved, an EIA could focus on the relative impacts of the renewable sources, such as their siting, the opportunity cost of any productive agricultural land excised, impacts on biodiversity, social concerns (e.g., noise from wind farms) and the relative economic costs of construction and maintenance. The latter must not be overlooked in a comparison of all forms of electricity generation. To be thorough, a life-cycle approach is required in the analysis of each and every alternative. This analysis could change the rankings.

Unless the future of electricity generation is determined through an SEA, the result is likely to be a public request to analyze alternatives each time a project surfaces. Undoubtedly, those concerned about climate change will demand renewable energy sources be considered every time an EIA is prepared for a coal or a gas project. Those who remain enamored with coal will demand it be considered every time an alternative electricity source is subject to an EIA. The only way the two sides will meet is by putting both cases on the table in an EIA. This cumbersome approach need not be the solution. It is a waste of time and money. A government-sanctioned and overseen SEA is the answer. As major technological advances are made, supplementary SEAs would be undertaken. This would become the normal process in deciding on electricity sources.

It is not only electricity generation where a range of alternatives exist. Providing freshwater is another example, build a dam, construct a desalination plant, clean and recycle wastewater, or engage in serious demand management. Again, an SEA would resolve the matter, at a regional scale, but unlikely at a wider scale due to differences in climate, geography and population, to name three key factors. Transport is another case where options exist—buses, trams or rail. For long-haul goods transport, there are two options, road or rail. For lightweight, high-priced goods, we can add in air transport. The issue is which to favor? An SEA, or if not done, an EIA paying genuine attention to alternatives will determine the best alternative. With regard to private transport, we will soon—if not already as in some countries, Norway being the stand-out front-runner—need to compare fossil-fuel propulsion to electricity-powered vehicle transport. Of course, the source of the electricity is critical in the case of the latter.

Finally, what we term *radical* alternatives should not be ruled out. Previously, I mentioned the freeway congestion project and a very simple economic assessment of it. A traffic planner might consider reducing the overall traffic flow, and in doing so reduce the lost time and money to the truck drivers, by imposing a toll, thereby reducing private travel. Another example, a radical alternative to generating more electricity is to provide incentives—over and above any existing ones—to reduce demand. A similar approach is applicable to water use. It is already done to some extent with the use of tariffs set to discourage excess use. Much more efficient environmental management could be achieved by the use of monetary incentives and disincentives.

The Short Term and the Long Term

There are two other essential matters to investigate and report on under a NEPA-style EIA. One is the requirement to assess impacts over both the short and the long term. Nothing unusual here, other than we will see that when we superimpose the principles of sustainable development on EIA, the long term is indefinite. While the concept of sustainable development had not been formulated in 1970, something similar was envisaged because there is specific mention of irreversible and irretrievable use of resources in NEPA. It is said, with some justification, that the drafters of NEPA anticipated sustainable development, and not only in requiring serious attention to the long term, but in the requirement to integrate environmental and economic considerations, and the recognition of the relationship between population growth, technological advancements and the environmental health of the planet.

As a general observation, it is the unusual EIA which pays has serious attention to the long term, let alone any analysis of impacts beyond the life of the project. In fact, most do not go to the life of projects. What is the lifespan of a dam? More than 100 years if the built-up silt is removed when appropriate. In fact, depending on construction material and some other features, the lifespan could be much longer. We could ask, what is the lifespan of a solar farm? At what age do the solar panels require replacing, and what happens to the old ones? If one is to commence coal mining today, how far into the future does one look in anticipation of the end of coal? You presumably are aware of the much-touted adage: *the stone age did not end because we ran out of stones.* Credit where credit is due: thus spoke Ahmed Zaki Yamani, Minister of Oil in Saudi Arabia.

Flow-on, Indirect and Induced Impacts

We must be mindful that indirect and induced impacts can be both positive and negative. If there is a tendency to seek out the negative and neglect the positive, this is wrong. In terms of economic impacts, it can be relatively easy to find positive flow-on impacts; for example, if the project results in a significant increase in a rural region's population, economies of scale are likely to generate benefits—a group of medical doctors could find it worthwhile to open up a practice in an otherwise un-serviced rural region.

The impacts of a project do not necessarily stop at its physical boundary (e.g., the airport perimeter and the flight path) but can have a variety of *flow-on* impacts. One distinction is on-site *versus* off-site. The latter tends to be of most interest, as on-site impacts can be addressed by changes in project design. For example, in the design of a cattle feedlot, the layout can funnel the effluent into a secure pond and be allowed to dry out. If this is not done, there will be serious pollution downstream. Something similar applies to an upstream factory. It can be required to treat any water that is contaminated before being released into waterways.

Some indirect impacts will be easy to identify, others less so. This is where *systems thinking and modeling* come into play in drawing boundaries. Without boundaries it will be a matter of a cat chasing its tail. Recall that Rachel Carson traced chemical pollutants through the food chain to discover the ultimate damage to large sea birds. In fact, there was no reason why the pollutants could not go farther up the food chain. We have useful means of tracing impacts and they are the various chemical cycles. An important one that tends to be easy to conceptualize but still difficult to use at a fine scale is the carbon cycle. For example, we know that legumes are excellent in taking carbon to the soil; however, they eventually die or are eaten and carbon dioxide is released. What is the net result? This would be a matter of researching each type of legume. Other important cycles which can help us conceptualize the flow of impacts are the phosphorous, nitrogen and water cycles. Turning attention to economic flows we have combined economic-ecologic models, we have life-cycle analysis, and simple economic or combined-discipline input-output matrices. If effort were to be applied to further develop these approaches, it would be one of the most fruitful uses of time. This is because we are generally too relaxed about making the essential ecological-economic links.

The EIA literature differentiates between indirect and induced impacts. From an ecological perspective it makes no real sense to differentiate them. What follows on, follows on. The difference makes some sense from an economic perspective. An induced impact is best explained by an example. A large tourism complex is built to cater to an expected increase in foreign tourists. It requires staff who come from outside the local region. They buy houses in the area. Their children need schools, and these families require all sorts of social infrastructure. Eventually, a new small city develops as more people than the resort workers are induced to move there. With this, there are positive economies of scale and scope; but, generally, at some stage of growth, negative ones set in—so-called diseconomies at too large a scale. This could be something as simple as local traffic congestion, or local inflation, but more insidious impacts such as increased crime cannot be ruled out.

The easiest way of conceptualizing these interdependencies is through forms of input-output analysis. From an ecological perspective, food chains are an excellent starting point. For example, it can be relatively easy to impact the population of predators if the project destroys the habitat of their prey. How far into the food chain—the web of life—one traces the impacts is a matter of judgment. The decision is determined by how important is the consequence. If the analyst is fortunate, already-published research findings will be an important help. Possibly everything the analysts want to know has been calculated in previous research. However, food chain analysis is not the only tool needed. As noted above, reference to chemical cycles is likely to be necessary, if for no other reason that they underpin food chain analyses, as well as having their own value.

We are vitally interested in the amount of carbon dioxide entering the atmosphere. This is not the only place for carbon to go. It can be stored in the oceans, in the soil and in forests. On the one hand, we have techniques to measure carbon in soil and trees and these methods produce rigorous results. On the other hand, we struggle to obtain definitive estimates of carbon in the oceans. The nature of the project being assessed will determine which of the chemical cycles are helpful. For example, if the project was a large monoculture requiring large amounts of nitrogen-based fertilizer, we would want to know how much of the fertilizer washed off the farm into local streams and determine where it went from there. Measuring run-off of fertilizers is easy enough to do with modern instruments. Depending on the layout of the cultivated land, it might be necessary to channel the run-off into a receptor to get reliable measurements. Obviously, using both food chain analysis and chemical cycles needs to be undertaken by folk with the relevant expertise. Water and soil samples can be taken—under instructions—and sent to laboratories for analysis.

Indirect economic impacts of projects tend to find their way into most EIAs. This is due in part to the convention of using economic input-output analysis. This is useful in identifying industries or sectors of the local, regional or national economies which are connected in some way to the project. These include industries involved in supplying goods and services, say, locally produced cement and the services of plumbers and electricians. There is the flow the other way, to local, regional and national customers of the product/s or service/s provided by the project. However, one needs to be aware of the problems with economic input-output analysis. A fundamental one is double counting in the generation of *output* impacts. The technique is more reliable when it comes to employment and income impacts. If the input-output technique is to be used, it should be confined to estimating flow-on employment; but the veracity of the employment multipliers should be tested by reference to data gathered from local industries. Too many unrealistic employment multipliers have been reported over the years. They artificially boost the employment benefit of projects—as was discussed in the previous chapter relating the story of the Adani coal mine project.

The utilization of economic input-output analysis is made much easier if recently derived regional and national transactions tables are available. One has to be lucky to be in that position, as the effort involved in putting together a transactions table is far from trivial and hence it is done infrequently. In the period of rapid technological change, these tables are soon out of date. My scrutiny, undertaken over many decades, of a large number of EIAs suggests that there are inconsistencies in the application of input-output studies used in EIAs. The evidence is obvious when there are large differences reported for *multipliers* for similar projects. If input-output analysis is applied in an EIA, it should be undertaken by an expert in that field of economics. It is too easy to arrive at employment multipliers which in the real world are plainly wrong. This can lead to unnecessary disputes. I shall have more to say on economic impacts in due course.

Taking into Account Cumulative Impacts

Assessing cumulative impacts is not attempted in most countries. As we have noted, project-by-project assessment is the norm—even if two or more like projects are scheduled for the same location. In New Zealand, where EIA is subsumed under land use and resource planning, a cumulative impact assessment should be the standard procedure. In 2019, Bryan Jenkins undertook a review with a particular focus on water allocation and water quality. The title of his journal article ("Challenges in Cumulative Impact Assessment: Case Studies from Canterbury, New Zealand") suggests that the concept is not without practical difficulties. In the UK, Lourdes Cooper and William Sheate undertook a study titled *Cumulative effects assessments: A review of UK environmental statements.* They concluded that cumulative effects *were far from thoroughly addressed.* Cumulative impact assessment has been on the books in Canada since 1995 and was firmly established in the *Canadian Environmental Assessment*

Act of 2012. This does not mean that it is undertaken in all cases where it is warranted.

Cumulative impacts are defined as the overall environmental impact of *past, present and reasonably foreseeable* projects affecting the same general ecosystem. The projects are likely to be similar, but they do not have to be. Typical cases will include a number of large tourist resorts, as on Australia's Gold Coast; a number of large coal mines, as is common in most coal-bearing basins around the world; and a localized spread of similar agricultural pursuits, such as dairy farms in the Waikato Region in New Zealand. The idea is that individually a project could have only minor impacts which could be mitigated or offset, but as more and more like projects are developed, the combination of effects could be substantial. If a variety of pollutants are involved, there could be synergistic impacts—where the overall damage by the new pollutant is greater than the sum of the parts.

The development of the City of the Gold Coast is a prime example of cumulative impacts. When the first high-rise tourist resort, of six stories (Lennons Broadbeach), was built in 1956, there was virtually no impact on the local pristine natural environment. But that was about to change. The area's beauty and excellent surf, plus an exciting ambiance (for the era), made for interesting stories taken back home by Second World War US servicemen who had visited for rest and recreation. It is no wonder that numerous specific locations in the city were given names familiar to Americans, such as Florida Keys and Miami Waters. At the time the first high rise was built, there would not have been an expectation that massive high-rise apartments and hotels would sit precariously on the Pacific Ocean foreshore. As a mental exercise, assume that EIAs were being undertaken back in that distant era, at what stage would a cumulative impact assessment been called for? When would city planners, giving permission for one-after-the-other major tourism projects, think we better consider the cumulative impact of what we are sanctioning? There is no easy answer to this question. What would the impact assessors have been looking for, the ever-increasing loss of natural habitat, the loss of fore-dunes and the role they play in coastal zone dynamics, the dramatic change of village and rural communities? The vast tourism income? The enjoyment many obtain from a Gold Coast vacation? How difficult is cumulative impact assessment—particularly in a dynamic economy!

Eventually, some did take notice of the transformation of the City of Gold Coast. What the *over-development* of that tourism city did was alert town planners responsible for oversight of the comparable and competitor tourism location, the City of the Sunshine Coast. This city is about the same distance from the Queensland capital of Brisbane as the City of the Gold Coast is, but in the northern direction. The town planners and local government politicians took an SEA approach when deciding on the future of the City of the Sunshine Coast. They might not have called it SEA, but in essence it was. While not quite a *tale of two cities,* distinct are they; for example, most of the Sunshine Coast's beach fore-dunes have been left untouched, massive high-rise hotels and apartments do not block the afternoon sun for beachgoers (as they do on the Gold Coast), and the pace of life is much more relaxed. The point is that one can learn from the experience of others. Is that a cumulative impact?

Not all situations where cumulative impacts are important are as complex as that of the City of the Gold Coast. Mining projects are others where a number tend to be concentrated in a specific locality, for the simple reason that the ore body or oil deposit is underground at that location. We can expect a number of mining firms to be involved in exploiting a large coal basin, a gas field or a tar sands deposit. I refer to the earlier discussion of coal mining in the Galilee Basin, the region of the approved Adani mine, where numerous other mines are on the drawing board. This is a classic case where cumulative impact assessment should have been mandatory. There are many similar cases around the world.

In the case of the Galilee Basin coal deposit, an SEA would not have been an overly difficult environmental exercise, except with regard to the water aquifers in the area. The key foci of an SEA would be the following: the loss of grazing land, at least for the duration of mining; the very significant demand for water at the mine sites, at the expense of the graziers; and, the loss of biodiversity due to habitat destruction. From an economic perspective, the question would settle on demand and supply for coal, relying, unfortunately, on a smudged crystal ball to look forward as the renewables encroached on coal's territory. However, given what we know about the rather rapid uptake of alternative electricity sources, our crystal ball is providing us a far clearer view of the future than the one Kodak was relying on before its bankruptcy in 2011—who would have thought that a hand-held phone would replace a camera! Furthermore, in undertaking an SEA, serious consideration would have to be given to the potential drop in price of coal if a number of these very large mines came online at the same time. As the amount of royalties and corporate taxes, and hence benefit to the nation, depends on the price of coal, serious modeling of global coal demand and supply would have been required.

In regard to the cumulative impact of multiple coal mines in the Galilee Basin, I have not forgotten the potential loss of much habitat for the small bird, the black-throated finch, of which much has been made, and yet is to be resolved. Readers who are aware of the proposed Adani coal mine are likely to know that it is endangering bird life in the Galilee Basin. Birds will lose habitat with mining and the only possibility of saving a viable population would be to allow it to move to adjacent land of similar habitat. One might presume all the available offset land for this bird would be lost if all the mines were approved and commenced operating. It is possible that we will not face this dilemma. We are still in doubt that the Adani mine will go ahead, and the prospect of any others in this basin becoming operational must be very doubtful.

Turn attention to an unresolved issue with cumulative impact assessment. Who would commission and pay for a cumulative environmental impact assessment? This is the very question asked about the payment for undertaking SEA. How likely is it that a particular proponent, especially the first in an area, would have an incentive to pay for an SEA, or have potential cumulative impacts assessed? In the case we are using as an illustration, the Adani firm would not be interested in a cumulative impact assessment except in terms of the economic consequences of the other mines opening up. This leads me to suggest that cumulative impact assessment should be undertaken for governments as a type of land-use planning exercise, in other words, an SEA. One method of undertaking an SEA would be to establish a one-off Commission of Inquiry with specific terms of reference to investigate and determine the optimum level of activity in an area—whether it be mining or tourism development, to nominate the industries we have been using for illustrative purpose. This has been done occasionally in a number of countries, including Canada, New Zealand and Australia, but in the case of the latter, that was many decades ago. This approach is common in New Zealand.

Regardless of the lack of appetite for cumulative impact assessment, the concept is in need of an agreed methodology—this is likely to explain, in part, the reticence to apply the concept. In arguing this, I realize that there is a significant literature on the subject and some published guidelines. Yet, they do not go to the fundamentals. The first challenge is to define what *reasonably foreseeable* means. One could assert that recognizing what is reasonably feasible, and likely to be adopted, cannot be that hard—if we neglect unexpected technological advances. It is not easy to forget Kodak's kaput moment. It was not only photography that was revolutionized by the information and communication (digital) economy as it made redundant office machines and the typing pool. Then we learned at the end of 2019 that the world of viruses is tremendously powerful, as a deadly zoonotic pandemic had killed 3,359,476 people worldwide by May 17, 2021, and closed national economies. How foreseeable was that! Pandemics aside, Schumpeter's *creative destruction* is a product of human ingenuity, yet not foreseeable. The classic cases in recent history are air travel, steam power and railways, and even farther back, the factory system.

A fact that needs to be recognized is that modern governments do undertake a form of SEA—not called that—as well as having an understanding of cumulative impacts when it comes to planning for government-built or managed infrastructure. Unless their ideological bent is completely laissez-faire—and none comes to mind as being this blasé—governments have the ability and, generally, willingness to come to judgments about future societal needs. At a mundane level, governments have to look quite some distance into the future when planning new road works, rail lines, ports, water storages, power supplies, hospitals and schools. As noted previously, one mined resource which is taken into account in government planning is quarry material. Governments are wise enough to quarantine sources required for expected future road works. Simple economic sense. There is no evidence of gross failure in regard to planning for societal infrastructure in the so-called *mixed economies*; that is where a combination of private enterprise mixes with government planning. Government decisions on where and when to build certain types of infrastructure have a very significant influence on what investors and entrepreneurs, as well as small-business owners, will do. In other words, governments play a major role in *making* the future—and thereby have some notion of cumulative impacts. It is not that larger step to have cumulative impacts in mind when the next proponent seeks approval for another mine in a defined region, another tourism resort in a highly prized environment, another cotton farm in a river basin, another smoke-emitting factory in an industrial center and so on.

Cumulative impact assessment is so interesting and challenging that I cannot let it go without introducing another twist. We must not simply look for negative cumulative impacts, such as localized air pollution from clusters of factories. Positive outcomes can emanate from cumulative effects. The development of a concentration of similar businesses is likely to result in economies of scale and, possibly, scope. These features benefit consumers through reduced prices and wider choices. The development of cities out of villages allowed for the introduction of a range of amenities and facilitated cultural and recreational opportunities for their residents. These are the type of things that are only economically viable with large concentrations of businesses and the populations dependent on them. They are a form of positive cumulative impacts. One will search without success to find this type of analysis in EIAs.

Let us consider a pro-environment project designed to have cumulative impacts. I have mentioned this previously, but here I shall expand the story. Many years ago, I was involved in conservation farming in the highlands of northern Thailand, around Chang Mai and Chang Rai. The project aimed to convince slash-and-burn tribal farmers to plant grass strips between horizontal rows of rain-fed rice. These farmers did not practice terrace farming. The grass rows would catch run-off and thereby reduce on-site soil erosion and, consequently, increase yields, as well as diminishing off-site environmental problems. The project team leader, Mark Hoey, with assistance from Thai government personnel, convinced a sizable group of these farmers to change their slash-and-burn farming to conservation practices.

I was impressed and came away from the Thai highlands convinced that a cumulative impact would do much to save the forests in northern Thailand, while improving the farmers' crop yields. I firmly believed that a demonstration effect would follow the success of the few pioneering farmers who had been encouraged to change their practices. To achieve the desired outcome was going to require Thai government agricultural extension officers to spend considerable effort explaining the benefits to the hill tribe communities. When all the hill tribe farmers had converted to conservation farming, the cumulative impact would have done its job. I am sad to report that notwithstanding this optimistic prediction, the project failed, as I noted previously, due to the reticence of the government officials to spend time with the tribal people. The hill tribe people were looked down upon, and not given the assistance they deserved. There can be, particularly, in developing countries, factors which escape the analyst's thinking. I learned from that experience, more so than from any textbook, that it is essential to gain a sound understanding of human psychology and behavior, including *in-group* and *out-group* relationships and tensions.

In Conclusion

We have now completed our discussion of the issues to be dealt with in an EIA. It is a fair comment that some—it could be argued that most—are given less than sufficient attention in practice. Proponents do not have the incentive to address alternatives to their preferred project. Therefore, why pay a consultant to do that! Furthermore, proponents have little reason to pay for a cumulative impact study. In fact, it is only via an SEA that cumulative impacts can be understood and, potentially, managed. And this means we have to look to governments and the environmental profession to take the lead, and the former to, in the first instance, meet the cost.

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Ethical Dilemmas in EIA

Introduction

I have devoted an earlier chapter to the matter of incorporating sustainable development principles in EIA; however, there were issues that were only skimmed and some very important ones not dealt with. Now that considerable material has been canvassed, it is an appropriate place to build on the previous discussion. We have noted that in October 1987, *Our Common Future*, otherwise known as the Brundtland Report after the chair of the United Nations Commission on the Environment and Development, was released. The Commission was established in 1983 and spent the next four years gathering evidence from around the world and reflecting on the global problems of environmental degradation and lack of development in the poor and very poor nations. The Commission's solution was sustainable development. Note, that Australians came to call it *ecologically sustainable development (ESD)*—for the purpose of underlining the fundamental truth that unless the planet's ecosystems are protected there can be no improvement for the poor, or anyone else. In theory, if not in practice, sustainable development was adopted around the world.

T. Hundloe, *Environmental Impact Assessment*, Palgrave Studies in Environmental Policy and Regulation, https://doi.org/10.1007/978-3-030-80942-3_11

I shall focus on two ethical issues. One is the diabolical dilemma of achieving intergenerational equity in an uncertain future world. The other intra-generational equity, in terms of who today are responsible for carbon dioxide emissions? We have good evidence that climate change will make many humans worse off in the future. This is not to be doubted, although some might benefit. However, to be able to explore the ethical issue pertaining to fairness across generations, it is necessary to imagine a hypothetical world without human-caused climate change. This is because other factors influence the state of the world.

Here is the hypothetical situation, what if there is a continuation of accelerated innovation as we have experienced in the recent past (the period could be 100 years, 50 years or the past 10 years)? At least, in the industrialized world, enormous material progress has resulted. I shall deal with that before coming to the far less satisfactory rate of progress on matters social. With regard to intergenerational equity, how do we take into account the contributions past generations have made to improve the well-being of the present generation? In seeking intergenerational equity, is this possible?

Achieving Parity Between Generations

If we are to work to ensure that future generations are to be no worse off than the present generation, certain things follow. We will need to take into account realistic expectations of technological advances which, all other things being equal, will make the average future person better off—at least, materially. In this situation, intergenerational fairness means that we of the present generation need not forego benefits for the future generations, as they will benefit from technological, scientific and, hopefully, social advancement. The latter is not as likely as scientific and technological advancement, because we struggle with agreeing on how to advance humanist principles. Some reject the humanist advances made on Enlightenment principles and want to take us back to a far less civil past, the most radical of them would return us to a barbaric world. It is not all regress as others are seeking to improve the position of those who are marginalized.

In the literature on sustainable development, the very likely prospect of progress and how it should influence our actions today is downplayed.

This is due to the concentration on a less well-off future—there tends to be pessimism. This suggests we believe that we have reached a dead end with material progress. This is understandable once we introduce climate change, over-population and a global spread of environmental refugees. But, for our hypothetical discussion we are putting pessimism aside.

Will the Future Reflect the Past Material Progress?

We need to ask and attempt to answer, what are our realistic expectations about the future? The Enlightenment thinkers and the nineteenth-century intellectual giants who followed, such as John Stuart Mill, Charles Darwin, Karl Marx and Friedrich Engels, had supreme belief in human progress, although Mill, Marx and Engels would say it needed a helping hand. The general idea of evolutionary change came from Darwin in his study of nature. Of course, nature has no interest, so to speak, in the future of any particular species. Yet, we humans came to view our evolution as positive; that is, we would progress—whatever that is taken to mean.

More so than any other eminent thinkers, Marx and Engels attempted to build a theory of economic progress. It was as if history had a purpose. They were much more scientific in their analysis than that summary suggests. They could draw on the progress made through historical stages to illustrate their theory—from ancient primitive communism, to feudalism, to capitalism. Given that when they wrote capitalism was still developing, their historical story had to stop at that stage. They made predictions on the basis of something akin to a law, that of *dialectical (historical) materialism*: from the capitalism they knew first-hand to socialism, moving on to climax in a communist utopia of superabundance of material goods, where work was purely for pleasure and there was no need for annoying government. At last, we were to be free. Who knows! By the way, this utopia was to be delivered by capitalism, and only when it ran out of steam; or, in Marxist terms, when it faced contradictions which could only be resolved by its demise. Do not bother to think of utopia until we have eliminated poverty across the world. Given the vast number of poor and desperately poor in the world, we have much material progress to be pursued before we need to contemplate the pleasures and—I would guess—challenges of living in a utopia. That stated, we need to recognize we are making substantial material progress, particularly in the industrialized countries, and, most importantly, in the rapidly industrializing ones such as China. Undoubtedly, we are able to produce increasing amounts of goods and services with less, relying on automation and non-human energy. All we need is renewable energy, a limited population of humans and an economic system which is based on an acceptable level of fairness! Never be afraid to ask, I say.

What About Social Progress?

In terms of material progress, the scholars I mentioned were certainly right in terms of forecasting the economic advancement we humans have made to date. And to go out on a limb, we should not ignore the evidence of social progress. Some argue the two go hand in hand. Allow me to use Australia as an example. Compare the Australian life of both the First Australians and the British convicts of the late eighteenth/early nineteenth centuries, to modern Australian lifestyles. David Hill's 2019 book *Convict Colony* is an excellent, authoritative account of that sad early period. There are numerous other books paying particular attention to the awful ill-treatment of indigenous Australians and the cruelty to convicts. However, we have progressed from atrocious barbarity to something much better. This does not mean that there are not pockets of serious disadvantage, where Australian governments and a variety of organizations flounder around seemingly not knowing what to do, or if they believe they do, no one else does and progress is slow. Two countries which Australians compare themselves to have done considerably better. New Zealand has a different history to Australia in relation to its ethnic division, having done remarkably well with the Treaty of Waitangi. Canada also has benefitted from having treaties with its indigenous people; and in giving special recognition as a separate cultural group to the mixed-ethnic Metis, a far better designation than being torn between two cultures, and induced to accept one over the other, as blended ethnicities can be in required to do in Australia.

Notwithstanding different degrees of social progress—or lack of progress—human social advancement has proven to be possible. Given that I am writing this book after the killing of African American George Floyd on May 25, 2020, I am obliged to temper my belief that there has been significant meaningful social progress. However, it is necessary to recognize that the situation in the USA is very different from that in the other industrialized democracies. One can state this without contradiction, while recognizing that pockets of racism and ethnic divisions remain in many countries. There is considerable variation, with special Sami parliaments in the Nordic countries, while the Basques fight for rights in their part of Spain. There is much more—mainly ignored by the Western media—racism and ethnic conflict in the developing and poor countries than realized. One of the best-known examples is the Indonesian invasion, colonization and asserted genocide in Irian Jaya. These are strong words but are the ones used by the Irian Jaya resistance, and supported by numerous commentators with in-depth knowledge of the history of Western Papua/New Guinea. With this ever so brief digression on human material and social progress completed, I shall revert to discuss fairness across generations.

What Is Fair Across Generations?

If we expect that we will continue to make material progress in future years, this leads to an ethical dilemma in terms of intergenerational equity. Stop for a moment and reflect on how hard our parents and grandparents worked so that we could be better off than they were. Undoubtedly, we are. We have no way of repaying them—unless they are still alive. Intergenerational equity is not easy to arrange if the obligation is to a past generation. If the present generation's circumstance resembles that of our parents and grandparents, should we work hard and deny ourselves leisure and pleasure so that our children and their children benefit not only from our legacy but also through the inevitable gains of material progress? If this is how it plays out, future generations will be considerably better off than we are. One could argue that this is unfair on us—it is not intergenerational equity.

Our offspring, not being able to put themselves in our place, do not appreciate the sacrifices made for them and, how work was harder a generation or two ago. Try explaining to a ten-year-old what it is like to help out in the dairy farm before and after school. Helping-out is likely to mean stripping the last milk out of a cow's udder and washing down the bales smattered by cow poo. Attempt to explain to a 14-year-old what it was like at that age to work 9 to 5 in a factory, a garage, a shop, a building site, or 7.30 a.m. to 5.30 p.m. in a shearing shed rather than be in school. Obviously, I am referring to life in the rich industrialized countries—and to situations I need not draw from imagination.

What I have been discussing is one possible scenario. The other is, given what we expect from our present scientific modeling, the converse. Our children and grandchildren will be worse off as a consequence of our lifestyles. What we are doing today will have an adverse impact on their material well-being. I am, of course, thinking of climate change. In this case, the problem—and solution—is ours. This does not mean that the intergenerational dilemma discussed above should not be a serious consideration. It is one that does not go away. Hopefully, when we resolve the climate change challenge, we can return to it.

The Climate Change Dilemmas

Our present knowledge of likely adverse impacts of climate change is on a very broad scale, and this is a problem when we are forced to consider specific geographical areas of the planet—for example, some will be hotter and less productive, some will be hotter and more productive, at least, to grow food. However, our present assessment is that there will be much more damage than benefit. Low-lying cities and even nation-states will be flooded; more extreme weather events will cause damage to housing and industries in all geographical regions; disease vectors will spread in line with changing climates. If the project we are assessing adds greenhouse gases to the atmosphere, in the long term it will have a marginal impact on the flooding of coral atolls, as melting ice in the Canadian and New Zealand fjords raise sea levels.

Without precise knowledge of the impacts of climate change—the where, when and how much damage—we are forced to make best-estimate predictions, and act on these. Obviously, if there are *no-regret* actions, we would be foolish not to pursue them. Installing solar, wind and pumped hydro-electricity are the stand-out no regrets. These sources provide the cheapest possible electricity—and it never runs out. However, with some notable exceptions, this option is not pursued with the urgency required. I refer to urgency for the simple reason that it is a slow process to turn a very big ship around, and the world is a big ship with a big appetite at present for carbon dioxide-emitting fuel. The available no-regret options are not going to save us from the impacts of climate change, yet they must be considered, where appropriate, in EIAs. If we are certain that future generations are going to be worse off, it is not an option to simply rely on no-regret options. We are obliged to do more, whatever we can, using our scientific knowledge to reverse the ongoing buildup of greenhouse gases. All things considered, the intergenerational fairness principle implies that the project which we are assessing has to be, at the very least, carbon neutral. We would prefer it to offset some of the present emissions. How carbon-neutrality is achieved is a matter to be discussed in each relevant EIA. The possibilities are determined by the nature of the project. If design features cannot do the job, and if the project goes ahead, we are left with finding a reliable way to offset the carbon emissions. A future section of this book is devoted to environmental offsets. They are becoming a key instrument in EIA, and need more attention by environmental scientists.

Intra-generational Equity: the *Scope 3* Matter

Let us turn our attention to a crucial—unresolved—matter in assessing climate change impacts. It is the intra-generational issue of who is responsible and, consequently, be required to offset greenhouse gas emissions. Here we are dealing with philosophical and pragmatic difficulties to be resolved when the product of a project in country *A* is exported to country *B,* where the use of that product releases greenhouse gases. The most-easy-to-comprehend example is when coal is exported and burned in the importing country. This issue raises the controversy over what are called *Scope 3* emissions.

On this matter, OECD countries can call on the polluter-pays-principle, which is based on a fundamental principle of neo-classical economics—which is that the *consumer is sovereign*. This we discussed previously; however, to reiterate, consider the following explanation. A coal miner will only produce coal if there is demand for it. And it is those who buy what is produced by burning the coal, electricity, who are the sovereign consumers. Without their purchases of electricity, coal would not be mined for that purpose. One cannot rationally argue against this. Electricity is something all people on the planet are very keen to have, and the better-off people have the ability to pay and get it. Applying the polluter-pays-principle, all of us who use electricity produced by burning coal or natural gas are the polluters.

The polluter is the person who turns on the television set, the air-conditioner, the stove, the lights, the personal computer and any other electrical appliance. Of course, not only are householders in need of electricity, office buildings burn lights day and night, and business computers are in constant use. Manufacturing industries use large amounts of electricity and so does farming, if less intensively. The point being, there are many and various users and all are adding to the load of carbon dioxide in the atmosphere.

On a global scale, Scope 3 emissions tend to be treated under the consumer sovereignty principle. There are exceptions, not necessarily by government decision-makers but by judges of environmental tribunals and courts. It is worth pointing out that the polluter-pays-principle need not stop a government from adopting the view that the producer, for example, a coal miner who exports coal, should not be debited with the greenhouse gas emissions. The idea behind this is that it is much easier to levy a greenhouse gas tax on a few large electricity producers than on millions of consumers of electricity. An environmental practitioner is in the hands of the specific law that pertains to Scope 3 emissions, and the law varies globally—and even within federal nations. However, this does not mean the issue can be neglected in an EIA. At the very least, there needs to be a statement justifying the approach taken to Scope 3 emissions.

It is interesting to note that we are faced with inconsistencies in public policy with climate change emissions treated differently on consumer sovereignty grounds to other sectors of the economy. No wonder governments are challenged to come to a principled decision. Here is an example. In various jurisdictions, the sex industry is a case, governments make a criminal out of the provider of the service, the prostitute, while neglecting the customer. If this is applied to coal mining, the coal miners would be guilty of increasing greenhouse gases, not the overseas user of electricity generated by coal.

Governments are not consistent in determing who to target. In the Scandinavian countries, if anyone is to break the law on prostitution it is the customer, the consumer sovereignty principle applies. The rationale is to change the behavior of consumers. A particular application of the Scope 3 principle has the same objective—to put the cost of the pollution externality on the final consumer and, thereby, to provide the incentive for the consumer to seek out an alternative, such as a renewable, non-polluting electricity source. This would work if there was a carbon tax on electricity use. Here is another example where there is inconsistency. Drug consumers get off lightly in some countries but not in others. This puts drug dealing and use in the same category of prostitution. However, it seems preferable to be a *corporate high-flyer* using expensive illegal drugs than a dealer. The firing squad or gallows await minor-league suppliers, if apprehended in one of the world's remaining brutal societies.

What to do about Scope 3? An EIA practitioner is required to take notice of the best available scientific evidence—this from the IPPC—in dealing with the possible and, most importantly, probable impacts of climate change. In virtually all cases, the impact of the project under investigation will have no more than a marginal impact. However, the environmental practitioner will be asked by opponents of the project to address *the straw that broke the camel's back* argument; in other words, the concept that we are at a tipping point, and the project under consideration tips the scales. This tipping point argument is the most difficult—some would say, with considerable justification, an impossible—task to put on an environmental practitioner. There can be so many counterfactuals in play; claim and counter-claim, rebuttal of rebuttals, and the practitioner is left none the wiser. Here is a case for the *precautionary principle* to be applied—in other words, be risk-averse. In coal mining proposals in

Australia, opponents make much of the threats to the health of the Great Barrier Reef. Any realistic threat to this, the world's largest coral reef ecosystem, which viewed underwater is truly magnificent, must be taken seriously. While protecting biodiversity is first and foremost the reason for risk aversion, there is the secondary matter of the *Reef*, as Australians call it, earning foreign exchange due its appeal to tourists. Given that an exporting nation of coal cannot impose a *carbon* tax on consumers of electricity in a foreign country, should the responsibility fall on the exporting country?

In Conclusion

As we have noted previously, intra-generational equity requires us to favor the poor. For example, if poverty-stricken, slum-dwellers are to obtain electricity from a coal-fired electricity producer using imported coal, the cost of the climate change should not be borne by them; possibly borne by the coal-exporting country, otherwise the electricity generator in the poor country should be charged a greenhouse gas tax, but not allowed to pass it on to the consumers. The former situation is the more likely case, but the question becomes on what principle do we get a coal miner to subsidize poor electricity users in a foreign country? How do we get the coal miner to meet this de facto carbon tax; will there need to be offsetting projects in the exporting country? For this there are possibilities, one of which would be very large-scale reforestation projects. This would be a significant additional cost to the miner, possibly compensated by taxpayers. Should this be regarded as foreign aid?

With regard to intergenerational equity in the context of adverse impacts from climate change, the principle is simple. The present generation takes whatever action is required to limit the increase in greenhouse gases to the degree that future generations are no worse off. Obviously, there are major practical challenges involved, but on a project-by-project basis, this should not be too difficult. A proponent needs to be able to explain in the EIA for his or her project how any increase in greenhouse gases will be offset.

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Public Involvement

Introduction

The importance of public involvement in the EIA process cannot be overempathized. In combination with the examination and quantification of the previously neglected adverse impacts on the natural world, not to overlook the social world, bringing the public into the process is the determining feature of EIA. Public involvement should be a two-way flow of information and ideas. The end result should be a project that is based on the best data available and professional analysis, and if nothing else have the interested public understand why the project is needed—assuming that is the case.

The then Australian Environment Minister, Dr. Moss Cass, emphasized in his 1974 parliamentary speech introducing EIA in Australia that providing information which was previously denied to the public is a fundamental purpose of EIA. Be mindful that Cass went on to say that the findings of an EIA would not necessarily stop a project going ahead, but if it does go ahead, the public will know why. That signaled that an EIS/EIA is not to be a public relations document promoting the project—far from that. Sadly, some verge on being this when the topic turns to job creation and other asserted local economic benefits.

T. Hundloe, *Environmental Impact Assessment*, Palgrave Studies in Environmental Policy and Regulation, https://doi.org/10.1007/978-3-030-80942-3_12

Notwithstanding the enticement of politicians, such as Moss Cass—and the groundbreaking principles in NEPA—there is evidence that the busy citizen gets to pay little attention to published draft and final EIAs. There are two reasons for this. First, there is a general lack of awareness that the EIA process is underway, and few of the public know that draft and final assessments have been published. This is due to the fact that the media takes little notice. Governments will advertise that, say, a draft EIA is available for comment, but it seems no journalists will read it looking for a story. I can guarantee there is a story in virtually all EIAs. The media is very keen on publishing environmental conflicts but somewhat *dry* science—unless hotly contested—is not deemed newsworthy. The second reason for a lack of involvement is the enormous size of the published assessments. In this case the failure is systemic—more below.

Relying on the Proponent's Data

EIA consultants tend to rely on project proponents for data on two crucial matters, jobs to be created and procurement of materials needed for the development. The history shows that the proponent's data can be erroneous, too often exaggerated numbers. This will result in overstating the benefits if a proponent seeks to *boost the project* or *spin* a story. The Adani coal mine case is a telling example of the proponent overstating the job creation case. The error was eventually corrected, but not before the overstated benefits became cemented in the public mind—a matter not helped by eminent politicians, including a prime minister, quoting the incorrect number of jobs—in fact, sixfold of the real number.

In the Adani case, unfortunately, neither the consultant nor the Commonwealth and Queensland government officials picked up the gross exaggeration. So important and serious was this flaw that some commentators publicly claimed that the 2019 federal election result was determined on the basis of a very large number of imaginary jobs foregone if the mine was not approved. The opposition political party was portrayed as being opposed to the mine—an incorrect assertion. One would expect the losing side of politics to be very cranky with a flawed EIA which seriously diminished its electoral chance. The prospect needs to be recognized that the next time a blatantly wrong analysis in an EIA could damage the other side of politics. This should be enough incentive to lead governments to demand improvement in the quality of EIAs.

How Much and What Means of Public Involvement?

In the industrialized countries, the preparation of an EIA and the reporting of findings in an EIS/EIA involves the public, with at least one chance of public comment being a non-negotiable feature. More than likely, there are two chances of public involvement, or even more if comment on the final EIA and judicial review occurs, making for four points for involvement. In some countries, New Zealand being one, a public hearing can be part of the process. How and when during the process of preparing and finalizing an EIS/EIA the public can be involved is established by the enabling law of the country in which the procedure applies. There is no uniformity across jurisdictions on this matter. That stated, there is a *best practice*, which is that the public is invited to comment on the draft *terms of reference*, and allowed—encouraged—to comment on the draft EIS/EIA. The result of this procedure should be the incorporation of beneficial suggestions in the final EIA.

Here, I need to digress to make a serious complaint. It goes to the notion of governments role in the EIA process, and, consequently, of public trust. During the writing of this book, I became aware of a government notice informing the public that the draft terms of reference for an EIS/EIA for a proposed mine in central Queensland were being made available for public comment. The project is formally called the Lake Vermont Meadowbrook Project. My complaint is that the draft terms of reference were presumably prepared by the mining company, not prepared by the government authority to which falls the task to oversee the EIA process and make the final decision on the project. It is not a question of the adequacy of the terms of reference. What is wrong is that it should not be the case that the proponent establishes and submits the terms of reference to a government agency. Writing the terms of reference is the government's job. Universal ones have existed for nearly half a century. Politicians are taken to referring to the *pub test*. You are having a few beers and yarning away, someone brings the following rhetorical question into the discussion:

> *Would you let a mining company write out the questions it wants the government to ask it?*

One of you is a schoolteacher:

> *What a good idea! I could have saved a lot time and effort and let my students write their exam paper. Not only that effort saved, but I would not have to assess their answers. How dumb am I not to have realised this before!*

Reverting to the earlier discussion of the various steps in the process, a final EIA is a public document, and at the time it is released, one expects the future of the project to be settled on the basis of the findings. However, this is not always the case. I have already identified a project, the Adani mine, which, initially, seemed completed and settled on the completion of the EIA process, but then was subjected to a court hearing. Subsequent to this prolonged, dual process, the mine was approved—conditionally—by both the Queensland State and Australian Commonwealth governments. However, as this book goes to publication, approaching a decade after the mine was first mooted, the project remains in limbo, on the matter of unresolved offsets for the endangered black-throated finch. If the digging starts and the birds are without a home, the digging stops. The EIA process was not supposed to be this drawn out and this messy. In fact, it was not intended to be messy at all. It was intended to improve public administration.

Public comment on an EIA is one thing, and having your views recognized and addressed is another. There must not be lip service paid to the public's involvement. To give meaning to public comments, it should be obligatory for the organization overseeing the process, and the persons preparing the EIA/EIS, to note in writing any important public comments, and follow up with a formal response. Interested parties need to be able to ascertain how, and to what extent, their input into the assessment has made a difference, if at all. If public involvement can be shown to have improved the final outcome, there will be considerable public satisfaction with the EIA process. If particular public comments and ideas are not deemed worth pursuing by the proponent and/or the government agency overseeing the process, the reasons need to be stated. The reasons have to be convincing—based on science and reliable data—if the participants are to respect the process.

Plain English and Brevity Are Best Practice

The framers of NEPA thought that an EIS/EIA would be a *concise* public document, while being both comprehensive and easy for the layperson to understand. EIA is described by the *Oxford Dictionary of Ecology* as follows:

> *An attempt to identify and predict the impact on the biogeophysical environment and human health and well-being of proposed industrial developments, projects, or legislation. EIA also aims to devise easily comprehended, universally applicable schemes for communicating the results of the assessment.*

This reads as a straightforward requirement. A major shortcoming of the presentation of assessments is a propensity to be unnecessarily encyclopedic and, hence, not easily comprehended. In 2020, the USA Council on Environmental Quality noted a problem it had become aware of over the years and commented that EIAs are not to be:

> *Encylopedic documents that include information that is irrelevant or inconsequential to the decision-making process.*

One hopes notice is taken, or if not, the Council uses its authority to get an improvement. Given the extraordinary length of most EIAs, the thought of reading and commenting on one can be daunting for the general public. Even professionals find it difficult to find time to scrutinize the bookcase-filling volumes of a pipeline or mining project assessment. One will find numerous examples of very large EIAs. In the early days of EIA, one could expect about 300 pages for, say, a pipeline project in Alaska. In a relatively short time, the EIA for a similar project would be 10-fold larger, and today about 30-fold bigger, in the order of 2.5 million words—the equivalent in reading time to one book a week over a period of one year. No wonder the public does not find time to be involved.

As there is normally a two-stage process—a draft EIS/EIA followed by a final EIS/EIA—the task is doubly daunting. Unnecessarily detailed reports must be discouraged. Usually there are a few—certainly not a long list—of very important matters to be resolved and these should have priority. Analysis and the seeking of solutions need to trump simple description of the environment to be impacted. The latter is, generally, the easy part of the task, often done as a *desk-study*, to the disappointment of consultant bird-identifiers keen on a paid period in the bush with binoculars.

One suspects that there are two reasons for an encyclopedic EIS/EIA. One is that those undertaking the assessment and preparing the report do not want to be found to have missed *the* rare bird. That is a reasonable attitude. That rare bird, particularly if discovered by someone other than the EIA team, will go to the overall credibility of the assessment, and could sink the project. The other reason that encyclopedic assessments are prepared is that consultants who undertake this work are paid by the hour—the more hours, the merrier, and there is nothing more satisfying than being paid to wander along scientifically determined transects counting animals and plants. It beats sitting in front of a computer.

Determining the scope and time needed for the essential investigations should be resolved when government authorities set the terms of reference. Of course, we should expect difficult issues to arise in the assessment phase, and their resolution should not be time constrained, within realistic limits. If a matter is extremely important and cannot be determined in a reasonable time—an example could be the handling of nuclear waste—it would be ethically and scientifically warranted to cease the assessment and negate the project before *analysis paralysis* sets in. History illustrates the seeming impossibility of finding acceptable solutions to the nuclear waste disposal problem. There arise—only very occasionally—other complex issues which continued to be analyzed without a resolution. Environmental practitioners know what these are and will willingly say *don't waste time on this matter, there is no acceptable solution at this point in time*.

Adequate and Reliable Data

If an EIA is to inform the lay reader, it is essential that an appropriate amount of information has to be in it, and much care has to be put into *framing* results and conclusions. It is very easy to unintentionally mislead and consequently stir public opinion. It is in no one's interest to do so. Below, I shall use an example of how public opinion can be altered by putting different levels of information to people. I have borrowed this example from Michael Blastland's 2019 book *The Hidden Half*. He described how an experiment was undertaken to test the influence on people's views by how the question was framed. The experiment is reported in Box 12.1.

It is important to recognize that some (many?) people interested in the subject matter of a particular EIA are likely to come to read it with predetermined views, some with ideological blinkers over their eyes. It is more than likely that some will be so entrenched in their opinions that much convincing is going to be required to change their views. Expect some will not change regardless of the information provided. This is a shame if the information is correct—as it should be. In regard to the willingness to change one's mind, I am reminded of the possible apocryphal response by John Maynard Keynes when asked what he does if presented with better information than he presently has.

> *When the facts change, I change my mind. What do you do … ? When my information changes, I change my conclusions. What do you do … ? When someone persuades me that I am wrong, I change my mind. What do you do?*

One must be realistic—some people are not to be persuaded, regardless of the veracity of the information presented. There are enough examples of unchanging beliefs—one being rejection of the very old age of the Earth—to warn us that for some people scientific data does not cut it. This is not for the environmental practitioner to resolve, other than pointing out that very serious mistakes are likely if scientific evidence is *pooh-poohed.* Medical practitioners are faced with a similar problem with anti-vaccination attitudes.

Box 12.1 How Framing Information Can Make a Big Difference

A group of people is selected and randomly divided into three groups. Each group is asked: *Do you think the UK tax system is fair?*

Group 1 is asked the question and provided with no information.

Fifty-one (51) percent say the system is *unfair because the rich pay too little tax.*

Group 2 is asked the same question but provided with the following true statistics:

The point at which income tax starts to be paid has increased in recent years. Four (4) out of 10 adults pay no income tax.

The income tax system is top-heavy. The top 10 percent of income taxpayers pay 60 percent of all income tax.

The answer. *Only 33 percent say the system is unfair because the rich pay too little.*

Group 3 is asked the same question but provided with these true statistics:

The richest 10 percent of income taxpayers earn more income than the entire bottom 50 percent.

Someone earning 45,000 pounds sterling faces the same income tax on an extra pound sterling as someone earning 145,000 pounds sterling.

The answer changes rather dramatically. The percentage who say the rich do not pay enough jumps to 72 percent.

In Conclusion

In conclusion, I highlight the essential overriding principle of EIA, which is that it involves the combination of ecological, economic and social impacts—noting that some of these impacts can be positive while others are negative. The concept of EIA is to take our understanding of how, and to what extent, our development projects (such as a dam) effect the *whole*—from this we get the phrases a *holistic approach* and a *holistic assessment.* It is not uncommon for EIA statutes to explicitly make reference to the three essential elements—ecological, economic and social. This is often done by defining *the environment* to include humans, their constructed environment and their social and cultural relationships.

This treatment of projects should make for very interesting reading, particularly so, if the reader has an interest in the project. Most projects subject to EIA are interesting and many controversial. The EIA process was developed so that the public was no longer denied a role—and a significant one—in determining whether or not a specific project should be approved; and, ultimately, by influencing the final decisions made on major, societal-changing projects, given a citizen's role in shaping the future.

13

The Baselines and Uncertainty

Introduction

Let us commence this chapter with a question: Will it rain tomorrow? We are likely to have a good idea based on modern meteorological methods. Let us make the question a wee bit more difficult to answer. When might we expect another well-known animal go the way of the dodo? No idea.

Here we are dealing with one of the basic measurement issues in EIA. The projects we are going to assess will change the environment for better or worse; or by offsetting negative impacts, leave it as it was before the project took place. This is where the concept of a baseline plays the key role. The change has to be from something existing. Only at a particular point in time is the baseline guaranteed to be static. In many cases we expect that the baseline to be changing *without* the project. This means that we have to start by understanding the trajectory of the pre-project environment. That is not a simple matter even if the cause and nature of the change can be predicted. It becomes a much more complicated matter if each of the components of the environment (natural, social and economic) we are assessing can change—in some cases

T. Hundloe, *Environmental Impact Assessment*, Palgrave Studies in Environmental Policy and Regulation, https://doi.org/10.1007/978-3-030-80942-3_13

dramatically—due to exogenous events, such as complete destruction by a tsunami. How does a practitioner deal with such matters?

We will start with a philosophical question pertaining to the natural world. It is one which dogs anyone who asks *what is* natural?

The Natural World Without People

We immediately face a definitional dilemma. It is simply this: Do we accept that what we as humans do to change the world is *natural*, because we, Homo sapiens, are of nature? Let us not delay ourselves with this question, rather adopt the conventional wisdom—even though it does not hold up to Darwinian principles—that for the purposes of EIA we humans are separate from nature and we act on the natural world, and it acts on us. We take this position because we have to make our task simple.

Some are tempted to formulate, in their own mind, a picture of the natural world before humans had a significant influence. Alfred Crosby in his excellent book *Ecological Imperialism*, published in 1986, makes a compelling case not to try to do that. All non-human animals experienced the colonization of their world by humans, as we spread out of Africa about 100,000 years ago. Long before that we had interactions with the other animals with which we shared the African environment. It is thought that humans and animals in Africa co-evolved over a very long period of time. This means, it is theorized, that they learned to live with each other, and neither humans nor their prey and predators as species were in threat of extinction. The situation changed when humans spread into parts of the planet which had never experienced human colonization—in these parts of the world extinctions occurred.

What would it mean to go back to a world of pre-human influence? I shall select Australia as an example because it is the country with the longest surviving indigenous culture in the world. We do not know with any certainty what Australia was like before the first indigenous people came, sometime between 40,000 and 50,000 years ago—possibly earlier, we are still learning about this distant past. We do know of some of the extinct animals because we discovered pre-historic bones in archaeological digs.

We debate the cause of their misfortune. Were humans responsible in some way or not? Two competing theories are postulated.

Most experts, including Tim Flannery, argue that the Australian megafauna, such as the giant kangaroo, the 3-tonne Diprotodon (a flightless bird), the giant wombat and the Varanus "Meglania" (a large goanna), were killed by indigenous people hunting, and in their use of fire. The extinction of the megafauna dates to the latter half of the Pleistocene Epoch, about 45,000–46,000 years ago, not long after the first humans arrived and as their numbers grew so did their demand for food. That was relatively easy to satisfy with such large prey available. The other theory suggests that climate change was responsible for the extinction of the largest animals. A similar debate prevails in North America, where the Woolly Mammoths, the Mastodons and Giant Sloths disappeared about 13,000 years ago. This is much later than in the Australian case; however, it is thought that the arrival of humans happened much later in time, about the time of the extinctions. The cause of the American extinction is generally considered hunting by the North American Clovis people. The opposing thesis puts the blame on climate change.

If hunting was the cause of extinction, and we desired to return the planet to its *natural, pre-human state*, this would require us to bring back the megafauna! No one countenances the impossible. The country where we have proof of human hunting leading to extinction is New Zealand. We know that the moa disappeared when Maori arrived about 700 to 800 years ago. Regardless of what humans do or don't do, there will be over time the loss of some animals through the process of evolution. There is no *rule* of evolution that means all living things will be living in the future, whether the near or distant future. In fact, evolution means, expect change. However, if the project we are assessing led to the loss of a much-revered species through habitat destruction or any other human impact, this would not be natural and would be a very serious impact. If this was likely to occur, it most probably would stop the project, unless new habitat was available and the animal could be successfully relocated. In fact, the loss of any animal due to a project would be a very serious matter—we are to be ever mindful that biological diversity is our guarantee for a future on the planet.

To go to the global scale, if through some reason completely beyond human activity a change in climate took place, as we know it has done in the past—the thaw after the ice age which separated Tasmania from mainland Australia—this would be a natural change. We would accept this as we would evolutionary change. But, if climate changed due to human actions—as it is doing today—this would be unnatural. We are entitled to call climate change occurring at the present *anthropocentric*, otherwise human-created, and hence have to deal with it in EIAs.

The Uncertain Occurrence of Natural Events

A challenge for environmental practitioners undertaking EIAs is deciding on how to account for natural occurrences capable of causing immense damage when the events are unpredictable. We might be able to assign rough probabilities to their occurrence, but that is no help in predicting when—the particular year—they will occur. Will a destructive event occur in the lifetime of the project we are assessing? To build or not build would be determined by that knowledge.

We automatically think of the recent earthquakes such as the one off Japan in 2011, which created the tsunami that led to 15,897 deaths and the destruction of the Fukushima nuclear reactor; the Indian Ocean earthquake of 2004, which destroyed the city of Banda Aceh on the Sumatran coast and cost 227,898 lives; Hurricane Katrina, which in 2005 caused 1833 deaths and enormous property damage to New Orleans and coastal Louisiana; and earthquakes in New Zealand, where the Christchurch one of 2011 killed 185 people. Imagine assigning the probability of any of these events occurring, if undertaking an EIA for, say, a coastal tourism resort, an urban development or a nuclear reactor!

While not of the intensity of damage caused by the natural events mentioned above, prolonged droughts, extensive floods and serious wildfires come to various parts of the world. Some states of the USA are prone to suffer any or all of these natural events on an annual basis, however expect surprises. Australia has been described by poet Dorothea Mackellar as a land *of droughts and flooding rains*. We could add in cyclones and wildfires. The Australian summer of 2019–2020 has been called the *Aggressive*

Summer due to the extensive wildfires which took 33 human lives, more than 3000 homes, burned 17 million hectares and on one estimate killed 1 billion animals (excluding an un-estimated number of insects).

How to account for natural disasters when they could impact the viability of a project is an important issue for an EIA practitioner. A large tourism resort on a coastal location is an example of a project where the probability of hurricanes (cyclones) and tsunamis would have to be taken into account. A major agricultural enterprise in a region subject to the occasional serve drought is another case where the probability of a disaster has to be accounted for in an EIA. Probabilities can be assigned, and the expected benefits of the project can be adjusted for the level of risk involved—surprises notwithstanding. Two consecutive one-in-a–hundred-years floods can be accounted for, but not a mid-ocean volcanic eruption comparable to the one in 2011 which flattened Fukushima. In some cases we live with the risk until forced to account for it by unexpected disasters.

Establishing the Project's Baseline State

Uncertain natural events render deciding on realistic baselines on which to base an EIA very difficult—yet a baseline has to be set if we are to assess what the result of a project will be. The EIA process can be described as the with and without situation. If the project is allowed to go ahead, what will be the impact on the natural, social and economic environments compared to the no action case? The *without* the project is the baseline. For practical purposes, the experts in the field have to work with the prevailing situation—the *without*. This does not mean disregarding serious but unpredictable events. They will need to be discussed in the EIA, but their possibility cannot delay an ecologist gathering data in the field. Predictable events, such as hurricanes and storm surges will be incorporated in the EIA when it comes to summing up of the benefits and costs of the project. This is done by applying a risk factor to the expected benefits and costs.

Consider a practical situation where changes in natural conditions pose a problem for an ecologist. If a fauna expert is in the field seeking to estimate the population of a species of bird which is likely to lose its habitat in the opening up of a large mine, and a major drought has existed for, say, five years, the bird count is likely to be at the lower end of its (fluctuating) range. Undertake the same count after three years of good rain and expect the number of birds recorded to be at the high end. One is not allowed years to complete an EIA. In this case, the ornithologist could be lucky and find that there have been recent bird counts in the area, and they cover a range of local climatic conditions. With this data, the *average* year is determined—assuming one is satisfied with working with averages. Another source of information for the ornithologist is to search the literature to ascertain if the same species has been studied elsewhere in reasonably similar environments. If so, transfer of the results is likely to produce an estimate to work with. There is little else one can do, unless the expert is confident that his or her work is being undertaken in a *normal* year.

What is true in counting bird numbers will be true with regard to recording the size of a flock of sheep or a herd of cattle. The carrying capacity of a drought-stricken grazing property will be far less than *normal*, and as a consequence, the value of the property will be much reduced. This means that if a mining company wanted to purchase the grazing property to get to the underground minerals, the cost would be a lot lower than it would be in a run of good grazing years. If the cost to the mining company is reduced, the economics of mining is improved and the flow-on of royalties and corporate taxes would be higher. This climate-induced advantage would be a distorted state of the mine's profitability. In many cases determining what the *average* would be, based on historical data, will suffice.

What else does a practitioner do given the real world is not in a steady state? The first obvious thing is to explain the natural conditions that prevailed during the period under which the EIA was prepared. The next task is to look for reliable data from earlier years when natural conditions were different. In the Australian situation—the one I know best—scientists working for the Bureau of Meteorology, CSIRO and in the universities will have valuable historical data. Other countries have their equivalent sources of reliable data. Even with background information gathered from research institutions, the environmental practitioner will be called on to use professional judgment in formulating a realistic-as-possible ecological baseline.

The Economic Baseline: A Case Study

I am relying on Australian experience to tell this part of the story; that is, I am taking advantage of a long life studying the Australian economy. That the data leads to an interesting and unambiguous result is another reason to use it. Australia is one of a few countries to have experienced dramatic changes in demand for its exports, the reason for a major upward trajectory in its general economic baseline. In contrast to the vast majority of national economies, Australia has had continual economic growth for 30 years.

We need to think of a general economy-wide baseline (the state of the nation's economy) as well as a baseline specific to the project being assessed (the economic condition of the particular industry or sector). In terms of the overall economy, the most important variable will be the terms of trade. The terms of trade will have considerable influence on the value of a nation's currency and, hence, the future of its export sales. This will be very important if the project being assessed is to produce products for export, such as minerals, ores, food products and fibers such as cotton and wool. If after consideration of the available data, an analyst comes to the opinion that the terms of trade are not stable, it will be necessary to come to a view of the likely situation throughout the life of the project. This is far from easy task. To what extent can the future terms of trade be gauged? On this matter, we can expect a project proponent to have been advised by his or her experts. It is in his or her interest to have a realistic view of the future. That noted, an environmental practitioner preparing an EIA for the project also has a professional responsibility in this case. This is certainly the case, if the benefits to the exporting nation are based on royalties, rents and taxes. It is incumbent on the EIA assessors to reach their own view.

For some projects the industry or sector baseline will be relatively easy to establish, others fraught with problematic uncertainty. As an example of a relatively easy case, let us use the example relied on previously, a new port in northern Australia. The port will be much closer to the Asian markets than any existing one. The need for the port is based on major expansion of horticulture, grazing and aquaculture in northern Australia. With what we know about the increasing demand in China, India and the rest of Asia for *clean-green* foods, the baseline conditions for this project could be drawn with some certainty.

Australia is a very efficient producer of agricultural goods. We produce enough to feed 60 million people, yet there are only 26 million Australians to feed. Once they are fed, the rest is exported. On this basis, the north Australian port makes sense. There will be more agricultural products to export. All being equal, Australia will remain a wealthy country selling food into the emerging Asian markets for the foreseeable future. The projected growth in demand from China is astronomical. The implications for Australia, as a *clean-green* producer in relatively close proximity to China—and not to overlook the other emerging Asian economies—should be obvious.

Not that many years ago, Australia's economic baseline would have looked very different. Not only has demand for agricultural products increased significantly, but the situation for iron ore is also similar, now exported in vast quantities. In the last decade, international tourism, a major industry for some decades, has been boosted by Chinese tourists. The inflow of foreign students, again dominated by Chinese, completes the big four foreign exchange-earners for Australia. One of these export industries is new, the foreign student market, while all have grown. Writing during the period of tightly controlled borders due to the coronavirus pandemic, both international tourists and foreign students are no longer coming, but one would expect this to turn around as vaccination becomes universal. Then, at some unpredictable date, another pandemic?

How did this dramatic increase in demand by the Chinese eventuate? Go back in time and note how we were blindsided about the economic takeoff in China. In 1978, who would have predicted a very large and growing Chinese middle class? I do not recall anyone doing so. The unpredictable happened in 1979. China had a new powerful leader of its Communist Party, and unexpectedly China was about to become a capitalist state, utilizing its vast but relatively cheap labor force working with ever-more sophisticated technology copied from the industrialized countries. At that time (1979) Australia as an exporting country was benefitting from its two-way trade with Japan, and from the economic growth of the four so-called *Asian Tigers*. Australia was selling its ores and minerals into these countries—not to overlook its seafood. Australia's exports paid for its Japanese cars, pick-ups (utilities) and off-road vehicles, and much more. The extraordinary economic growth of China took Australian exports and inexpensive imports to another level. I shall now make my point. Had we drawn an Australia-wide economic baseline in 1978, I venture to say its slope, while being upward, would be of a much lower gradient than it has become.

For forecasters, both politics and economics have an unfortunate habit of behaving erratically. Who predicted the collapse of the Soviet Union in 1991, or the so-called *global financial crisis* of 2007–2008? What of Donald Trump's election as US president in 2016? One might ask, who would have predicted through all the global turmoil, that Australia has denied global trends and had 30 years of economic growth? At this point in time, Australia is a genuinely lucky country. However, during the period in which I have been researching and writing this book, Australia's trade relationship with China has developed some—as of yet, minor—unfavorable twists and turns. The economic baseline might not be as stable and upward-sloping as we have come to expect. I should not neglect to mention that the present pandemic—the COVID-19 disease—could have far-reaching, long term effects on global trade. Who would want to prepare an EIA for a major tourism resort based on foreign visitors, or a new cruise ship terminal—anywhere in the world?

Whatever our EIA project is, the Australian economic baseline is upward-sloping—at the moment. There are possible and probable changes on the horizon which should suggest caution. To those I turn. Consider a project where the slope of the baseline is far more difficult to gauge than that for agricultural exports, the opening of coal mines based on exporting thermal coal for electricity generation. The story is different for coking coal used in making steel. If the baseline for demand for thermal coal was based on the past, it would be positive. As noted previously, Australia has been, and at present remains, the predominant player, at close to 30 percent of world export trade. Yet, the longer-term future is decidedly uncertain.

The future of coal exports depends on two related factors, global agreement on reducing greenhouse gases and the speed at which renewable energy sources are introduced. The only thing which would allow for a long-term future for coal is a breakthrough in carbon capture and storage. That aside, the baseline for an export coal project would commence with a relatively strong upward trajectory followed by a downward turn at some point in the future, the date of which is subject to guesswork. It will not be in the next few years, but the farther we look into the future, the greater is the likelihood of the end of thermal coal exports. Once the export of thermal coal ceases, all other things being equal, the Australian economy takes a hit. Yet, we might expect that not all other things will be equal.

What is the relevance of this discussion of the baseline other than to point to the difficulty of predicting the future? As an example, is it appropriate in preparing an EIA for a thermal coal mine, from which coal is to be exported, to assume an unchanged baseline for the next 60 years? This is not a hypothetical case. It is the case which was made in the EIA for the Adani coal mine.

If, in this discussion of economic baselines, you are wondering why I have not discussed employment, it is because it is more appropriately handled as a special type of economic-cum-social issue, what we label socio-economic. There is no necessary relationship between the size of a project, its financial cost and impact on the natural world, and the employment created. Some projects are highly capital intensive with few employees, such as modern mines, while others are highly labor intensive, such as tourism resorts and cruise ships. In the future, automation is guaranteed to reduce the need for workers in virtually all industries where human-to-human skills and interpersonal relationships are not essential. It would be unwise to assume that forever and a day the 40-hour working week will remain. The response to automation will have to be a shorter working week, and a radical change from work being the major source of income; that is, the distribution of what an economy produces will occur by a different—yet to be determined—means. Yes, I am writing about the rich countries. I wish I had a solution for workers throughout the world, particularly in the poor countries. The future of employment takes us from EIA to Technology Assessment, a tool which had a short life some decades ago. That is another book.

The Socio-economic Baseline: Employment and Related Issues

Projects can impact societies in a range of social (non-economic) ways. If notice is taken of project proponents and their political and media supporters, employment trumps everything else. Some argue that any jobs created should be allowed to outweigh all sorts of environmental damage. We do not want to see this case being made in an EIA. Clearly, employment is important, both at a national and a local level, although there is a tendency to focus on the local, particularly if rural communities are declining, in part due to the increasing capital intensity of agriculture. In what we term *FIFO* (fly-in-fly out) industries, some forms of mining are good examples, the national rather than the local employment situation is relevant as the workers can live anywhere as they fly-in and fly-out according to their roster.

To once again use Australia as an example, some projects attract significant numbers of foreign migrants and, if in large numbers on extended stays, a new town to cater for their housing and consumer needs can develop, and the workers will remain in Australia. A well-known case was the construction of the Snowy Hydro-Electricity Scheme, a hydroelectricity and agricultural irrigation project, not far from the Australian capital city, Canberra. On a world-scale this was a big project. It benefitted from applying the Tennessee Valley Authority model. It took 25 years to complete, from 1949 to 1974. Approximately 100,000 workers were involved, 70 percent migrants from 30 countries—and they stayed in Australia. Lives were lost (121 died) during the construction of 16 dams, seven power stations, one pumping station and 225 km of tunnels. Two new townships were formed, Cabramurra, the highest township in Australia and Khancoban, while the existing town of Cooma grew into a vibrant local community. One can but speculate on what it would have been like to be part of a team of environmental practitioners preparing an EIA for this project—I expect it would have been fascinating. I leave it to you to contemplate the issues and how they might have been resolved. Some believe that the project would not have been permitted, due to not meeting EIA criteria.

If the project being assessed is going to employ local workers as opposed to workers from far afield, including overseas, a number of factors are relevant. The point of commencement is the prevailing local unemployment rate. The definitions of unemployment warrant discussion. Economists do not focus on zero unemployment but rather the natural *rate of unemployment*. I need not go to detail here, but there are a few matters to understand. The first is that this rate can change over time. In industrialized countries it is higher than it was 50 years ago. Prior to the pandemic which commenced early in 2020, it was between 5 to 6 percent for Canada and Australia, about 5 percent for the UK, between 4 and 5 percent for the USA and just over 4 percent in New Zealand. The rate varies across nations and tends to be higher in rural areas. The point is that this unemployment rate is the best we can achieve in modern economies, not the accepted 2 to 3 percent of the past.

There are other features of the employment rate which we should note. Obviously, the number of people actively seeking work (the participation rate) effects the percentage of unemployed. If people who fail to find a job after many attempts give up searching, the participation rate declines and unemployment does not seem as bad. Then there is the very peculiar concept applied by the official statistical services in some countries, which is that one only has to work for one hour in a week to be defined as an employed person. Even though the number of workers in this category is low, it does bias the figures, and frustrates folk who believe that a more realistic yardstick should be used. As there are different definitional issues around the world when it comes to measuring employment, it is important to check the local practice. Finally, there are the youth unemployment rates, a matter of special concern, and these tend to be higher than the average in locations with a thin industrial base.

What one finds in most EIAs are fairly reliable estimates of local unemployment. These data can be sourced from government statistics which are generally of recent origin. These data help build a socio-economic baseline. If the project is to employ the local unemployed, this will show a pleasant change. However, this is not the full story in many situations. What is too often neglected in EIAs is comparison of the skills of the local unemployed to the skills required in the project being assessed. If the project is in a location with a small local population, it is highly likely that skilled workers will need to be recruited from elsewhere. Hence, there is no benefit to the local unemployed. This tends to be glossed over in practice, thereby distorting the local employment assessment. Regardless of where the workers come from, if the required workers are already in short supply, this is likely to bid up wages or have business leaders call for more migrants. In summary, an assessor has to be very careful in estimating the number of jobs likely to be created by a project. If any issue will be controversial, this will be.

If a careful analysis is undertaken, it is rare to find capital-intensive projects absorbing unemployed labor. Furthermore, there can be a significant difference in the number of workers required (with the required skills) at the construction phase and the operational phase of a project. In certain cases there will be more work in the construction phase, when building is taking place, than in the operational phase where automated machinery is doing the bulk of the work. This fact needs to be recognized before exaggerated claims are made about the employment to be created. Permanent employment is a good thing, while temporary employment can suggest good times, only to disappoint.

There is likely to be unfortunate local circumstances where employment is declining, and with a new large project any local employment gained is significant. Declining employment is likely to be the result of technological advancement. What those who do not take notice of labor productivity gains in agriculture and mining miss is the significant gains which have occurred due to automation. Folk will lament the fact that their rural town is dying, but not recognize this is because the industries on which the town is based need less workers. Consider the impact of internet banking, the near 100 percent decline in letter writing, the significant drop in newspaper sales and the common practice of doing much general business on a personal computer, and it is the folk in rural communities who are, partly at least, responsible for the decline of their towns.

The message is that an EIA practitioner should make the actual employment situation clear. It is far better that local communities understand that their baseline is changing, rather than living in the past. Whether the changes I have nominated mean a better or worse local community is a trade-off between productivity gains and broader social attributes of the *old-style* country towns—the latter possibly valued higher than the former.

Baselines are complicated things to draw—unless one assumes they are straight lines (steady state baselines).

The Special Case of Climate Change Baselines

We have a reasonable *business-as-usual* baseline showing the increase in greenhouse gases. At a global scale we see this climbing ever higher. We have a baseline drawn on the basis that we will at a global scale not go beyond an increase of 1.5 or 2 degrees Celsius increase in average temperature. This is a hypothetical, not actual, baseline drawn on the basis of actions being taken to stop the climb at that level. This graph keeps climbing until it reaches the imposed ceiling before leveling out and, again depending on the proposed actions, commencing to decline. We can show different scenarios. What we can graph at a global level is the cumulative effect of the greenhouse gas contribution of all countries. And while we can graph national emissions—and must do so—the buildup and the reduction in greenhouse gases is a global problem, and each country is at present doing its own thing.

We have three situations to consider. One is a project which itself has only a marginal impact on climate change, but it is likely to suffer adverse impacts in the future due to climate change. We could think of a coastal tourist development where the prospect of more intense storms, wave surges and tropical cyclones (hurricanes) are likely to cause damage to the development. These probabilities would be, or should be, a concern of the developer. If an EIA was required for such a project, it should reflect the risks associated with climate change. The matter of risk should be reflected in the terms of reference.

Situation two is a project which itself adds a significant amount to the carbon dioxide to the atmosphere. A coal-based power station is an example. It is impossible with our present level of knowledge to calculate the additional damage that thousands of tonnes of greenhouse gases will do. Only much large increases are modeled by the International Panel on Climate Change (IPCC). Its modeling deals with significant carbon dioxide additions which will increase the average global temperature by significant amounts, not the relatively small, or even minute, quantities one more power station would contribute. We face the *straw that broke the camel's back* debate—to which there is no answer without making assumptions, and these are difficult to agree on.

To again use the coal-bearing Galilee Basin to illustrate a point. It is estimated by the Australian organization known as the Climate Council that if *all* the coal in the basin was extracted and burned, there would be an extra 705 million tonnes of carbon dioxide emitted into the atmosphere each year, over the period that mining took place. This would equal a little more than doubling Australia's total annual carbon dioxide emissions, assuming that some of the Galilee Basin coal did not displace coal mined elsewhere in the country. On a global scale, doubling Australia's coal production would not make a measurable impact on the damage predicted to be done by global carbon dioxide emissions. This is *not* to argue that there would be no impact—any addition will have a cumulative adverse effect and the notion of *the straw that broke the camel's back* must always be kept in mind. However, we are focusing on an environmental practitioner making measurements, and wondering what his or her measures mean.

Yet that is not the end of the matter. Notwithstanding the difficulty in calculating incremental environmental damage from by emitting a little more carbon dioxide to the atmosphere, we can—should—be risk-averse. By measuring the increase in carbon dioxide from a project, we can point to the amount of greenhouse gas which would need to be offset on the basis that we aim to make the project greenhouse gas emission neutral. If each new project could offset its greenhouse gas emissions, that is something to aim for, if it could reduce the overall load that would be something to celebrate.

The third case is a pro-environment project, such as a solar farm, a wind farm, a hydroelectricity scheme (run-of-the-river or pumped hydro), a geothermal power station or a nuclear power plant. With these sources of electricity we are replacing fossil fuel. Without these projects we would be emitting more greenhouse gases. Each tonne of carbon dioxide not emitted by using these sources is a benefit, and one would anticipate that this would trump any possible negative impacts caused by changing power sources. With renewable energy, we can expect some negative impacts, depending on location of the projects and their design. For example, one does not build a wind farm very close to human settlements. Even if there is no noise pollution, some people are likely to assert there is. We know that water impoundments for hydroelectricity generation are likely to have impacts on local flora and fauna; and very large dams can flood villages requiring the movement of families, as well as flooding cemeteries and other non-movable cultural features of the landscape. These situations involve making trade-offs. I am prepared to suggest that the benefit of non-polluting, sustainable electricity is going to be hard to trump.

Social and Cultural Baselines

Even to contemplate the concept of a social or cultural baseline is perplexing, constructing one near impossible. Yet, if we are to be true to the principles of sustainable development, we need to ask which of the prevailing social and cultural conditions should be sustained, if threatened by the project we are assessing? Obviously, sustaining what exists is a much easier task in a homogeneous society than in one divided by class, culture and religion—noting, though, that what we call multiculturalism need not mean division, rather it can be cosmopolitan. With this topic we could enter into a long and fascinating debate about relative social, cultural and religious arrangements. We will not do that, rather by real-world cases show how cumulative developments have changed the very nature of societies. Whether the changes in total or part are welcome is for those impacted to say.

Major projects are likely to have social effects on the communities in which they will sit, depending on the nature of the project, and flow-on links on the wider community. Likewise, major projects or a combination of projects can have impacts on local, regional or even national cultures. The obvious examples of both social and cultural changes are major tourism projects, particularly where one resort after the other is built and the result is a conglomeration such as the Gold Coast or Kuta, Nusa Dua and Legian in Bali. The social, cultural and economic effects on Bali from the time it went from a rural community and an idyllic destination for the artistic type to modern mass tourism are very obvious. One would need to ask the Balinese what they thought of the changes—in my investigations I found that some welcomed the income tourism brings, while lamenting the rapid erosion of an ancient culture.

It took decades, but the local Gold Coast society went from a casual, village-based, set of independent communities to a mass-market tourism destination. As noted previously, American soldiers on leave during the Second World War had an influence on the destination's emerging style. When they went back home, they described the beauty of the beaches and, one presumes, the local women they met. The smart tourism entrepreneurs were awake to the potential of promoting the area to potential American tourists and gave many local places names familiar to Americans. The Gold Coast society baseline changed dramatically. I know. I was born there and went to school there in the 1950s. We could debate whether the change was for better or worse.

The changes started to become noticeable in the late 1960s with the construction of high-rise hotels and apartments; and, end-of-the-year family holidays camping in tents gave way to *upmarket* motel, hotel and apartment accommodation. Then in the 1980s, large numbers of Japanese visitors came, followed two decades later by equally large numbers of Chinese. Australians went to Bali. The visitors to the Gold Coast went about their holiday pursuits in a manner no different from domestic tourists who, if not in Bali or Fiji, were no longer camping but dining out and seeking out theme-park entertainment for youngsters. By the 1980s, there was no noticeable cultural impact as a result of large-scale foreign tourism—the foreigners fitted in with the local social environment, some trying very hard to copy locals in the surf. However, the beautiful natural environment was no more, and that was an impact unwanted by the locals.

At about the same time that the Gold Coast underwent a dramatic change, in Bali there were significant cultural changes underway, particularly for the Balinese who came to the beach areas to work in the tourism industry. The foreign visitors were not going to behave as the Balinese. No doubt many Balinese would retain their religious faith, but the world of commerce and dealing with hedonistic holidaymakers had an influence.

This is not the place to delve into this topic, it is simply to draw attention to cumulative impacts of mass tourism. That said, it should be noted that mass tourism need not have adverse effects on local societies. Much depends on the reason tourists visit; for example, one gets the impression that the tens of millions who visit Italy each year come to experience Roman culture and follow the timeworn adage *when in Rome do as the Romans do*. The Romans are not influenced or disconcerted by the tourists, and the tourists are likely to come away a little more knowledgeable—a good outcome all round. A major reason for this is that an environmental practitioner is not going to be commissioned to undertake an EIA for a Las Vegas-style hotel in the center of Rome. It is possible for the tourist destination to influence the tourist, not the converse.

Tourism projects are very different from most others which will be subject to EIA, and the difference is that the others are likely to impact only a few people directly, and only be influential on the local community, not beyond it. This is the case for a mining project, an airport expansion, a new dam, a cattle feed-lot, or a new off-shore fishery. Their wider influence will be indirect. It is only with very large projects, such as the Snowy Mountains Hydro-Electricity Scheme and port developments, with associated heavy industry, that significant social impacts will need attention. Where that is the case, more schools, hospital beds and police will be the demand on governments and local taxpayers. On the positive side, local businesses will expand and economies of scale and scope are likely to result in more and improved restaurants, coffee shops, entertainment venues and sports clubs.

Impact on Indigenous Communities

Where projects impact on indigenous communities, much depends on the established historical relationship between the local indigenous folk and the settler, or colonial, culture. The size of the project is also likely to be important. For example, the New Zealand situation is that of a long-established bicultural society, based as it is on the formal arrangements dating to 1840 with the Treaty of Waitangi. New Zealanders experienced a mixing and transfer of cultures. For example, Christianity and the English language were adopted by the indigenous Maori. On the other hand, New Zealand sporting teams, even if comprising only members with European ancestors, perform the *haka*, a form of Maori *war dance*. It is a compelling experience to view the New Zealand rugby union team, the All Blacks, perform the *haka*. Bio-culturalism is strong in New Zealand and regardless of original cultures, most natives refer to themselves as *New Zealanders* or *Kiwis* rather than divide themselves on ethnic grounds. This results in a vastly different situation to that of a country such as Australia where it is necessary to give special treatment to indigenous interests. In the USA and Canada there are formal arrangements, some dating from early treaties which determine relationship between indigenous peoples and projects; and in terms of EIA, there are established legal requirements. Australia is different in the sense that treaties as such do not exist; however, where indigenous land rights (Native Title) exist, these can be a major consideration in environmental assessments. Much will depend on the actual rights in existence in the area of the project.

When the subject is indigenous artifacts—and they are known to exist—they will be protected by law in most countries. One obvious problem is that not all have been found and recorded. This will mean notifying the government if anything suspected to be of indigenous value is discovered on the project site. To the casual observer it seems that construction teams working in the very old cities of Europe are forever coming across ancient and fascinating human bones, jewels, broken pottery and the like. There are no identifiable ancestors to claim these things—they belong to all of humanity. In these cases, a project will remain in limbo while we explore our collective past.

The most difficult problem a practitioner can come across is competing claims or conflicting advice from sub-groups of the same tribe. This is more common than expected. It will differ site-to-site; hence, no specific advice is possible. If need be, one will have to seek professional advice from an anthropologist who is trusted by each group, or, at least, has the authority to rule on the matter. Understanding and accommodating indigenous interests is a case-by-case situation.

It can come as a shock to practitioners assigned to overseas projects that not all nations recognize rights of indigenous or minority people, or treat women as equals. A classic case of the former is the non-recognition of the Kurds in their homelands. Hundreds of thousands have been killed for doing no more than seeking to be recognized. For a long time they were not permitted to speak their own language. Kurdish women were forced to marry Muslim Turks. Imagine if this was the situation in any of the industrialized countries! There are numerous cases, if not as dramatic as the Kurdish one, around the world, where the original people to settle an area have been marginalized—and remain so. Then there is the interesting French position—all people in a French outpost such as Tahiti are *French* with equal rights, no debate! This, it is argued, guarantees complete equality. Yet, other countries such as Norway and its Nordic neighbors have created separate parliaments, with limited roles, for the minority groups, the Sami in this case.

Best to do some serious research before accepting a consultancy to work in a country you know little about. Clearly, if you are not comfortable with the local attitudes or laws, you should not work in the country in question—unless you believe you have a prospect of making a change for the better. It is your choice.

In Conclusion

There is real difficulty in being adamant about establishing realistic baselines. It is easy enough to pose the counterfactual question: What would both the local and the wider world *look like* without the project? A genuine attempt at this has to be made if an EIA is to be taken seriously. I have, without being exhaustive, dealt with a number of issues above. What I personally do is graph straight-line (or steady state) baselines for the three categories (ecological, economic and social) covering, say, 30 years into the future. The number of years chosen should reflect, at least, the expected life of a project. For projects with indefinite life spans, such as freeways which are under continuing maintenance, a 25- to 30-year period is usually my limit. Having drawn the steady-state projections, I model, using the available scientific data, matters capable of changing the baselines. I have given some examples throughout the chapter. Based on my models I draw the baselines I shall work with.

I am not surprised if one of the baselines is improving over time, for example, measures of material well-being on the up, while another baseline will, at the commencement of the project, have built-in decline, for example, loss of soil productivity in an agricultural region. Both require recognition. Without starting with a realistic baseline, we are not going to be able to undertake a with and without analysis, and that is what an EIA is, when it is all said and done.

In the next section the subject matter is the extremely important issue of offsetting the environmental damage which cannot be eliminated through better design, adopting an appropriate alternative means of meeting the goal of the project, or changing its scale or location. Offsetting has in recent years become a major EIA matter—and a controversial one.

Part III

Offsetting Environmental Damage

14

The Principles of Offsetting

Introduction

The concept of offsetting environmental damage, a damage which cannot be mitigated if a project goes ahead, has become a common feature of EIA. Possibly too common. A key feature of EIA has been, as described previously, the search for alternatives which do not do the environmental damage which would be caused by the original project. If not a feasible alternative, there is the promise—at least, the possibility—that a change in design of the project could mean no damage. If neither of these solutions were possible, the original project could be rejected. A way around this problem was conceived, and it came to be called offsetting.

You can have your cake and eat it too was the message we have come to appreciate with the development of environmental offsetting. A project which had much-desired benefits, but there remained environmental costs which were not amenable to mitigation in the context of the project, would be allowed to go ahead if a proponent undertook action over and above what was originally intended to compensate for those costs. In the jargon of environmental offsetting this means no net loss*;* for example, there is a loss of, say, a habitat but it is replaced by a habitat of equal

T. Hundloe, *Environmental Impact Assessment*, Palgrave Studies in Environmental Policy and Regulation, https://doi.org/10.1007/978-3-030-80942-3_14

environmental quality, otherwise a *like for like* exchange. You are likely to ask how can this be; there is no magic wand to create out of thin air, as the saying goes, a substitute parcel of rainforest the moment an area is stripped bare by a bulldozer.

To answer the question, we need to construct a scenario as follows. Assume there are two equivalent areas. Area A is allowed to be bulldozed for a development—for what does not matter—only on the condition that a replacement area can be saved as a like for like replacement. A potential replacement area, Area B, is owned by someone who has an unfettered legal right to bulldoze the land—the owner could be planning to construct a tourism complex. The owner of Area B is simply waiting for the right opportunity; however, he or she can surrender the right to destroy it by selling the land at a fair price to the owner of Area A. This means that Area B can be purchased by the first-mentioned developer, and to save it, he or she gives it to the government to protect as a national park or other type of reserve—and now Area A can be developed.

This is purely a hypothetical illustration, based on assumptions which are unlikely to exist in the real world. Unlikely does not mean never. Situations as described above do exist. Around the world, there is considerable land in good or even pristine natural condition which is owned outright (it is unfettered private property) and with this form of ownership comes unstinted rights to do as one likes with the land. This land can be bought by a person or corporation who has been given the right by a government to destroy another parcel of natural land so that, for example, a new town can be built, a cotton farm established, or a mine dug, on the condition the degraded land is replaced.

In summary, one parcel of land is destroyed for the purpose of development and another existing parcel, which could have been legally destroyed, has its status changed so that it becomes the former's replacement. You could, rightly, argue that there is *an overall net loss* of valuable habitat in this situation. However, if you argue this, you are overlooking the fact that a loss would have occurred when the property owner with unlimited rights to use his or her land bulldozed it. Obviously, this scenario depends on the ownership rights outlined. Deviate from them, and the scheme fails.

In the situation where a genuine like for like scenario is not possible, the advocates of environmental offsets have another scenario in mind. It is not based on immediate replacement of bulldozed natural land, rather replacement occurs over time with the gradual restoration of a parcel of already-degraded land. In this scenario, the developer would be given permission to bulldoze a parcel of land on the condition that another parcel of land, initially in a degraded state, is restored to a natural condition equivalent to the land to be destroyed. As in the first scenario, the developer would purchase this land before restoring it; this assumes, the developer does not already own the degraded land in question. The obvious problem with this scenario is the existence of a time lag between the destruction of one piece of land and the completion of the restoration process. As we will come to appreciate, offset enthusiasts go to much trouble in an attempt to get around this problem. We must empathize that the replacement has to be on the basis of like for like. This means that pristine rainforest is replaced by pristine rainforest, pine forest by pine forest, mangrove forest by mangrove forest. Given that every piece of land is unique, this criterion is never likely to be met in a perfect sense except by chance.

You will note that I have limited my discussion to offsetting loss of habitats, otherwise, offsetting the loss of biodiversity; however, environmental offsetting covers much more than that. In the concept's formative days, offsetting was not applied to biodiversity but rather to compensating for increased greenhouse gases in the atmosphere. The concept is radically different in this application. This is how it works. You take a plane trip from Chicago to New York, and you purchase a few *carbon* credits—*over and above the outlay on your flight ticket*. This money goes to purchase trees—somewhere in the world. These trees suck up carbon dioxide. In theory the amount of carbon dioxide your seat on the plane was responsible for is absorbed by the trees your money purchases. The carbon dioxide offsetting schemes are voluntary. We shall come to the range of environmental offsetting schemes later on. Here I shall concentrate on offsetting the loss of biodiversity.

Offsetting to the Rescue

The folk who developed EIA were conscious that not all adverse impacts were going to be resolved by identifying a feasible alternative or changing the design or the location of a project. Yet, for a very long time, there was not a formal role for offsetting—certainly not as explicit as is the situation now. In the early decades of EIA, before offsetting took hold, practitioners struggled with the conundrum, what to do if only one adverse impact remained for an otherwise beneficial project. If a generalization is permitted, in this case decision-makers were likely to approve a project rather than prohibit it. If compensation for damage occurred, and maybe it did in some circumstances, it was an informal process, and not transparent.

Today, a handful of countries have written offsetting into formal EIA law and procedures, while many others are making attempts to practice the concept in a less formal—sometimes ad hoc—manner. Australia has become the standard-bearer for the concept, with offsetting being a condition for approval of a project in the EIA process, if adverse impacts cannot be mitigated. The concept has become popular, much used, possibly overused, if not abused. That recognized, for project proponents, the introduction of formal offsetting was welcome. It allowed a certain amount of degradation, particularly the loss of biodiversity (but not solely confined to this type of loss) on the condition it could—would—be replaced. We could have our cake and eat it too.

Clearly, offsetting the loss of biodiversity is of immediate and prime interest. The Earth is losing biodiversity at a rapid rate. And, given that in many parts of the world the human population continues to grow and, consequently, more land is required for agriculture, and cities gobble up good-quality farmland, the loss of biodiversity must continue—this notwithstanding that there is evidence of naturally occurring re-establishment of forests. The data is frightening. We are losing 137 plants, animals and insects every day from the destruction of rainforests. One-and-a-half acres of rainforest are lost every second.

Offsetting: Impossible Tasks

Look to the future, unless we tackle the loss of biodiversity, not just as another task in a long list on the agenda of environmental management and sustainable development, but as a first-order issue on the same line as managing human population growth and climate change while giving the poor of the world a helping hand up, we are setting ourselves up to fail our future generations—and the other animals with which we share the planet. Look to the past, our parents, our grandparents and those before them who worked much harder than we do, enjoyed far less in material wealth and lived shorter lives fighting illnesses without cures, so that we of the rich countries are able to enjoy, on average, well-being unknown in human history. We are threatening to disregard and dishonor the sacrifices they made on our behalf—throw it all away, for what?

The destruction of biodiversity is not something we see daily because it does not happen at a large scale in the rich countries—not anymore. In general, we have quite good laws to protect our remaining biodiversity, although we struggle more than we should have to due to population increases pushing our cities into near-natural areas. Protecting biodiversity is not just rich people in rich countries looking after their own backyards. Recognizing that we are all citizens of one world, we have an obligation to pull our weight in what has to be a global effort to protect biodiversity. At present, the great swathes of rainforests lost daily are in poor countries and the people who do the actual felling of forests are the very poor. They fell forests or starve. The profits from the work of the poor are appropriated by entrepreneurs acting legally or illegally. This forces us to recognize a truly awful economic truth. If we were able to halt the massive felling of rainforests, how do the poor earn enough to feed themselves? We are not capable of offsetting the loss of forests at the scale and speed of its occurrence. The story of the forests provides perspective.

We know that there is great inequality in wealth and economic power in the world. One fact suffices: 42 individuals hold 40 percent of the world's wealth. The global population is nearing 8 billion. In terms of a percentage of the world's population, 42 individuals are less than

0.000000002 percent of the world's population. I am indebted to A.C. Grayling (2002) for the following fact. The richest Mexican has more money than the poorest 17 million of his fellow Mexicans. In contrast to the concentration of enormous wealth, half of the world's population have to exist on less than $2.50 per day and 80 percent on less than $10 per day. No wonder rainforests are felled, coral reefs are dynamited for fish and both terrestrial and marine species become extinct. There are no practical means to offset these losses.

Throughout history there have always been rich and powerful. However, we have never seen the aggregation of wealth in so few hands as we do today. We label the enormously rich the *one percent*. The diabolical distortion of wealth and power renders the global economy unstable, unhealthy and grossly unfair. It leads to the loss of biodiversity. If the commonly used phrase *economic reform* meant anything, this situation would be changed. It is not for me, here, to suggest how this would be achieved. Economic reform is not our subject, but we can understand the ongoing, rapid loss of biodiversity in places such as the Amazon Basin (the so-called *Lungs of the Planet*), Kalimantan in Indonesia, and other poor countries, by being mindful that the world's poor have no other means to feed their families than by destroying nature to produce goods we, the rich, demand. Destruction of habitat on a broad scale is not something we can offset.

Environmental Offsetting Comes in Various Forms

The concept of eating your cake and having it is easy to implement for some types of *environmental offsets*, due to the fact that they are relatively easy to measure. A carbon atom is a carbon atom, is a carbon atom (in an animal, plant, soil or ocean). Each greenhouse gas can be readily converted to an equivalent carbon dioxide emission. We know how many tonnes of carbon dioxide (or its equivalent) have to be sequestered to compensate for an amount emitted. On a project basis, as long as the amount emitted is small, forests can be planted as compensation. The polluting, electricity-generating powerhouse can be replaced by various forms of clean electricity generated without diminishing our electricity supply, meaning we can continue to turn on our television sets, have hot showers and cook meals while doing no environmental harm. This type of offset goes by various names, such as *averted* offsets or *protection* offsets. In this case, we are protecting biodiversity and our well-being by averting increased climate change that comes from burning coal.

Environmental offsetting is relatively easy in the situations described above. I stress *relatively*, as no offsetting comes without its difficulties—except ticking a pay-as-you-fly box on your next flight, and who knows what good that does! The answer seems to be very little, for the simple fact few do it, due to passenger concern about the credibility of the schemes. There is a lack of transparency and hence knowledge about what really happens to your offset dollars. In passing, we can note that the Australian airline QANTAS leads the global airline industry in passenger take-up of voluntary carbon offsets.

The Biodiversity Offsetting Hierarchy in EIA

Offsetting biodiversity is a much more difficult matter than the other types of environmental offsetting, except in the *ideal situation*, a fact we will come to appreciate. Being somewhat conservative, do not expect to find many ideal cases—possibly none. A fundamental consideration is whether biodiversity offsetting is to be judged by the strict principles that have been established for it, or it is allowed to become a broad *compensatory* scheme, as the other types of environmental offsets are. This we will come to explore.

An important issue in environmental assessments is in separating *mitigation and* restoration from offsetting. We expect that, to the extent possible, adverse impacts are mitigated during the design phase of a project. We expect that on the completion of the project, disturbed land is restored. The latter is a requirement of mining companies in the industrialized countries. Offsetting is different. The *offsetting hierarchy* makes this clear. It is first to last, avoid, minimize, mitigate, restore, offset.

A Digression on Terminology

Before proceeding, it is important to note that some organizations confuse offsetting terminology. For example, a publication jointly authored by the International Union for Conservation of Nature and the International Council on Mining and Metals (2013) introduces the concept of *restoration* offsets. In the offset hierarchy, restoration is not offsetting. A clear example of the difference is that we do not refer to offsetting when we engage in restoring a mine site. Restoring is about returning an area of land back to its pre-development state. This is not the only terminological problem we face. The words *discounting* and multipliers are also problems. We will consider these concepts in detail below. Here note that most of the offsetting literature defines discounting in terms of adjusting for time lags in achieving a desired biodiversity outcome.

On the subject of interpreting the jargon used in biodiversity offsetting, there is an informative journal article by Joseph Bull and his colleagues (Bull, J. et al. 2016). Their discussion, with some additional comment, is summarized in Appendix to this chapter.

Thinking About the Ideal in Biodiversity Offsetting

I shall now deal with the issues raised in the introduction to this chapter. In determining what is an ideal no net loss offset, offsetting trailblazer, Martine Maron and colleagues (2016) subscribe to the proposition that the *ideal* is, well, simply an ideal. Be mindful that an ideal is something to be aimed for, not what is likely to be achieved in practice. These experts note:

> *The concept of* 'no net loss' *lies at the heart of offsetting … Strictly speaking, impacts on 'biodiversity' can never be offset, because no two places will ever have identical biodiversity.*

Their journal article summarizes most of the major problems in biodiversity offsetting and is appropriately titled "Taming a Wicked Problem: Resolving Controversies in Biodiversity Offsetting". They suggest that there is only moderate scope to solve the crucial problems. Is offsetting being required to do too much—in a number of cases, the impossible? If this is the case, it is better to recognize this rather than have biodiversity offsetting dismissed because it is portrayed as a solution to environmental harm in circumstances where it cannot deliver. It is more than likely that in some situations—one *can't have one's cake and eat it too!*

If biodiversity offsetting is to occur, Maron and her colleagues suggest we need to resort to a *crude* simplification of the natural world, collapsing it into what we can measure, such as types of vegetation, the condition of the vegetation, its geographic location and areal extent. And even then, we can be forced to resort to surrogate measures of the key elements of biodiversity. These experts have put much intellectual effort into the task of developing these. What they are seeking is to arrive at the situation where if area C is lost to development, area D is satisfactory as a like-to-like equivalent, as long as we can get *close enough* to save what we want to save, for example, an endangered bird.

As with exercises such as this, the experts seek to construct a number, an index, involving several ecological components, which can be used to align near like for like areas of land, or habitats. This is not easy. The crucial components need to be selected, weighted if necessary, and combined in a manner which makes sense from an ecological perspective; that is, this procedure aims to allow the construction of an index number for particular environments, each with its specific annual rainfall, hours of sunlight per day, number of windy days, proneness to weather extremes and habitat available for a certain animal. The concept, a combined mix of weighted components, allows for index numbers to be calculated each with varying quantities of its components. What we are looking for are equivalent indices. For example, a different environment to the one to be offset can have a slightly different mix of natural attributes as long as they combine to equal the original one; as a trivial example, area C has a constantly flowing spring but less rainfall than area D, but both produce the same overall natural conditions to sustain the same animals in the same numbers. We could be happy to accept this as a like for like under the index number scheme.

A procedure similar to the one described here is used in the small number of countries. Some users of this method take the trouble to make their methodology understandable to the public. Notwithstanding their attempts, unfortunately, they fail at this: the methodologies are too complicated for a layperson who wants to know if a patch of koala habitat lost in a housing development can be replaced elsewhere and that all the koalas are happily relocated to their new home. Even expert commentators find these calculators very complicated (see Takacs, 2017, p. 16).

There is another method used in attempting to arrive at like for like offsetting when strict equivalent areas are not to be found. A number called a *multiplier* has been introduced for this purpose. What is a multiplier in the offset world? A multiplier is a number, say four (a number which seems to be a favorite one), by which a replacement area for a lost site is multiplied to adjust for uncertainty in successfully protecting the biodiversity it is to protect, as well as for time lags in producing the desired outcome. Put simply, by using a multiplier one does not necessarily replace 10 acres of koala habitat with another 10-acre plot but, if the multiplier is four, with 40 acres. This could be the appropriate decision, then, again, it might not be. Prima facie, the method is crude. Too large an area, too small an area? The magnitude of the multiplier has to be explained and the science behind it made clear.

I venture to say that for the available examples of this method, both the reasoning and the science are not convincing. Undoubtedly, if a 40-acre plot has the same number of the preferred koala food trees as the 10-acre plot, one could argue that all other things being equal the koalas could be translocated. This approach would require a case-by-case assessment, not a generalized multiplier. Generalization is the problem with this approach. There are other means, both practical and theoretically acceptable, of dealing with both uncertainty and time lags, but they reduce the number of options for offset losses. Before proceeding, let us note that others also have problems with the concept of calculating multipliers. To use the language of Overton and colleagues (2013), they state that the magnitudes of multipliers are determined by *ambiguous procedures*.

Making Offsetting More Reliable, Less Complex

Uncertainty can be reduced considerably if offsetting is confined to situations where success has been proven in similar situations. For example, there are reliable historical cases of relocating animals, as well as a history of the failures. The message is to seek out successful results, maintain a compendium of them, and analyze why they were successful. This is learning through experience. Why put faith in a theoretical multiplier when there are real-world examples as a guide.

Where a proposed biodiversity offsetting project involves significant uncertainty, it needs to be trialed as a potential, so-called *advanced offset*. Assume we can predict destruction of the habitat of an endangered animal by a project that will commence some years in the future. Well in advance of the development occurring we need to acquire habitat which is already suitable or can be restored to a condition suitable for the animal to be relocated to when the time comes. In the case of restoration, if done with sufficient lead-time, we will know if it is successful and, assuming that relocation has been successful elsewhere in the past, we should be confident of the animal surviving in a new home. In this case we are getting the order of the stages right. If we have to wait for habitat restoration to occur, having destroyed the original habitat, the process is doomed to fail from the start.

There are many projects where the lead-time is many years. For example, there are mining leases which exist for a long time, in some cases decades, before the mining company is ready to mine. There are prospective residential developments (housing estates) where the developer acquires the land and waits for years before calling in the bulldozers. There are other examples. In circumstances such as these, much time is available to locate like for like replacement sites—if they exist—or to restore an area of degraded land if they don't. This is the process by which to make use of advanced offsets. Advanced offsets are discussed in more detail below; however, note that their value is in the offset being in place and proven before it can substitute for a lost environment. This is simply a form of the precautionary principle, otherwise risk-aversion—something we say we practice but have a propensity to overlook, especially when it is most relevant.

Where we are faced with significant time lags between the loss of an ecosystem and its offset being available, we should not countenance offsetting, as this is in no manner compatible with the overarching principles of no net loss and like for like offsets. How no net loss is to be achieved when there is no new home waiting for a displaced animal is beyond rational reasoning. There has come about, unfortunately but understandably, attempts to solve the time lag problem by introducing magical numbers to allow for a delayed response. The magical number is a so-called *discount* factor.

Offset *discounting* involves selecting a so-called *discount rate* to do what is impossible in ecology, allow the slow rate of growth of biodiversity in a newly planted forest to be made equal—immediately—to the existing biological diversity of the area to be lost. Let us consider what happens in the real world. The trees are felled on the project site, the ground flattened. Animals not killed in the process of clearing quickly die of hunger. Predators of those animals consequently die of hunger. If nothing else, relocation has to be immediate. Relocated to where? The restored site is still some significant time away from maturity and being habitat for the displaced animals. It is not that this problem is not well known. The following quote from the IUCN-ICMM (2013) "Independent Report on Biodiversity Offsets" summarizes the problem from an ecological functioning perspective when the loss of ecosystems is not immediately dealt with—even a short time without a new home is too much time:

> *Where the* biodiversity *in question performs an important ecological function … even the temporary loss … would cause long-term damage to animal populations.*

The term *ecological time preference* has been invented to capture the idea of discounting in offsetting. It seems to be without theoretical justification or practical meaning. Discounting should be discontinued and advanced offsets relied on where time lags are obvious.

These are forceful comments. They are aimed at saving biodiversity offsetting from being discredited and subsequently discarded.

I recognize the significant intellectual effort that both public servants and fellow academics have put into developing the calculators, including multipliers and discount rates. They have responded to politicians and project proponents who want offsetting to solve a major problem—to get a project accepted notwithstanding the adverse impacts which are incapable to be mitigated. However, now is the time for them to go back to the politicians and proponents, tell them the bad news; that some things are impossible, such as saving animals if there is a time gap between habitat destruction and a viable offset becoming available.

The message does not have to be all bad news. The experts should advocate advanced offsets and recommend that governments and proponents undertake forward planning to identify environments which would be suitable as advanced offsets. This should not be as difficult as it seems. We know more about where likely losses of environments are likely to occur than we think. We have sufficient geological knowledge to know where mining is likely to be proposed; reliable predictions of where and when highways will be built; forecasts for dams, electricity generation and other types of infrastructure are sitting in the in-trays of senior government engineers and economists. Small armies of engineers, economists and demographers are employed by governments to analyze demographic data and make predictions for well into the future. Align these experts with SEA practitioners, and give them the job of identifying possible substitute environments for those to be lost when the time comes to build, and quarantine the replacement environments.

Are Offset Calculators Worth the Effort?

A great deal of intellectual effort has gone into developing the existing variety of biodiversity offset calculators. This work had to be done, for the simple reason to determine if realistic calculators could be developed. We have learned from this work, learned that the effort to date has involved pushing the boundary too far. There is a long history of attempts in the environmental field to construct what I call *go* or *go to jail* metrics. These attempts commenced in the 1970s when EIA first became a tool to decide on the future of projects. Measures called *magnitude* and *importance* were put into a matrix—both measures scaled between 1 and 10, in some cases between 1 and 5. The individual numbers for each impact were multiplied; for example, the magnitude of the loss of something was, say, 7 because it was at the *large* end of the scale, and if it was deemed a wee bit important, it was given 6, with the result a number made famous by Douglas Adams—*the meaning of life, the universe, and everything*.

The *meaning of everything* exercise in spurious and simple mathematics was not enough for some of the pioneers of EIA. Using the matrix described above, individual cells were multiplied, columns and rows added vertically and horizontally. The motto *if you can't measure, it does not exist* held sway. Hocus pocus! Enough, we cried! This and other formalistic EIA methods were soon discarded, and today EIAs are very much case specific and no *fancy formulae* comes into play (except in some cases where very suspect economic modeling is undertaken). Unfortunately, EIA has lent itself to some curious and spurious efforts in devising metrics for managers. Who will ever forget the Adani coal mine example, discussed earlier, where in its EIA, 10,000 jobs were reported as to be generated. When the EIA was subject to the rigors of examination in a court case, we discovered that the number should have been under 1500!

As we know models are only as reliable as the assumptions that go into building them, and the output is only as accurate as the data that is fed into them. What applies to economics applies to ecology. Atte Moilanen and Janne Kotiaho (2018) warn us about a human propensity to measure things we value: *You get what you measure*. These analysts make the point that hundreds, or even thousands, of species lost to development will not be recorded in attempts to measure biodiversity. Environmental practitioners will see the large animals and be on the lookout for endangered ones. But, what of the species living underground or otherwise difficult to locate? When enormous holes are dug to extract coal, ore or minerals, these critters have lost their home. Maybe, given that in total very little land is disturbed by mining, in its case the loss might not matter. A large urban development could be another matter when it comes to life living just under the surface of the soil. When we have limited knowledge, modeling can be fraught with problems, and just because we end up with a number does not make it a useful number.

In Conclusion

Regardless of the difficulties, we must recognize that there is a strong appeal for biodiversity offsetting. If it can be done successfully, it allows destruction of biodiversity on the condition that there is no net loss of biodiversity, and the replacement ecosystem is close to being like for like. As projects which destroy ecosystems are not destined to come to a halt in the foreseeable future, we are forced to seek the best way to offset. The only feasible candidate—exceptional circumstances aside—is the use of advanced offsets.

Appendix: Offsetting Terminology

All new fields in science or technology come to have their own jargon. Biodiversity offsetting is not, as they say, *Robinson Crusoe—alone in this regard.*

An annoying factor in the field of biodiversity offsetting is that when one goes looking at practice around the world, there is not a common term for the concept. Of 15 countries where biodiversity offsetting is practiced or at least referred to, only 4 call it *biodiversity* offsetting—the UK, Australia, New Zealand and South Africa. In eight countries, it goes by the term *compensation*, and three have other names for the concept. There are more than 15 countries practicing something akin to biodiversity offsetting but without a common descriptor, they are not easy to identify. The following are the terms that require explanation and/or altering so to better fit their intent.

NO NET LOSS (NNL) of *BIODIVERSITY*: Biodiversity is understood to exist at three different levels—genetic, species and ecosystems. Seeking to achieve NNL at these three levels is not feasible, on the obvious grounds that biota carry unique genetic combinations. What practitioners attempt to do is construct a *surrogate* for *total biodiversity.* There is no necessary agreement in the practice of selecting a surrogate, or on the surrogates that are presently used. However, there is a tendency to focus on measurable variables, such as area, vegetation cover, obvious species, their habitat and their condition.

How to present NNL so that the layperson understands what is being measured and what is to be achieved by it are difficult matters. Our language suggests certainty—*NO net loss.* The layperson could assume that *all* biodiversity is being offset. This, of course, overstates our capabilities. The public is encouraged by governments and developers to be relaxed—all is well, nothing is being lost. Advocates of offsetting are likely to use such terms as *improving the environment.* The reality is something else!

FRAMES of REFERENCE: This phrase is an umbrella term used to describe baselines, scenarios or *counterfactuals.* The term "baseline" is used in most environmental fields (such as environmental impact assessment) and for ease of understanding should be the preferred term across the environmental sub-disciplines. That aside, the crucial issue is that there is a lack of consistency in deciding on what the baseline should be. Is it the present set of conditions of interest, or is a dynamic set of conditions?

Determining the baseline is the first step in working out how NNL is to be measured. Should the chosen baseline be an *unchanging pre-development* state? Or should it be a dynamic (shifting) baseline, which accounts for changes in the ecosystem or elements of it, due to natural succession or, in the case of bacteria and possibly some other short-lived life, evolution? The practice in Australia, calling the concept *counterfactuals*, is to model *what is likely to happen—the shifting baseline*. This is good practice—if it can be done.

THE MITIGATION(OFFSETTING) HIERARCHY: Offsetting is considered the last resort in dealing with human developments which are destined to have a significant adverse impact on the natural, near-natural or valued human-formed environments. The steps in the hierarchy are avoid, minimize, restore/remediate, offset. On the one hand, avoidance and minimization are to be achieved at the design and implementation stages. These are preventative actions. On the other hand, restoration or remediation and offsetting are all compensatory actions. A good example of restoration/remediation is what is by law required in Australia after mining takes place. The land is to be re-configured to resemble it pre-mining; the topsoil which has been stored while mining occurs is replaced and the original types of vegetation replanted. Only so-called *residual* impacts are a matter for offsetting. Where to draw boundaries between these stages can be a definitional problem. It is argued that restoration/remediation *reverses* damage, while offsetting *compensates* for damage in some way, such as planting vegetation on a new area.

THE VERB: TO OFFSET: In commenting on this I draw directly on Bull et al. (2016), who write:

> *to qualify as an offset, there must be demonstrably quantifiable equivalence between what is lost and gained, and the term offset should be quarantined for this use only.*

Bull and his colleagues make the point that:

> *financial compensation, education schemes, or research and monitoring funds … do not constitute true biodiversity offsets unless measurable gains in biota are achieved.*

The broader term *compensation* is appropriate for these mechanisms. If we are to take notice of these experts, we need to change much of our official language.

MULTIPLIERS*:* As with a number of terms used in the biodiversity offset field, multipliers have been borrowed from economics, where the *Keynesian multiplier* is in common usage. In biodiversity offsetting, if an area of lost habitat has to be replaced by an area of greater size (multiplied), we do not have a strict like for like substitution.

You could rightly ask why use a multiplier? The answer is to adjust for the uncertainty involved in achieving a like for like outcome. The uncertainty is that an offset area the same size as the lost area might not result in a like for like, no net loss outcome. On what criterion is the magnitude of the multipliers chosen? This question needs to be answered in each case.

There is another reason given for the need to multiply the area. It is to account for time lags that inevitably occur as newly planted forests grow to reach maturity and provide all the ecological benefits of the old forest. In this case it is obvious that a genuine like for like result has not been possible. Quite how a much larger area would have to be to account for time lags is not obvious—and possibly not computable. The lags cannot be eliminated. It is a mystery how this multiplier concept is supposed to work.

Take a relatively fast-growing species such as brigalow. It is estimated that it would take 30 years *to return to a remnant habitat structure and bird species richness* (Sonter et al. 2017). For brigalow habitat to provide all necessities for birdlife equivalent to a destroyed area, how does an area four or more times the lost area compensate. There is no healthy habitat in one year's time, in five years' time or in ten years' time—the habitat is still not equivalent in environmental health to the lost area? In five years' time or even ten years' time, the offset area will not be anything other than stunted growth, with an under-story different to a mature stand; one must doubt that the food supply and the nesting requirements will exist for the bird population. In fact, one can be adamant that they won't exist until the replanted forest is approaching maturity.

While we can appreciate the intent—and considerable intellectual effort that has been applied to developing multipliers—they cannot but fail to achieve the strict principles of biodiversity offsetting. I suspect the advocates of multiplying know that. If the multiplying procedure is to continue, let us call it a form of *compensation* rather than biodiversity offsetting.

DISCOUNTING*:* Here is a question posed by Clive Spash in an article titled "Terrible economics, ecosystems and banking" *(in Environmental Values, 2011, vo. 20, no.2, pp. 141–145)* for individual ecologists to answer: *Why do conservation biologists,* ecologists*, and other natural scientists … feel the need to copy, or rather parody, a narrow economic discourse?*

I have no idea.

The concept of so-called *ecological time preference* has crept—one could say dived head-first—into dangerous water. The idea has been put into practice by applying a discount factor in valuing an offset which will take a long time to deliver biodiversity equal to that which is to be lost. A prime example is a forest. All types of forests take a long time to reach maturity and, hence, have associated with them the wide range of flora and fauna which would have been in an original forest. The discount rate is supposed to bring the distant future gains back to what ecologists call *net present biodiversity value* or something similar. I simply cannot understand this from a scientific point of view. Maybe I have missed something in the argument.

Put aside the fact that economists continue to debate the choice of discount rates in their discipline. The literature on discounting and the search for the holy grail of *the* rate is vast—it would take years to read all of it, and then be no closer to an agreed position. More importantly, with the acceptance of inter-generational equity (the fundamental principle of sustainable development), discounting of economic gains and losses as they occur as time passes has been either discontinued or the discount rate reduced to a tiny fraction, to equate to what economists call *pure time preference.* The prospect of distant, serious adverse impacts of climate change has provided a real-world reason to abandon the *old-fashioned* discounting.

Admittedly, in the assessment of public infrastructure projects using formal cost-benefit analysis, governments will mandate a discount rate. That is no reason for it to be used in an entirely inappropriate context by ecologists. The irony is just as economists have come to recognize the danger of discounting—serious environmental damage in 30 or more years' time, when discounted, becomes nothing more than a very minor annoyance—ecologists have discovered discounting. The sooner it is discarded in biodiversity offsetting, the better.

15

Can We Convert Biodiversity into Dollars?

Introduction

An American professor of environmental law, David Takacs, recently wrote a very challenging article about offsetting biodiversity. The article is titled “Are Koalas Fungible? Biodiversity Offsetting and the Law”. It was published in 2017. He visited Australia when researching the topic, hence the reference to koalas.

Recall our two principles: no net loss and like for like. If one or the other principle cannot be met, there can be no offset. But not so fast! Proponents of this ideal form of biodiversity offsetting recognized early on that they were in danger of creating a formidable, if not impossible, task for practitioners. There needed to be a *default* position—if the ideal was not possible, what possibly was not impossible and acceptable? It came to be argued that like for like had to be fungible and liquid; that is, unlike things had to be converted into a common third thing and, hence, able to be exchanged. Money is an example which we all understand. Money came to play a major role in biodiversity offsetting, for better or worse. Let us explore the concept before coming to judgment.

T. Hundloe, *Environmental Impact Assessment*, Palgrave Studies in Environmental Policy and Regulation, https://doi.org/10.1007/978-3-030-80942-3_15

A Common Measuring Rod for Uncommon Things

While in the previous chapter I have dismissed as impractical the derivation of a common numeraire in the practice of biodiversity offsetting, I need to revert to the concept of fungibility and liquidity. Required is a common unit of measurement for biodiversity; if something is to be lost on the condition that an equal thing replaces it, the exchange has to be conducted using common units. Takacs would presumably approve of calling these units *gum nuts*, after the Australian eucalyptus tree, which is the food of the koala. To comprehend what this means, we would have measures such as the following, obviously nonsensical, hypothetical examples:

1. Great Barrier Reef (larger than combined UK, Switzerland and Holland) = one trillion gum nuts
2. Flinders Reef off Moreton Island, Australia (less than 40 acres) = one thousand gum nuts
3. The Amazon Basin (25 times the size of Britain) = one trillion gum nuts
4. Burleigh Heads National Park, the smallest in Australia (74 acres) = one thousand gum nuts

Let us use these units to do the job of explaining the dilemma we face if there is no genuine like for like biodiversity to replace an area lost. We would not exchange the Great Barrier Reef for Finders Reef, but we would exchange it for one billion clones of this tiny reef. The tiny reef is in as good as ecological condition as the Great Barrier Reef. We would exchange the Great Barrier Reef for the Amazon rainforests on the basis of being equal in gum nut currency. Of course, we would not—but let the maths stand. We would not exchange the Amazon rainforests for Burleigh Heads National Park, but we would for one billion clones of this tiny park. That's your gum nut currency at work!

A conventional monetary currency—dollars—would be even better, if we could value in dollar terms these unique environments. Only if we were prepared to. We are using hypothetical examples. The real world is a different story.

Theoretical and Philosophical Matters

It is easy to complicate the search for a measure of biodiversity by introducing a single species whose demise is to be offset. I realize that no one is going to deliberately countenance killing off a single species, but who knows what the results of massive forest clearing will be. We would be attempting the impossible if we tried to put one species into a biodiversity accounting scheme. The best we can do is deal with this animal's or plant's habitat. And we have not, until now, discussed how we would try to compensate for the loss of genetic diversity. A currency applied to the value of genes! Beyond our mindset.

As a start, I will introduce ethical considerations, although my intention is to steer clear of these as much as possible as the ecological issues are perplexing enough. We can, and many of us do, recognize animals—at least the cuddly ones—as sentient creatures. That is—possibly—a start to thinking about how we might value each and every one of them. The notion of sentience has an impeccable history. The eighteenth-century philosopher, David Hume, is considered the first eminent scholar to recognize animals as sentient creatures; a later eighteenth-century philosopher, Jeremy Bentham, was another to come to this conclusion; today, the conventional wisdom is to consider all common animals as sentient.

On the basis of sentience, each individual is to be saved—none of Bentham's utilitarianism of *the greatest good for the greatest number* which would permit sacrificing a small number of animals in one place if it meant saving a larger number in another place. A koala, is a koala, is a koala. It would matter if the koala population on the Gold Coast was wiped out as *a sacrifice* population, on the basis that a much larger population was going to be saved around Brisbane. While we might not be guided by Immanuel Kant's categorical imperative that every individual (animal in our case) is *an end in itself*, there is very strong evidence that people have an attachment to their *local* wildlife; and the fact that individual animals will be rescued from danger suggests that we do accept that Kant's concept applies to sentient animals.

If biodiversity offsetting is only going to be possible if biodiversity is fungible, we would need to be willing to convert it into a common measuring rod and trade it to save it. If such a measuring rod existed, or could be constructed, what would it be measuring? Whatever it was, it would be a human construct, based on subjective and vague views of how the natural world works; and on principle, who does not object to the commodification of nature!

Yet, we need to be realistic if we are to save valuable environments. There is a vital link between the environment and the economy. If we do not understand this link, we will see more and more of nature destroyed. The link does not infer commodification of nature as such, rather a realistic acceptance of a relationship. This requires us to recognize the fact that valuable parcels of pristine and near-pristine land are owned—yes, legally owned—by individuals and corporations, and they can have anything from freedom to do as they please with what they own to having to abide by strict government regulation. Once we recognize this and do not, being realistic, expect the situation to change in our lifetime, we are obliged to enter into a form of trading biodiversity. Trading will only be beneficial if the appropriate institutional arrangements are in place. These we will discuss.

In Support of Liquidity

Notwithstanding your reservations, which are likely to also be mine, there is a reason to purchase parcels of land in the circumstances I describe next. We start with the situation where someone has the right to use, change or destroy, a valuable biodiversity-rich parcel of land. The owner can be going to bulldoze the forest to convert it for agricultural purposes. If that parcel of land is suitable to offset the bulldozing of another parcel of land, should we not be willing to compensate the owner of the first parcel of land if the land is not bulldozed, rather kept as forest to offset the loss of the other parcel?

In various parts of the world there are farmers and others who own significant pieces of natural forest or bushland. If they can be shown that there is money to be made from preserving their land, more than can be made by agriculture, they have an incentive to protect this land and, possibly, sell it to a developer who must offset the damage his or her project will cause. Here is the opportunity for a project proponent to offset the damage which will be done to his or her land. In economic terms the farmers are being compensated in dollars for their lost income, the amount they would have made from clearing the land to grow crops or run cattle. To complete the story, we need a developer who could be a miner, a real estate developer, simply someone who will only be permitted to destroy land for his or her project if an equivalent parcel of land can be protected indefinitely. This is the offset land the developer purchases and maintains it or gives to a national park management authority. Before continuing with this explanation, I need to make an important point.

The concept I have described introduces a moral hazard. Is it not possible that the farmer had no intention of clearing the land in question and it is only as a consequence of an offer to buy that he or she asserts otherwise? This is where the concept of additionality comes into play. The farmer's conservation effort has to be something which would not have occurred in normal circumstance, if it is to be valued as an offset. As practitioners know, this is difficult to determine. Who but the farmer knows what was in his or her mind when the creek running through the farm was fenced off, and clumps of forest were left; was the fencing to keep the cattle from eroding the bank and muddying his/her favorite swimming hole, while also protecting koala habitat, something he/she would have done regardless? Prohibiting cattle from muddying my favorite water hole was one of two motives—the other was nature conservation—I had to fence off the creek on a property I part own.

Let us assume his matter resolved, and additionality has been established. The incentive for landholders to protect areas of their farms is the prospect of selling their conservation effort to a developer who is going to destroy biodiversity somewhere else and is required to offset that loss. Now, if one farmer had a parcel of land that met the like for like criterion in full, he or she could do a direct deal with a developer, sell the parcel or enter into a legal, financial agreement to maintain appropriate patches of native vegetation on the farm.

There is likely to be many farmers all doing their little bit in protecting aspects of biodiversity on their individual properties. The types of environments protected could be very different, depending on where they were. This itself could make matters difficult if like for like substitution is the objective. However, there is a practical way of pooling the farmers' efforts. Their offset parcels would be registered by a government authority, in some sort of legal device which ensured that the farmers maintained the potential offset land parcels in prime natural condition. These individual little bits could be *parceled up* into a larger number of units—like stock-market shares/securities/stocks, call them what you like. For this to work, the units in the parcel, each on separate farms, would have to in total have the same ecological value as the area to be destroyed. A developer, required by law to offset the damage he or she will do, would purchase an appropriate parcel of offset land from a consortium of farmers, or from an offset trader who had acquired parcels from numerous farmers wishing to cash in on the effort they had put into protecting parts of their properties. This would entail a major saving in transactions cost—not each farmer looking for a buyer, or a buyer going farmer to farmer.

If this process is to work, some very smart folk are going to have to be able to value land for its biodiversity value; or, could we rely on market forces to establish a price? Presumably, we should be able to determine the value to the farmer of the land not to be farmed, because this is the opportunity cost of the foregone agricultural product from that land; that is, foregone profits. Now, an economist would claim that in a perfect market the farmer's opportunity cost would equal the price willing to be paid by the person needing to protect the land. Maybe it is, maybe it is not! Whatever the actual case, deals will be done by willing buyers and willing sellers. Notwithstanding how vague this proposition might seem to be, it has enough going for it to be developed fully. It is nothing more or less than a form of *bio-banking*.

Land Deal Offsets at a Global Scale

We have been dealing with cases involving offsets for projects such as dams, mines, tourism resorts, new towns and the like which are projects within our individual countries. We can apply the same principle on a global scale. In a rough and ready way, we do this when we provide money in grants or aid to protect biodiversity in poor countries where it is under serious threat. In fact, the only way that we have of gaining protection of all the Amazon rainforests (only approximately half of the Brazilian part of the forests is protected) is to compensate those who presently earn income, both profits and wages (legal and illegal) from exploiting the forests. This is also the case for virtually all existing biodiverse areas in poor countries. Money can purchase biodiversity. The difficulty is in finding willing contributors to such schemes in a global economic environment in which, with notable exceptions, so many countries have retreated into nationalistic self-interest of the short term variety. While monetizing nature is likely to go against the grain, pragmatism means we should use monetary compensation in the pursuit of global protection of biodiversity. Any philosophical debate is a topic for another time.

Measuring Ecological Health

Moving on from the pragmatic principle of purchasing biodiversity and reverting back to measuring biodiversity where we are not allowing a market price to do the job, should we try to construct an objective measure for levels of biodiversity? Does it matter if we don't? There is a particular circumstance when it does matter and this is when a project proponent is allowed to give money to a government agency in lieu of making the effort to find the parcel of land that will offset the damaged land. In what follows, we are not back discussing calculators, with their multipliers and discount rates.

As a proxy for very high levels of biodiversity, species richness has been relied on. While this measure allows the Great Barrier Reef and the Amazon rainforests to score highly, it does not apply to a healthy, natural Mitchel grass plain, the Alaskan permafrost, the Great Australian Desert (number four in size of world deserts), the Everglades, the Scottish-highlands or New Zealand's Fiordland [New Zealand spelling of *fjord*]. Species are few in these ecosystems, although they are climax communities and resilient. This understanding tempers our attraction to *diversity* as *the* ideal measure.

Is there a notion of ecological health more suitable than species richness? A particular alternative has appeal because it allows substitution of equally healthy ecosystems which do not have to be rich in species.

Ecological health is measured on the ground by ecologists. Comparisons are made by undertaking *ecological* equivalence studies. The idea is to ascertain if there are two or more parcels of, say, spruce forest, which are capable of being deemed equivalent and hence substitutes as offsets. What is being measured is the *bio-condition* of possible substitute areas. The parcels could be scattered and that need not matter, although this will be determined on a case-by-case basis.

In applying the standard bio-condition analysis we use a set of measures, one for each important ecosystem attribute; for example, the cover of dead timber on a forest floor, the density of the tree canopy and the variety of herb species. The importance of each attribute is given by its contribution to an ideal of 100 percent health. For example, dead, decomposing timber is returning nutrients to the soil—and more—but it is likely to be a small contribution to the overall economic health of the area. The art-cum-science in bio-condition analysis, and in ecological equivalence studies, is in choosing the appropriate parameters for, say, ground cover, forb species, age of mature trees and much more, and, applying a weighting of importance to each attribute in the overall 100 percent mark. This is part science—usually the major part—and part art, by the latter I mean educated opinions by botanists and zoologists.

For bio-condition analyses, we are fortunate in those circumstances where benchmarks have already been established for specific ecosystems. This is the case in my homeland, the State of Queensland in Australia. Botanists from the Queensland Herbarium have done this work. By reference to their work, an environmental practitioner will be able to ascertain how close a study area is to a representative ideal, and seek out sites which rank equally. This type of exercise does not allow for an exact apples-to-apples comparison of different ecosystems, rather the practitioner is looking for approximate equivalent areas.

When the task pertains to a very large, complex ecosystem, the issue is different—and near impossible. Martine Maron and colleagues (2016) were given the task of measuring the biodiversity value of the Great Barrier Reef, for the purpose of developing offset measures. Note the statement made by these scientists:

The biodiversity values of the [Reef] are complex, multidimensional, and impossible to quantify and measure holistically.

Their statement is a warning to researchers who entertain developing indices of biodiversity applicable to ecosystems such as rainforests, coral reefs and other complex arrangements. We might ask, why ask for the impossible? The fetish to quantify—and commodify—nature is the root cause. As the responsible experts we have a duty to draw a line at some stage and say *not realistic, Minister* (otherwise, the head of a government authority).

As noted, at present if there is one measure of biodiversity which has near-universal acceptance, it is species richness. Species richness is correlated to resilience in times of stress. It is selected as the measure of the complexity, maturity, resilience and magnitude of the biodiversity of an ecosystem. Yet, this one metric tends to be tautological, unless we explore and come to describe the relationship of the parts. It tells us that complex ecosystems (coral reefs and tropical rainforests) are rich in species, resilient and so forth. Important and interesting as this is, it does not help if our task is to deal with very specific threats to corals, such as run-off of nitrogen from adjacent farms and seek offsets to this damage. Hence, we continue in our search, only to have Martine Maron and colleagues (2016) inform us that in regard to the Great Barrier Reef:

a set of metrics will be fundamentally imprecise and incomplete.

In Conclusion

I realize that I have been quite pessimistic, a disposition by nature I do not have. My pessimism stems in part from my knowledge that even in economics, where the construction of an index of economic well-being has a long history, major inconsistencies, exclusions and flaws render the measure dangerous in lay hands, while not an insurmountable problem for economists. Because economists understand the measure they use, they know how to fix it, and how silly it can be in certain circumstances. There would not be an economist who did not know that the more money we had to spend in cleaning up oil spills, the higher GDP (a generally good outcome)—and think that is not a result to be welcomed.

Nature is complex in a different way to a human-constructed economy, and given that we are struggling to understand one very important characteristic of the natural system, the relationship between greenhouse gases, their sinks and climate, we ought not think we can form anything but crude indices of biodiversity. We have to do what we can with what we have.

On the positive side, I recognize the scope for a developer to seek out a private landholder who just happens to have a similar parcel of land to the parcel the developer can only clear if it can be replaced. A deal might be possible. The comparison of the two blocks of land should be made on the ground by expert botanists and zoologists—recognizing that a perfect fit in the sense of identical twins would be extraordinary good luck.

16

Illustrating Offsets

Introduction

In this chapter we shall explore the practicality of offsetting using various scenarios. While these are not directly based on real-world cases, they mimic ones that are. Following the case studies, we return to a realistic way of achieving results that, if not precise like to like and no net loss, are the best we can do. As an aid to understanding the need to conserve biodiversity, see Box 16.1.

An *Ideal* Case

To illustrate the concept of the ideal case of biodiversity offsetting, let us start with a simple example. The one here is an extension on an earlier one. It plays a role in this chapter as the benchmark for variations on the theme. It is unlikely to be a real-world scenario; yet if it was a possibility, it would be biodiversity offsetting *gold*, as they say. This is the hypothetical situation. There exist, side by side, two equal-sized blocks of mature forest. It does not have to be forest—any climax community will suffice.

T. Hundloe, *Environmental Impact Assessment*, Palgrave Studies in Environmental Policy and Regulation, https://doi.org/10.1007/978-3-030-80942-3_16

Box 16.1 The Value of Ecosystem Diversity

It is necessary to note why we consider biodiversity important and valuable. What is interesting is if you search the literature on why biodiversity is important you will find many references to its value to us, humans. Nothing wrong with that, except that the answers tend to focus on our material or economic well-being, such as a source of potential life-enhancing drugs, potential new agricultural species plus nature's aesthetic value (attracting big-spending eco-tourists).

Here are some examples of common drugs extracted from nature: aspirin from willows; quinine from cinchonine; morphine from the opium poppy; digoxin from foxglove. On the one hand, we are also likely to know of commercial products acquired from nature: timber, wild fruits and vegetables, game meat and skins, wild honey and beeswax, clothing fibers and natural dyes; plant resins and gums; and fish and shellfish. On the other hand, we might not know that in Cameroon approximately 70 percent of the animal protein that people eat comes directly from its natural forests. The protein is sourced from the bush—wild caught animals called bush meat—plus snails, caterpillars and other insects. And we should not overlook Chinese medicine used by herbalists. It is reliant on more than 5000 plant species (as Mindell informs us, 2006, p. 169). One suspects we have only scratched the surfaces in the search for valuable natural products.

With regard to the tourism drawing power of biodiverse natural environments here is a short list: in the USA, the Grand Canyon; in Canada, Banff; in Australia, we cannot go past the Great Barrier Reef; in New Zealand, Fiordland. Nature-based tourism is important to these countries and many others, such as Thailand, Kenya, Tanzania and other sub-Saharan nations. In Australia with more World Heritage-listed natural areas than any other country, tourism is the country's most important job-creating industry. There are various estimates of the economic value of the Great Barrier Reefs as a foreign tourist attraction. None are free from methodological challenges, but let us simply note that billions of dollars are involved. Adjacent to the mid-part of the Great Barrier Reef is its *sister* World Heritage Area, the Wet Tropics Rainforests. This biodiverse ecosystem produces in the order of billion dollars in foreign tourism income annually. We cannot deny the economic value of biodiversity to human societies, and its significant importance to the poorer countries. And, there is biodiversity's intrinsic value which we have no possibility of valuing in terms meaningful to twenty-first-century humans.

However, as we cannot but notice, we are living in, and surrounded by, modified nature, by which I mean changed by humans, commencing from the day we evolved to become the highest order colonizer and predator in the planet's food chain. Yet, with our present global population and demands on the planet, we are living healthy and, in the rich countries, wealthy material lives. That situation is under challenge from climate

(*continued*)

Box 16.1 (continued)

change, human population increase and economic development. If present trends continue, biodiversity will increase in economic and intrinsic ecological value—more of us will rely on it and there will be increasingly less of it.

The crucial point in understanding why we value biodiversity and want to ensure that any losses, which are deemed necessary, are compensated on a *like for like* basis is that the greater the biodiversity—the greater the richness of species, of ecosystems and at the basic level, genes—the more complex a system is, and more stable and resilient is the global system. This resilience is going to be crucial while we continue to put more and more pressure on the natural world. This is our understanding of biodiversity.

One block is privately owned and the owner has the power to do as he or she pleases with it. This is a necessary condition for the example to work. The twin block is held under a government lease which allows the lessee to convert the block to a farm, on the condition that he or she offsets the loss of biodiversity.

Ecological surveys prove (as best as can be proved) that the twin blocks are home to all the same plant and animal species; in each block, each major species is in the same number; all are of the same condition in terms of health, length of life and recruitment capacity. What I am suggesting is that these blocks are as close to like to like as can be determined by on-the-ground research by experts. Because the forests are mature—in other words *climax communities*—there is no expectation of succession. Any evolutionary changes are beyond our ability to predict.

Here is an appropriate place to digress and note that not all life forms evolve at a slow pace. We know that in the case of bacteria we can see evolution at work with the aid of a microscope. Given the role of bacteria in the web of life, we should not disregard their evolutionary change. As ecologist and evolutionary biologist David Mindell (2006, p. 183) maintains, we should be recognise the capability for the rapid evolution of some forms of life and recognize this in our efforts to save biodiversity. This suggests that research needs to be done to identify taxa that are members of species-rich groups which contain potentially rapidly evolving species.

Reverting to our hypothetical example, let us call one area *Block A*, the leased one. The lessee has identified an expected profitable use of the block, an exotic fruit farm, which requires the complete clearing of the block. If the lessee wishes to proceed with the fruit farm development, he/she will need to purchase *Block B*, the privately owned block, and give it to the government, or in some other legal fashion ensure its ongoing existence in its natural state. This arrangement will go ahead if: the owner of Block B is willing to sell; and, at a price which is such that the developer of Block A can enter into the arrangement and still expect to make a profit from the fruit farm. If the deal goes ahead, the government converts Block B into a nature reserve, making it an addition to its protected area estate. Case closed! We now come to more complex scenarios.

A Weed Infestation Example

Let us again assume two neighboring Blocks A and B of equal size: one, A, leased from the government with conditions attached—no development of the block unless it is offset; the other Block, B, privately owned and able to be legally cleared. There is one important difference with this case and the previous ideal case—there is some degradation of the privately owned Block B. It is infested with weeds. This means its biodiversity value is less than Block A, which is in prime biodiversity condition. A like for like situation does not exist—yet. Work will be required on Block B if it is to be purchased by the developer and given to the government to become a protected area.

If Block B is cleared of weeds, it would soon—how soon is very important—revert to the prime ecological condition of Block A. If the lessee of Block A seeks to bulldoze his or her block for development, he or she could purchase Block B—at a lesser price than the Block B referred to previously, which was in prime condition—and hire a *green army* for a few days or weeks to eradicate the weeds. Block B will eventually come to resemble Block A—confirmed by ecologists checking the beta-diversity.

Does the government authorize the clearing of Block A? How does it take into account the delay in Block B reaching prime condition? I have argued against the practice of using so-called multipliers and discounting to deal with time lags in restoration. However, if these approaches were taken, a much larger area than Block B would be required as the offset. Yet, relatively minor ecological restoration should not require an addition to Block B. Rather than adding a given amount of prime biodiverse land to Block B (i.e., Block B + small Block C), the more likely solution in the case of its weed infestation is restoration of Block B. Recovery from weed eradication should be fairly quick and maybe nothing else is required. Ensuring that it took place sometime before Block A was destroyed for development would be a prerequisite, thus allowing time for recovery. This would be essential if animals were to be relocated and, obviously, need food and habitat immediately.

A Not-Quite *like for like* Case: Pig-Rooting Example

I have chosen feral pigs as an example of large animals which can do substantial damage to pristine environments. You can substitute any other troublesome species. Damage done to natural ecosystems by feral pigs is much worse than weed infestation. We can construct a scenario much like the weed one using pigs as the cause of disturbance to Block B. As with weed eradication, there are means of restoring the block, ridding the area of pigs and fencing the area, keeping it free of pigs. Depending on the damage done by the pigs, there will be a delay before Block B is in a similar natural state to Block A. Should the government authorize an offset agreement in this circumstance? How is the delay in Block B reaching prime condition dealt with? Again, restoration will not take long. Maybe the short delay in reaching an approximate like for like state means no further intervention; it will need to be accomplished before the bulldozers roll into Block A.

So far we have dealt with easy cases. What is the situation if a large block of land in its natural condition is to be completely destroyed and there is no equal-sized block with the same biodiversity characteristics nearby? We will come to the matter of the importance or not of geographical separation below. Put it aside in the first instance.

Hard Cases

To make the case a realistic possibility, there exists in a littoral zone in a large bay extensive mangrove forests. The bay supports a high-value commercial fishery. The mangroves play a vital role in the life cycle of the fish species. A large city sits relatively close to the bay. It has an international airport. Increasing passenger numbers and a very significant increase in demand in overseas markets for live fish necessitate a major expansion of the runway and the airport infrastructure. If the expansion does not occur, the high-value seafood trade will not continue to increase and the seafood otherwise exported at high prices will have to be sold on the domestic market for a much lower price—the seafood is not favored by domestic consumers.

The airport expansion would cut into the mangrove forests. A considerable area would be cleared completely. Let us assume the area amounts to 20 percent of the existing mangrove forest in the bay. Furthermore, let us, for the sake of the case, assume that reduction in mangroves results in a 20 percent decline in seafood harvests. Yes, we can quibble about the correlation; that is, the science—or lack of science—behind that assumption. I have searched the literature and not found an agreed quantifiable relationship between mangrove stands and seafood harvests. However, this is simply an example, loosely based on an actual case, to illustrate a point about time lags—and nothing else.

We know that mangroves re-establish themselves naturally, and that we can plant them in appropriate areas and they will eventually establish a productive, sustainable mangrove ecosystem. That will take many years. While we can make a reasonable assumption of the time span involved, all that matters for our case is that it is a substantial period of time to reach maturity. In a mangrove area I know well, Moreton Bay, Queensland (an extensive mangrove area associated with important commercial seafoods such as shrimps and crabs), replanted mangroves will flower in 4 to 5 years and result in a self-maintaining community at that stage of their lives, but it takes 12 years for the trees to reach two to three meters in height (Saenger, 1996).

Reverting to the illustrative example, there happens to be littoral-zone land in the bay which in the past was a part of the natural ecosystem but now cleared of mangroves. We know that this area could be restored by planting-out nursery-grown mangrove trees. Assuming that we commenced planting mangroves on this land near to the airport extension the same day that we cleared the first mangroves for the expansion, the seafood harvest would be immediately reduced, and there would a significant period of time in which the seafood harvest remained reduced. It would be a matter of years (possible the 12 referred to above) before the planted mangroves reached maturity and played their important role in the marine ecosystem.

The number of years with a reduced harvest would be more than enough time to do economic damage. Let us assume, again to make the story simple, that because our commercial fishers can no longer meet the growing overseas demand for live seafood products, this lucrative market is lost to them. The economic cost of the loss of mangroves is substantial.

In this case, only after many years does the local ecosystem revert to a near like for like situation, and if the fishery still existed, we would return to a *no net loss* case. While that is true from an ecological perspective, it is not from an economic one, given the loss of a valuable overseas market which is now sourcing its live seafood from the Solomon Islands. What could have been done, if anything, to prevent this outcome? The airport owners could increase the charge to the airlines to the extent that the fishers were compensated for their monetary loss. That approach is reasonably common when an industry is put out of business. It does nothing for the loss of biodiversity. However, there are other approaches available. To these we turn.

To achieve a no net loss economic outcome, we would require that as one mature mangrove tree was felled, an equally mature one took its place. This suggests smart planning. What is called bio-banking could have solved the issue—planting mangrove forests well in advance of the airport construction; or providing incentives to private landholders with mangrove forests on their land to conserve the mangroves. Here I am deliberately overlooking the likelihood of legal protection for mangroves and assuming for illustrative effect that the mangroves on private land could be felled legally. The idea of bio-banking (described by different terms in various jurisdictions) is a feature of SEA.

If a suitable area of bio-banked mangroves already existed, the proponent of the airport expansion could purchase it immediately as the offset. Ask yourself, what if the bio-banked mangrove stands were not adjacent but some 500 miles away from the airport. The particular fishery would not be saved.

Bio-banking

It is appropriate here to digress and comment on bio-banking. Bio-banking promises solutions and for that we are pleased. However, if I put on my economist's hat, I suggest that there is a long way to go before we have a robust, competitive market in bio-banked land for biodiversity offsets. This does not rule bio-banking out. There are those working to make it happen. There is nothing wrong with the concept in theory—just as there is nothing wrong in theory with *eco-taxes* including *carbon taxes!* And there is nothing wrong with international trade given robust markets for environmental goods and services. We are someway from any of these pro-environment situations. The few existing bio-banking markets are what economists call *thin*; that is, too few participants to settle on stable prices for whatever is being traded. I have, over many years, witnessed considerable interest developed in *economic environmental instruments*, as they are called, only to see interest wane and, in some cases, collapse—the markets are too thin, they are subject to radical changes in government policies and there is little confidence in them by both buyers and sellers.

There is nothing new in the concept of holding land for a future use, which is what bio-banking is. Here, I shall expand on points I have discussed in an earlier chapter. The one situation where private developers are willing to purchase and hold land for lengthy periods is for real estate development. In this industry there is the expertise required to make relatively smart predictions as to locations and the time when residential, commercial and industrial lands will be needed in the future. On this basis, a real estate developer might purchase land relatively cheaply and sit on it. These experts tend to have the skill to judge the cost of holding land; however, there have been a few spectacular bankruptcies due to getting it wrong. Reliable crystal balls are very scarce.

It is not only real estate developers who are competent in holding land for its (distant) future use. Governments are very competent—well, some are, sometimes—at setting aside land for future needs. In fact, governments can—and we expect them to—look far into the future and make decisions to hold land based on forecasted population growth and shifts in population. What governments do based on predictions is quarantine land from immediate development. This will be done for future schools, hospitals, roads, rail lines and other public infrastructure. Quarry sources are also quarantined. Governments should do this for biodiversity offsetting. This makes biodiversity offsetting via biodiversity-banking a land-use planning exercise, rather than a catch-up scurry when a developer (who, e.g., could be involved in urban development or mining) drives the dozer in. As discussed previously, the approach being discussed is pure SEA. It is the thinking behind the New Zealand land use-cum-EIA law. The theory is laudable, the practice yet to prove its worth.

An interesting example of the approach of quarantining areas for potential future was the case when the boundaries for the Great Barrier Reef Marine Park (a World Heritage-listed area) were being drawn. The most senior official in the Queensland government (the Coordinator General) identified all possible port developments along the adjacent coast, and these areas were excluded from the protected area. He could foresee major political disputes if it became necessary to construct ports in these locations, and they happened to be in a World Heritage area. I was the Great Barrier Reef Marine Park Authority's designated *Marine Park Planner* at the time and a witness to the decision to exclude the potential port areas.

The Matter of Distant Offset Sites

In the above examples of offsetting, we have made the situations relatively easy to conceptualize. It is very unlikely that we will have such simple cases to deal with. Now that the general principles have been spelled out and examples worked through, we can truncate the discussion on other—more than likely—scenarios. The first is where like for like can take us far afield in search of land.

Let us separate Block A and Block B—the original one with no degradation—by some distance from the other. The following are completely hypothetical situations. I use them because I expect that you will be able to conceptualize the type of ecosystems involved.

Let us assume Block A is a private rainforest block bordering the Daintree River, at Cape Tribulation, and just outside the Wet Tropics World Heritage Area of northern Australia, and Block B is again on private property and rainforest, also adjacent to the same World Heritage Area but on the Atherton Tablelands. The distance between the two blocks approaches 120 miles.

Does this distance negate the like for like criterion if, as far as we can ascertain, each block has the same vines (strong enough for Tarzan, with Jane in his arms, to swing among the giant trees), the same number of nine-foot snakes, the same leaf-littered forest floor with thousands of creepy-crawlies—I guess you get the picture? If Block A was to be cleared for a banana farm, would Block B amount to an appropriate offset? Is distance not a problem because the two blocks are in the same regional ecosystem—both are tropical rainforests with not identical but virtually all the same plants and animals, and both border the same World Heritage Area?

Let us construct a case where the distance between Blocks A and B is very significant, much more than 120 miles. Much of the undeveloped parts of the Australian coast include patches of mangrove forests in the littoral zone. For the sake of the exercise let us assume that there are mangroves on two privately owned blocks, as for the rainforest example. One block in private ownership has no constraints on clearing it and that is what could happen if it is not purchased as an offset. Let us assume the other block can only be cleared if it is offset. The blocks are 1200 miles apart; the fisheries that they provide ecosystem services to are very different in terms of species. Would we authorize this exchange as a biodiversity offset?

We could complicate the matter further by assuming the two areas are in different States/Provinces, with different rules on offsetting. However, that is not our immediate interest. We could compare the relative economic value of the fish species caught in the vicinity of the two marine areas—disregarding that they are different species. If we found that in substituting one area of mangroves for another there was no economic loss from the different fish harvests, would that satisfy us?

The discussion so far has been on ecosystems, not individual species. Admittedly, we cannot divorce plants and animals from their ecosystems. However, many of our valued, threatened or endangered animals and plants exist in modified environments, and hence we are not searching for pristine environments as replacement for their habitat if it is destroyed. In terms of like for like offsetting of an animal or a plant, we will search for the appropriate environment to relocate the species.

With both plants and animals we face the question of the feasibility of translocation. It is easy to become somewhat unconcerned about this matter. For example, in the case of Australia, kangaroos, possums and a large variety of birds, including scrub turkeys, relocate themselves to where we provide their preferred food. We might also be unconcerned with translocating plants given our success as gardeners. This was not always the case, as when the first British arrived in Australia, they struggled to get their preferred plants to grow in the soils of a very old, weathered continent.

Translocating is not always as simple as sending a few Australian possums to New Zealand and watching a population explosion. It is very much a species-by-species situation. If we know from experience that translocation is possible—with a very high success rate—relocation will be the solution, as long as we can acquire the suitable ecosystem. Experience of success is the key here, as with many other things. I note that arguments about success rates are not uncommon, which suggests success is variable and comparisons can falter on the reliance of different measures.

Let us commence with an endangered animal, a bird, whose habitat is to be destroyed by an open-cut coal mine—nothing like a bit of controversy to keep you interested. Admittedly, Australian readers and others who have an eye to environmental controversies are most likely to guess the name of the bird as well as that of the prospective miner. Adjoining the block to be mined—on a neighboring property—is habitat in a similar ecological condition to that inhabited by the bird. We would expect that the same number of these birds, per square mile, to be living on this block as on the one that will be destroyed. That would cause an immediate over-population problem if relocation to the neighboring block is attempted. Yet, it is possible that the first thing that enters the head of the miner is to purchase the neighboring block and believe that the animal can simply move next door, so to speak. The animal finding its home being demolished will look over the fence and notice *the grass is greener* and seek to move there, notwithstanding the fact that its prospective new home is not *terra nullius (unoccupied)*.

Prima facie, moving homes seems reasonable enough—not much of a problem to fly into the new home. The animal commences to do that as its home is bulldozed—only to find that its prospective new home is occupied by members of the same species. There is no spare room. What you would have in this case is two identical populations competing for the same, limited food source and the same limited habitat. Regardless of how the competition takes place, the end result is a surviving population of exactly the same size as one of the original populations, not the much larger combined two original populations. Hence, this option is not viable.

Let us construct a viable option. We have the same block of land with vegetation to be destroyed by a mining operation and a neighboring block of the same size. Now, for a crucial difference. The neighbor's block is much more heavily grazed by beef cattle than the mining site block—the cattle herd has destroyed much of the food source of the endangered animal (a special grass seed), hence, there no longer is a maximum population of the bird on this property.

The prospective miner could, on expert advice, determine that this neighboring block would be a like for like home for the bird if the trampling and grazing were reduced to the much lower level, as on the animal's original home. In this circumstance, the miner could purchase the block next door and restore its ecological condition by reducing the cattle stocking rate. Rather than purchase the neighbor's land, the miner could enter into a financial agreement with the neighbor who undertakes to run less cattle and let the animal's habitat re-establish itself. The neighbor is compensated on an annual basis for the income foregone due to running less animals.

In either case there would be some time lag involved before the displaced animal could move into its new home. The ideal situation would be to think through this proposition well in advance of the mining taking place and have the adjacent block ready for its new family of birds as soon as it is needed. This we could call an *advance* or *strategic* offset, settled on in undertaking a SEA for the regional mining industry.

Advance Offsetting: The Solution to Time Lags

While biodiversity policies encourage *advance offsets*, they are not mandatory in most jurisdictions around the world. Yet they are the only viable solution to the time lag problem. American environmental lawyer, David Takacs (2017), illustrates the application in the USA. He gives the example of the US environmental organization, Wildlands, anticipating a building boom around the Californian capital. It purchased 3960 acres of derelict farmland and restored it, on the expectation that restored it would attract endangered animals and be sought after by urban developers needing to offset the destruction of habitat caused by construction of residential estates. What this process empathizes is the need for foresight and the willingness to make an investment in anticipation of demand. This is what advanced offsetting is about. It could—should—have been applied in the situation of the endangered bird I was referring to above. If you have not guessed, it is the case of Adani *versus the Black-throated Finch.*

A small number of facts are necessary background. In the first instance note there was a considerable time span—nine years—between when the Adani company first purchased the mining lease and commenced the approval process in 2010, to the conditional approval for mining being given in 2019. In 2011, the mining proposal was declared a *controlled action* by the Commonwealth government, giving it high status and requiring detailed oversight and an EIA. At the end 2012, the EIA was submitted to both the Commonwealth and Queensland governments.

One could rightly assume that by then—in fact, before—the company would have known it had a major matter in offsetting the loss of habitat for the endangered black-throated finch. The time to act on securing a new home for the birds was very early in the process.

It was not until nearly halfway through 2019 that the Queensland government (reluctantly, one should assume) signed off on an offset plan for this endangered bird. However, note that the plan is not a guaranteed outcome. One could think that well before 2019, considerable progress could have been made in ensuring that enough suitable habitat was available for the finch to establish a new home. Years passed by and, on the available evidence, it appears nothing of substance was done to establish a suitable restored habitat.

The first task would have been to seek to identify adjacent land which was not presently finch habitat due to grazing pressure but was otherwise suitable as habitat. Maybe this type of land was available, maybe not, but if it was, the land could have been purchased some years ago; and, if necessary, restored. If the land was not purchased, an agreement could have been sought with a neighbor to restore sufficient land and reduce its cattle stocking rate to that compatible with the needs of the finch. Either of these approaches would have been proof of good intentions of the mining company. Be mindful that the Adani company illustrated that it was willing to spend money in advance of obtaining permission to mine. It bought the lease of the pastoral property on which mining will occur. Shortage of money would not have been a problem.

Had restoration commenced on suitable land soon after the finch population was identified on the site of the proposed mine, that is, many years before 2019, by this date, the finches could have been relocated and living happily in their new home. The mining company and its supporters blame *green tape* for the long time it took to get approval for the mine. However, in as much as offset habitat for the finch was the cause of the delay, the solution was always in the company's hands. It did not take the opportunity of the considerable time available to secure an offset.

The possible solution I have outlined is based on locating suitable neighboring land—finch habitat without an existing finch population because of a lack of suitable grass seed as food due to cattle grazing. Maybe there was no land of this kind to be found. If so, the public was not told. In fact, in the publicly released EIA, readers were informed that finch offsets on neighboring properties were being investigated, but nothing of substance was revealed. For reasons incomprehensible, the identities of grazing properties were redacted. My map of Australia grazing properties lists them by name, and a search of a telephone directory identifies the owners or managers of each property. I rang one owner and engaged in an interesting discussion. As confidentiality was guaranteed, I must leave it at that.

As it eventuated, the public was eventually informed that the Adani company *discovered* that it had land, which would not be disturbed by mining, on its own ex-grazing property and this would be suitable to accommodate the finches when they had to relocate as a massive mine was dug in the ground. However, considerable restoration of this land will be required. The company has promised that the restoration will occur. Maybe it will work. It remains a mystery why Adani originally considered neighboring properties as offsets—as it did—if all along it had the solution in its own hands. This is just one of many mysteries involving the Adani coal-mine case.

I have written elsewhere (Hundloe, 2018) that if the offsetting of the black-throated finch fails, this is likely to bring an end to—in Australia at least—biodiversity offsetting. There is no other biodiversity offsetting case to have received as much publicity as this one. And no other mining project in Australia's history is being as closely watched by the public as the Adani mine. As noted previously, it is interesting to note that in 2020, the Adani company changed its name in Australia to *Bravus.* This caused some mirth by Latin scholars as Bravus has nothing to do with being brave as the company public relations gurus thought—no one studies Latin at high school as was the case in my day. The word, if anything, means *crooked* or *barbarian.*

The finch case raises another issue which is the relationship, or lack thereof, between endangered species laws and developments which threaten such species. One could argue that there should be no conflict, because protecting endangered species is expected to trump all else. Takacs (2017) puts the argument thus:

Engendered species laws exist for a reason.

The inference is: protect the species, only when that is accomplished should a development be considered. One would expect that the onus of proof that the animal or plant is safe must fall on a developer.

Dollars and Pounds as Offsets!

I have introduced, and paid some attention, to the matter of commodifying nature. Here, I shall go to a real-world situation. But first I need to make the point that biodiversity offsetting is a failure when money is a substitute for a like for like replacement environment. What I am referring to here is the practice of allowing developers to donate money to a government agency in lieu of finding a suitable area of land to compensate for the area lost. I realize that in some jurisdictions, government laws and policies allow for monetary compensation as a substitute for actual offsets and, hence, governments could claim that substituting cash for country is not a failure. I disagree.

There are a number of reasons to argue against monetary compensation in place of actual habitats being secured. One is that the concept sends the wrong message. It indicates to those who cause environmental damage that they need not engage in a serious search for an offset. Paying money into a government trust fund is relinquishing responsibility, and simply passing the task to find an offset on to the government. Taxpayers bear the cost of that search, and if public servants fail to find a suitable substitute, it is too late for the environment which has been allowed to be bulldozed.

It is not necessarily an easy job to locate and secure a specific offset. As Mark Twain is believed to have said about land, we can say about biodiversity: *they're not making it any more.* Hence, what we have left of biodiversity is very valuable and as we chip away at the edges because our population growth demands more urban and agricultural land as well as mines, what remains becomes ever more valuable. There are occasions where the most basic principles of economics have great value—the law of demand and supply is set to favor the environment in terms of arable land, clean water, un-polluted air and biodiversity.

If a near substitute cannot be found for a particular environment, or a habitat for an animal or plant, we are no longer in the biodiversity offsetting business, rather we face an ethical and economic problem. I have already labored the ethical dilemma, now consider an economic one. Do we sacrifice a particular natural environment (or animal or plant) and take a little of the developer's money instead? From a purely self-interested perspective, we might be the ultimate losers. For example, there is a prospect that something valuable will be discovered in a natural environment, say, a life-saving drug. As I was writing this book, billions of dollars are being spent in the search for life-saving drugs.

If we take the developer's money what we do with it? The theory is that it is used to purchase biodiversity *assets*—assets being another economic term creeping into our biodiversity discourse. Recall the principle of no net loss. Do we get enough money to purchase a large piece of pristine land, if that is what is required? If we obtain enough money, and the land purchased is in the pristine northern territories of Canada, the fjords of New Zealand or an untouched part of north-east Tasmania, does it in biodiversity terms equal hundreds of small patches of cleared koala country in Queensland? This is the sort of question which needs to be answered before allowing monetary compensation. I am going to assume that we will not take money to compensate for the extinction of the American bald eagle, the Australia koala or the New Zealand maui dolphin. My question is where do we draw the line?

Do not misunderstand my position. I am not arguing against valuing ecosystem goods and services in monetary terms. Where that is possible and the values are robust, there is a pragmatic reason to do so, because if we do not use dollar values, we will sacrifice valuable environments to developers. I can comment on this matter with a degree of confidence as putting a price on ecosystem goods and services has been a major part of my professional work, wearing my economist's hat (see Box 16.2).

When a government agency accepts money in lieu of a genuine nature-based offset, there is an assumption that the agency will pool the donated monies and, when a large enough sum exists, purchase a significant area of land to declare a national park. However, before the money is accepted, the responsible government agency should be required—one could argue, be obliged—to show the public how monetary payments meet the offset

Box 16.2 Environmental Economics Can Be Beneficial

Back in the late 1960s, the Great Barrier Reef which was going to by pimple-spotted with oil rigs until two University of Queensland economists convinced a Royal Commission (established to examine oil extraction) that the probability of discovering oil and making a fortune was very low. Tourism was by far the better option—as has been proven. Of course, the economic analysis was only part of the case to save the Reef. The campaigning by Judith Wright and John Busst, and the efforts of Eddie Hegerl and colleagues from the Australian Littoral Society, were the reasons we had the Royal Commission in the first place. As with the Reef, the same economic arguments, in combination with extremely strong ecological evidence of biodiversity value, saved both Fraser Island and the Wet Tropics Rainforests. These three are the best-known World Heritage Areas in Australia. Economics in highly skilled hands is a very powerful tool.

criteria; that is, how the pooled money will be spent to achieve no net loss on as close as possible a like to like biodiversity offset. This step in the process is missing. I remind Australian readers—however, the concept is of universal interest—of Moss Cass's comment when he presented the rationale for EIA: no more, not in the future, would the public be in the dark when environmentally important projects were proposed; people would be presented with *all* relevant information. How damage, not able to be mitigated, is proposed to be offset is the very sort of basic information the public has the right to know.

Monetary Offsetting in Practice

I have selected the Australian state of Queensland to illustrate the extent to which developers are paying money to a government fund rather than providing on-the-ground offsets. The Queensland government is quite transparent in its biodiversity offsetting practices in terms of who is paying the money into its offsets trust account. The development proponent, the project and the sum of money are all recorded and open to public scrutiny. This is praiseworthy.

I have undertaken an elementary analysis of 132 offset payments, amounting to just over A$36 million—neither a small nor a large sum. However, there is one significant amount, which when subtracted, reduces the total to A$12 million. This amount of A$24 million was from a major mining company. The smallest amount paid into the trust fund was A$540. Nearly half of the payments were under A$20,000, and more than one-third were under A$10,000 (46 under A$10,000 and 63 between A$10,000 and A$20,000). The average payment, excluding the mine project, was approximately A$92,000.

The type of projects for which offset money has been provided is interesting reading. Road upgrades and other minor road works, boat ramp construction or upgrades, dredging and one major plus a number of small mine-related projects comprise the vast majority of the projects. Clearly, minor works such as building a boat ramp and upgrading a road are going to have only small, local negative impacts—some during construction and others permanent such as the removal of a handful of trees.

The nature of these small, local impacts raises the question; why could not the developer plant a few nursery-grown trees as close as possible to where ones were removed? Maybe that is all that is required as an offset. This is making small-scale offsetting seem simple. An appropriate parcel of land has to be nearby for this to be feasible, and maybe it is not; more than trees might have been lost and, even if not a large number, some creatures will have lost or experienced degraded habitat. Nothing is simple in the offsetting business. Yet is the payment of money a better environmental result than looking hard for a local on-the-ground offset? What is more in line with like for like?

In Conclusion

You will have gained the impression that if we seek genuine biodiversity offsetting based on *guaranteed* no net loss and like for like we must, first, adopt SEA; and, second locate and quarantine as much land as deemed necessary to offset predicted developments. Land will be identified by forward-looking governments and businesses; acquired, and, set aside for important future infrastructure needs, such as freeways, dams, hospitals, schools, and for environmental offsets. There is nothing new or radical in this approach—except it has not been applied to environmental offsets. It is sound land-use planning. As noted previously, SEA is environmental planning—and planning is about influencing the future with a well-considered end in mind.

This concept is supported in the joint report by an international conservation body linked to an industry body (IUCN-ICCM, 2014). This gives us reason to believe it is thought possible by the key parties. I close with its take-home message:

> *For both human and ecological reasons, it is ideal to put offsets in place before impacts occur.*

All very simple!

Part IV

What Is to Be Done?

17

Faults to Fix in the EIA Game

There's a culture of approving everything
—Australian Green Senator Larissa Waters
There is much concern over the standard of science during the process of EIA.
—Ecological Society of Australia

Introduction

After 50 years of EIA, has there been a noticeable improvement in how we manage our relationship with the environment? In other words, what condition would the environment be in without EIA? This question is impossible to answer with satisfactory precision. The only way of making sense of this counterfactual would be to run forward to the present-day a *business-as-usual* scenario over the past five decades. While that would be a fascinating task, I am afraid I have not at my disposal the intellectual capacity or the time to undertake that task. Maybe there is something quite less ambitious we could attempt. At this stage, I shan't consider that possibility, leaving it for another day. Yet, we have the results of an

T. Hundloe, *Environmental Impact Assessment*, Palgrave Studies in Environmental Policy and Regulation, https://doi.org/10.1007/978-3-030-80942-3_17

analysis which will, in the interim, help us think about how EIA has made a difference and where there are problems.

I rely on an analysis undertaken in Australia, because there is not another study of comparable utility undertaken elsewhere that suits my purpose. Much of what we learn about Australian experience applies to other countries. The most comprehensive analyses of NEPA-based EIAs are undertaken by the US Council on Environmental Quality. Its reports are a *must read* for EIA practitioners.

Has EIA Resulted in Better Decisions?

The Australian analysis indicates close to 100 percent (in fact, 96.2 percent) of projects subject to EIA over a recent 15-year period had conditions attached to their approval. One could surmise that pre-EIA, these projects would have been approved without conditions—for the obvious reason that their environmental inadequacies would not have been detected. Without EIA we would not have known much about the projects, certainly not about their environmental pros and cons. This is because they would not have been considered, researched and, importantly, made public. On this basis alone, EIA has meant undoubted progress. We are far better informed than was the case of pre-EIA. Providing the public with details and assessments of projects, and the right to formally evaluate EIAs and provide comments on them, has given the interested public a role in environmental decision-making never had before.

An environmental lawyer who has devoted much time to involvement with EIA—in court and in research—Chris McGrath has stated with regard to the Australian application of EIA, as it has been since 1999 incorporated in the EPBC Act:

If you took it away, things would definitely be worse.

Pay attention to EIAs on a global scale and one finds a dramatic change in comparison to the pre-EIA state of affairs. In random scrutiny of conditions applied to projects undergoing environmental assessment, we find a range of conditions applied, from modification of design, alteration of size, land restoration guaranteed by developers' *clean-up* bonds, offset requirements, plus, in some cases, employment favoring indigenous people. On this basis, we would claim that EIA has been a success. Yet, as we have illustrated in the previous chapters, there are obvious shortcomings—some of which are serious enough to call for very significant changes. Before detailing these, it is worth reverting to the Australian study. For this I rely on analysis and reporting by *The Guardian* (12/8/2015, Australian edition).

This newspaper obtained from the Australian Commonwealth department, responsible for administering the EPBC Act, data on projects subject to EIAs over a 15-year period commencing from July 16, 2000. A total of 824 projects required EIAs over the 15-year period. This is a substantial number of cases, certainly enough to argue that it is a credible, representative study. Of that number of development projects, only 2.2 percent were rejected. A smaller percentage, 1.6 percent, were accepted without conditions being attached, leaving the remaining 96.2 percent approved with conditions applied. One could assume this very high approval rate is what Senator Waters (see introductory quote) had in mind with her comment on an approval culture. The study does not address the Senator's issue—something which would be very difficult to do. A quote reported in the study, made by a former staff member of the Commonwealth environment department, identifies two fundamental problems. One pertains to the ethics of EIA practitioners. The other to the expertise of the government officials who are responsible for the oversight of the EIA process. Here are the official's words:

> *A lot comes down to the* ethics *of the [EIA] consultant. Some behave more ethically than others, who are put under pressure to tell a story the proponents want to tell. [Environment] Department people are generally junior public servants who sit in Canberra and never go to the places they are assessing. They can have the wool pulled over their eyes.*

The question of competence harks back to the concern raised by Ecological Society of Australia (expressed in the quote at the start of this chapter). Let us consider that issue. We will discover that the major concern here is the perverse incentive entrenched in the existing EIA model.

The Issue of Ethical Practice and a Perverse Incentive

From the very early days of EIA, there have been those who have warned that the EIA model, where the project proponent selects his or her preferred consultant and pays that consultant to undertake the EIA and write the EIS, is flawed. This approach puts the environmental consultant in a very awkward situation—particularly, if the consultant is in line to undertake further work for the proponent if its project is approved. The argument is that this situation provides a very strong incentive to prepare a favorable EIA for the proponent, one that will get approval for the project. That noted, there are not on the public record instances of this being reported. Anyway, it would be hard to prove, other than through circumstantial evidence. This does not mean it is not happening.

We do have evidence of the quality of EIAs. Where sub-substandard EIAs are likely to be identified are in court cases in which they are subject to scrutiny by independent experts. Court cases pertaining to EIAs happen in the USA, Canada, Australia and New Zealand to name four of a number of countries. It is not clear who is to blame for the poor quality of the EIAs—the consultant, the governmental officials who write the terms of reference or the government officials who have to scrutinize the EIA and either approve as is, require amendments, or reject it. Setting the terms of reference based on analyzing need is essential.

A problem with the present practice is that, in the eyes of critics, there is a question of perceived bias—something very difficult to deal with. The politicians' *pub test* applies—what would a group of drinkers at the bar in a local hotel yarning away say about the incentive to favor the client! This perceived bias is unlikely to be an issue if it is known that the environmental consultant is not seeking follow-up work with a proponent. In the early days, when EIAs tended to be prepared by large engineering firms with a newly formed environment business attached, it was thought by critics of the EIA model that the firm was angling for the major engineering work on the project, once it was approved. The nature of the environmental consulting business has changed in recent years. Today, the environment profession constitutes a multitude of large and small environmental consulting firms, some sole traders. There are many environmental professionals in the large specialist consulting firms, and the individuals are committed to professional ethics. This change in the consulting business is a positive outcome.

The people who were, and remain, concerned with the existing EIA model have suggested alternative models where the responsibility to undertake EIA work is put in the hands of an independent research organization. This organization would manage the process, while engaging individual experts as part of EIA teams. To think of this in Australian circumstances, it is not unexpected that CSIRO has been nominated for that task. A somewhat similar approach, which has been in existence in Canada for some time is the appointment of independent review panels to undertake EIAs. They can draw on outside experts when required.

Under these models, a project proponent, or a government if a Canadian-style review panel, would pay the independent body to manage the EIA. This model is certainly a feasible option. One would imagine that it would be opposed by the large consulting firms. The model would not have any adverse impact on the business of the small firms and sole traders who obtain their work as sub-consultants. A compromise solution would be to have a government's environmental department select an EIA consulting firm for each project through a tendering process. The selected firm would report directly to the government department, but the cost would be met by the project proponent. This has considerable merit but would need appropriately qualified staff in the government organization to handle the process and, as is the case with specialist government-owned and -funded research institutions, would need to be beyond political interference.

Whether or not a radical change is required depends on the degree of trust in the existing system. The obvious evidence of a lack of trust in the present process is the number of legal challenges, and the discovery of significant faults in EIAs. We have noted this with regard to the gross exaggeration of jobs to be created by the Adani coal mine in northern Australia. It would not take too many faults of this notoriety to do serious damage to the existing EIA model. While I have relied on the experience in Australia, one needs to do no more than peruse the large number of legal challenges to EIA in the USA to recognize we face a common problem.

Ethics as an Individual Matter

The matter of ethics ultimately rests in the hands of individuals regardless for whom they work. Professional organizations (in the Australian and New Zealand context, there is the EIANZ, and in the American context, there is the Institute of Professional Environmental Practice) have a crucial role to play, particularly in promoting and, if necessary, enforcing a code of ethics. However, there remains the issue that at present not all environmental practitioners are members of a professional body and, hence, bound by its ethics. This is not to assert that professionals outside of a professional association are in any manner not ethical, but what this situation leaves open is the perception that this might be the case. Being a member of a recognized professional body provides a safeguard for quality, particularly if any deviation from accepted practice means expulsion and no work in the profession.

Fundamentally, it should not need an organization to instill in environmental practitioners an ethical code of practice. The future environmental practitioner should, as does the future medical practitioner, be introduced to a universal code of practice when entering into study for his or her professional qualification. Medicine is fortunate that an ancient Greek philosopher-cum-scientist was wise enough to comprehend the over-riding ethical importance of a code of medical ethics. I refer to the Hippocratic Oath. In modern times, this oath has been updated by the World Medical Association and is now recognized in the revised version of the Declaration of Geneva, first agreed to in 1948.

The original medical tradition was that the ethical oath was administered at the graduation of a medical student, or when the graduate was certified to practice. This practice is not followed today. Notwithstanding that, a medical student on entering university is made aware of the modern version of the Hippocratic Oath, and this remains the guiding principle throughout the person's career. It has served humanity well and can be expected to continue to do so. This ethical stance has elevated medical practitioners to the top of the scale of trusted people.

Our medical doctors look after our well-being. Who but the folk I named, some years ago, Earth Doctors are responsible for the well-being of the planet! They need to find a way to gain the trust of the public. The media makes this task hard as it plays on environmental controversies, for example, treating climate change *deniers* on an equal footing with climatologists. Not that I am arguing that deniers be denied their say—like all people, they are entitled to free speech—but rather their voice needs to be proportional to their knowledge. There are numerous other examples of the media *feeding* controversy, for either ideological reasons or simple financial ones—controversy sells; or as is said of the media *if it bleeds, it leads.*

The Australian Commonwealth Environment Department public servant quoted above drew attention to the ability of proponents to *pull the wool over the eyes* of those overseeing EIAs. This is a major worry. It can only happen if those being blinkered have not had the appropriate training in their degree. Furthermore, only if the relevant staff are adequately qualified and backed up by a professional body will this problem be overcome. Imagine if it was being reported that medical doctors in hospitals were not senior enough and suitably trained to operate. The media would have a field day. The public would be seriously alarmed. Politicians would likely lose their jobs for allowing this to happen.

Adequate and appropriate training is in the hands of the universities, and needs to be guided by the profession and independent experts. How should we train those who are involved in the various stages of EIA?

The EIA Team

As a general rule there will be two major types of environmental practitioners engaged in EIA work. There will be a well-qualified generalist and equally well-qualified specialists. The generalists will be those who manage the development of the terms of reference for an EIA, who oversee all its stages of preparation, including the writing of an EIS if this is a separate document, and who assess the EIS/EIA when it is submitted to a government body.

The specialists will be called upon to undertake the various elements of the EIA. The specific specialties appointed will be determined by the nature of the project; however, in all cases there will be ecologists, and probably a number of sub-specialists in this field; most likely, engineers specialized in the appropriate field (e.g., civil, mining or chemical engineering); an economist with appropriate expertise; at least one sociologist-cum-demographer and a climatologist. Depending very much on the nature of the project, there will be other specialists. For example, for mining projects, there will be a geologist, a hydrologist and a restoration ecologist, plus a range of others. For a port development, we would add a marine ecologist to the team of engineers, eco-toxicologists, transport economists and others. For a major agricultural project, there would be included an agronomist, a soil scientist, an analytical chemist and an agricultural economist. For a freeway there would be added a noise specialist to the team of civil engineers, transport economists, ecologists and town planners. For a major tourism project, there would be an economist with a background in tourism, plus engineers, architects and town planners. In certain situations, an anthropologist would be required. In addition, there could be specialists involved in laboratory analyses of water and soil samples, plus anything else that cannot be analyzed in the field.

Both desk work and fieldwork will be required for any EIA. I was greatly disturbed to read the comment by the Environment Department public servant that staff in the department did not visit the sites—and, in fact, did not spend some time at and around the sites. After reading up on a proposed project, the first thing one does as an expert is visit the site and explore the local natural, social and economic environment. It is no wonder, as discussed previously, that the exaggerated assertion of employment creation in the Adani mine EIA was not challenged (until independent experts took it to task in a court hearing), if those responsible to oversee and assess the EIA had not seen similar mines in operation and visited the outback communities from which it was implied mineworkers would be recruited.

It is essential that the generalist environmentalists know the site of the project for which they are responsible. Key to their understanding is training in botany and zoology as crucial components of ecology. In addition, they will need to have had training in economics and sociology, and at a reasonably high level. They will also need training in climate science, not just to understand the project's contribution, if any, to climate change, but how climate is likely to have an impact on the project. Is the mine likely to flood during a monsoon? What is the probability the tourism resort will be devastated by a hurricane (cyclone)? Questions such as these will need answering. In a nutshell, these assessors will need high-quality training as environmental generalists. This is a specialty field in environmental science and management on which I shall have much more to say.

The Profession Needs to Take Control

A mature profession takes control of its practice and establishes the training required for those entering the profession. To this very day, EIA—across the world—is a product of government, not of the environment profession. What is required of an EIA is determined by government officials, who ultimately are responsible to politicians. In the main politicians are not environmental experts. They can make unwise, even dangerous decisions. We have been witness to very poor decisions being made by politicians during the COVID-19 pandemic. On the other hand, where the response to the pandemic has been put in the hands of medical experts, the results generally have been outstanding.

Because different politicians have different, sometimes radically different, attitudes to the environment—compare Al Gore to Donald Trump—EIA laws change. They are watered down; or they are returned to a semblance of integrity. Different political systems produce quite different EIA laws and, different political ideologies result in a variety of EIA laws. Within federated nations such as the USA, Canada and Australia, there can be stark differences in the EIA laws of respective states or provinces. This situation makes clear that the profession of environmental science and management is some steps away from having the authority to establish common procedures and practices. One does not find on a jurisdiction-by-jurisdiction basis different procedures for a heart transplant—but we lack an agreed EIA practice in looking after the health of Mother Earth.

If environmental practitioners have been taking notice of how the global society, and most national societies, have confronted the COVID-19 pandemic, they will have noticed that with some notable exceptions, decisions have been made by the very highly trained expert epidemiologists, virologists and others in the medical profession. Except for the pathologically disturbed folk who believe the pandemic is a conspiracy, the societal response—particularly in political cultures with high levels of trust—has been very good. The experts are being trusted. Of course, so they should be. We do not trust a lawyer who has become a politician to build our bridges, fly our planes or manage a pandemic. We need to do no more than compare the relative success rates around the world in controlling COVID-19, to appreciate the outcome of different political ideologies. At the time of writing, Hungary had the worst result (based on reliable data) of 302 deaths per 100,000 population; the UK had 191 deaths per 100,000 population; the USA had 180, Canada 67 and Norway 15, respectively for 100,000 population. Australia with strict control by the medical profession had 3.59 deaths per 100,000, and New Zealand also with strict control by medical experts had 0.53 deaths per 100,000 population. These data will change.

One would have thought that after 50 years of environmental practice we would have a trusted environmental profession. The time has come to wean itself off government mothering. However, initially there is much to be done in settling on the fundamental requirements for training environmental professionals.

Conclusion

This chapter has made the case for a paradigm change in training of environmental professionals. I cannot leave it at that; rather, I have created an obligation to help the profession mature. I shall come to describe the work of the practitioners in greater detail after a digression to discuss the history, nature and potential future of the environment profession, with particular emphasis on EIA. This history is a prerequisite to understanding the ideas I shall put on the table for the education of Earth Doctors.

18

Improving the Quality of EIAs: Professionalism

Introduction

The previous chapter has highlighted problems with the conduct and oversight of the EIA process. One would expect that there would not be such issues so many decades from its introduction—50-plus years is a considerable time. Still, reality has to be faced. All parties in the EIA process have a responsibility to remedy the problems. If we cannot do this, the critics of EIA will be proven right, the environmental state of the planet will continue to degrade and the truly revolutionary promise of NEPA will have dissipated, if not be completely lost. And in Australia—the nation which was from the start a *true believer* in EIA—Moss Cass will have wasted his time and effort.

T. Hundloe, *Environmental Impact Assessment*, Palgrave Studies in Environmental Policy and Regulation, https://doi.org/10.1007/978-3-030-80942-3_18

Environmental Practice and Medical Practice Similarities

I have mentioned that I have labeled environmental practitioners Earth Doctors. To justify my position, I need to commence by comparing and contrasting medical practice and environmental practice. The questions to be answered are thus: Does the medical model of training and institutional organization suit environmental practitioners? If it does, is environmental practice mature enough to advance to the level of medical practice? Could it attain the same professional footing, with the same social status, as medicine? One immediate parallel between the two professions—there are a number of parallels—is that both medicine and environmental practice have a fundamental basis in biology—living things, humans and their home planet Earth.

Let us commence with a little history. The history of medicine is fascinating. Before the medical concepts formulated by the ancient Greeks took hold, when illness struck, humans put their faith in the gods they had created—to little avail, as they did not recover. Commencing in the ancient Greek era, medicine progressed from quaint biological theories—with the interruption due to the lost centuries of the Dark Ages—to in the sixteenth century the formation of the Royal Society of Physicians and, soon after, the Company of Barbers and Surgeons, then on to a period (not that many decades ago) when the medical scientists defeated *quackery*. Science won because it delivered results. Sick people were cured. Healthy people did not fall ill. Those fortunate enough to be living middle-class lifestyles live longer and longer. Even in the poorest communities, small benefits are being felt.

We could trace humans' history of dealing with the natural world over the same period as we trace that of medicine. Go back to pre-history, to the time when proto-humans evolved and pondered what they were doing and what was being done to them. Natural forces were given the status of all-powerful gods. All that our distant ancestors could do if droughts and famine struck was appease the gods by sacrificing goats, or in some cases fellow humans. As with elementary and wrong-headed medicine, an elementary and wrong-headed notion of nature developed.

Many mistakes were made; the one we tend to know from ancient history is the over-irrigation in the lower areas of the Tigris and Euphrates Rivers, where Babylon was turned into the desert country of modern Iraq. Science was to win out ultimately, commencing with the Renaissance and flowing through the Enlightenment, then to Darwin and Wallace. As noted previously, it was not until 1866 that the discipline of ecology was named and we commenced on the journey to modern environmental science and management—and EIA.

Today, the advances in medicine are outstanding. While much has been due to the work of medical scientists, pharmacologists, medical technologists and clinicians, it was not only their work in laboratories and learning from clinical practice that produced results. Major campaigns to address public health were critical. Campaigners for sanitation (led by women's groups) were at the forefront of developments in human and environmental health. To this very day, public health advocates are doing their best to eradicate polluted water and air in the poverty-stricken parts of the poor countries—these being serious human health issues. Family planning and women's rights are promoted. And, at this precise point in time, enormous efforts are being made to understand, control and finally eradicate the COVID-19 pandemic. That its genesis is as a zoonotic disease only illustrates the overlap between human medicine and environmental science and management.

The Status of Medicine and of Environmental Management

In the present era, on the one hand, medical science and clinical practice are non-contested areas of human endeavor. They are the most highly respected of professions. On the other hand, environmentalism (defined as pursuing policies and practices which aim to provide a healthy and productive environment) is a highly contested field—in the main because the experts are sidelined while ideologues fight for their preferred position. We can think of climate change as the classic example of a debate undertaken, by and large, by non-experts. While the experts release their lengthy reports, these play second fiddle to lay commentators who think they know better! Non-experts can be found on both side of the argument. Everyone has an opinion. Each knows the *truth*! This is the nature of modern political debate. Too often do symbolism and rhetoric substitute from scientific analysis and practical action. Scientific advancement cannot be made by this process. Problems cannot be solved by groups of non-experts firing barbs at each other on social media. We can thank our lucky stars that *would-be experts* on social media are not telling us how to do brain surgery! Yet!

This is not the book to enter into, and seek strategies to resolve, the worrying trend we witness of turning scientific matters into ideological debates, other than to be adamant that those who provide social media platforms need to be treated as publishers—responsible for the veracity of what they allow to be published. If they can be forced to be accountable—sued if necessary—we have a chance of returning to rational debate. There can be nothing better—more edifying—than debate between people who know what they are talking about, while nothing more dangerous than conspiracy theories which are so easily spread on social media. We must never forget that Hitler had both a conspiracy theory (the Jews and the communists were going to rule the world unless he stopped them) and he had control of the nation's propaganda machine. He *canceled* speeches contrary to his view and burned books.

I am optimistic and take the view that, if nothing else, enlightened self-interest will bring the doubters to acknowledge the benefits of environmental science, just as doubters came to welcome their healthier and longer lives provided by modern medicine. Quackery was beaten because it did not work. The same with witchcraft. Having written that, I cannot overlook the sad fact that there exist small, but highly vocal groups—given undeserving space in the media—who promote their conspiracy theories about issues such as vaccination, the existence of pandemics, and socialists and Jews controlling governments! Do not *cancel* or *no platform* them—they seek this response to make them *martyrs* for their cause—simply ignore them; do not give them oxygen. This is a message to the mainstream media if it wants to act responsibly.

Regardless of controversies and public attitudes, environmental scientists have a duty to keep progressing their science, in particular improving their university programs and elevating their status –as Earth Doctors. They have to aim for the day when silly anti-environmental comments are no longer published, because that would be embarrassing for the publisher. We should note that the most ideologically driven right-wing newspapers do not run columns condemning breast screening because they would lose readers. That is how we want it to be with regard to nonsensical anti-environmentalism stories. On this matter the environmental profession, in a similar manner to the public health profession, has a responsibility to educate the public and thereby influence the attitude the media takes to telling the truth.

The day must come when an understanding similar to that of medicine applies to environmental problems, and their solution. Environmental scientists should look forward to the day when school kids need not protest, because their problem has been solved.

Formal Recognition of the Professions

In most countries, medicine is a highly self-regulated profession. This came about through the efforts of its practitioners to be rid of quacks. Governments became convinced, via the advocacy of genuine medical practitioners, to help in the regulation of their profession. This is done by formal recognition of accreditation schemes. These were developed and are maintained by the medical practitioners themselves, and will remain so. We would say the process was professionally led. Let us consider the education of doctors and the management of the medical profession today.

I shall cite the Australian situation as it is the one I am most familiar with. In Australia, medicine, as with 14 other health professions, is subject to the National Registration and Accreditation Scheme. Other countries have something similar. Registration and accreditation are based on a medical practitioner having undertaken an accredited university degree, and required by law to be registered to practice. This procedure provides the comfort we need as patients. Furthermore, recognized qualifications provide governments with the assurance they need when they call on specialist expertise for advice, as in the COVID-19 pandemic.

The medical profession sets a very good example of how to manage the higher levels of professionalism. It does this by providing specialist training via a number of medical colleges. These undertake the formal professional training of *specialists*, who on completion of their training become *Fellows* of a particular *College*. The history of this collegiate system traces back to England and Scotland. All British colonies took the concept of colleges from the mother countries, and until they developed their own professional bodies, specialist medical doctors would be members of a *Royal* college. The first Royal College, the Royal College of Physicians of London, was established in 1518 under the reign of Henry VIII. A guild, the Guild of Surgeons of the City of London, existed from the fourteenth century.

A range of other professions follow a somewhat similar strategy to medicine; that is, require completion of a standard university degree in their specialist field followed by formal registration. Most of these professions are in the health field, and include pharmacists, physiotherapists, dentists, psychologists and nurses. The rationale for formal oversight of these professions is that public health and safety are at risk if unqualified people are allowed to practice.

In the non-medical field, there are a number of professions where registration, based on accredited degrees, is required if one is to be allowed to practice. Architects, lawyers, vet scientists and teachers are some of the better-known professions with this degree of oversight and formal management. This makes sense. Quacks in any field will seek to ply their *hocus pocus* where there is a vacuum. The environment profession would certainly benefit from the status given by registration. However, it is in the profession's hands to establish the professional and ethical criteria. The rationale for the registration of environmental practitioners is just as strong, if not stronger, as that for public health experts who are charged with managing human health. Earth Doctors have the planet (and *all* living matter) as their patient.

Need for a Standard Qualification

As previously noted, the first undergraduates in an environmental science program enrolled at Griffith University in 1975, postgraduates had enrolled earlier in 1971. Today, undergraduate environmental degrees are taught around the world. In addition to the basic degree, a number of universities offer course work, postgraduate certificates, diplomas and master's degrees, as well as research degrees at the masters and doctoral levels. In comparison to the previous era, where one would take an undergraduate degree in biology, botany, zoology or geology, there has been a very strong move to generalist science degrees. The environmental science and environmental management degrees are generalist programs.

The first model of an environmental undergraduate degree, that of Griffith University, no longer exists in its true form. This is the case even in its original home university. There are major differences across universities in what is included in their environmental degrees. This can be attributed to each university deciding it wants to be different—a marketing ploy in an era when universities compete for students—as well as the specific disciplinary background of those charged with developing these degrees.

If you are tasked with constructing an environmental degree and you have had no formal exposure to archaeology, paleontology, anthropology and pre-history, you are likely to omit these fields of endeavor, notwithstanding what can be learned from the study in these disciplines. There are other examples of intentional and unintentional omissions. Without a professionally agreed standard undergraduate environmental degree, it can be difficult to exclude personal bias in selecting the disciplines to be included.

I have noticed over the years that those people who favor field-based biology-botany-zoology are not as keen on molecular biology and genetics as those who favor laboratory research. I have also noticed that many (most?) ecologists are not keen on including economics in the degrees they construct. This is in part a dislike of economics, in part ignorance of the subject, and a lack of recognition that environmental progress requires ecologists to work with economics. This is one of the crucial findings of *Our Common Future*, the official manifesto of sustainable development.

As a digression, I made a deliberate attempt to introduce a modified version of the Griffith model when I became the inaugural Professor of Environmental Management at the University of Queensland and, following ten years there, made a similar attempt as the first professor to arrive at Bond University as Professor of Environmental Science and Management. On retiring from both universities, the programs changed. Personal perspectives count. Is this a good thing?

During my period at Bond University, I spent four years representing that University on the Australian Council of Environmental Deans and Directors (ACEDD). This body represents the 30-odd Australian universities with environmental programs. There is a proposal to invite New Zealand universities to join the organization. From my experience in discussing environmental education with my colleagues of ACEDD, I came to realize there was much work to be done to obtain agreement on an environmental tertiary education program. The profession is going to need an agreed program of study if it is to be recognized and achieve the public status of medicine. Since leaving my university positions, I have devoted considerable effort to the issue of determining the appropriate disciplinary content of an environmental degree.

At the early stage of the development of a profession, a variety of approaches and selection of disciplines to teach is a valued experiment. Retired Professor Stephen Dovers of the Australian National University commented some years back that the diversity in the environmental degree programs was desirable: *let a thousand flowers bloom*, he said. My position in 2021, many decades after the first environmental science student graduated, is that the time has come to seek agreement on the essential components of a professional environmental education. We should be able to identify the most beautiful flower.

In Conclusion

We face the urgent matter of addressing the problems which have been identified as flaws in the assessment of the environmental impacts of projects. Furthermore, we have yet to develop the skills—and, importantly, the status—to be the environmental assessors of important government policies, taxation proposals, trade agreements and whatever else is likely to have an impact on the environment. What I spell out in the following two chapters is a set of ideas—a manifesto, if you like—for the future.

19

Specialist and Generalist Earth Doctors

Introduction

I have made the point that looking after the health of the planet is analogous to looking after the health of humans. Hence, Earth Doctors. By analogy with medicine, I am with this book commencing a conversation on how we might formulate the educational requirements for students to become Earth Doctors. While Earth Doctors will have more to do than undertake EIAs, this and related work is likely to be a major component of the duties of a significant number of them. EIA work is one field of endeavor where, by necessity, both generalists and specialists are required.

I will, in the main, focus on generalists because these people are at the forefront of improving EIAs. Specialists will continue to be trained, either via the old-fashioned route of building on a relatively narrow undergraduate degree (e.g., botany) followed by research for a higher degree, or branching into a specialist field on the basis of a generalist environmental undergraduate degree. In the future, the skills of generalists have to be enhanced. They have a far more important role in environmental science and management than is recognized. They are the first port of call when an environmental problem occurs. They manage the EIA system. They

T. Hundloe, *Environmental Impact Assessment*, Palgrave Studies in Environmental Policy and Regulation, https://doi.org/10.1007/978-3-030-80942-3_19

are under pressure from proponents of developments, from anti-development advocates, and, if they work for governments, from politicians. And there is so much to learn, environmental science and management—I consider these two to be one, hence the singular—covers a large number of disciplines. We are not able to do justice to this extremely important field of endeavor in the present standard three- or four-year undergraduate degree. As with the medical doctors we know of as generalists (general practitioners or family doctors), who have to do additional study to become *specialist* generalists, so it will have to be if one is to become a *specialist* generalist environmental professional.

Generalists and Specialists

As noted previously, there are two types of environmental practitioners, generalists and specialists. This is analogous to medical practice. However, there is one significant difference. On the one hand, medical specialists build their specialist expertise on a common generalist university education, as I shall explain below. On the other hand, environmental specialists are just as likely to have built their specialist expertise based on a specialist undergraduate degree as they are to have developed it from an environmental science or management degree. In the former case, a zoologist is likely to have studied a strict science degree and undertaken a double major in zoology, before undertaking an honors degree in zoology and then a PhD in zoology. This could be followed by a position as a post-doctoral employee in a university, again researching in the field of zoology. In this case, the zoologist is not expected to have professional knowledge beyond zoology. This is certainly appropriate for a zoologist, as it would be for a specialist botanist or any other highly skilled specialization. Until the advent of environmental science and environmental management degrees, this strictly specialist route was the only one available if one was to be an expert in a designated field of environmental endeavor. The appendix to this chapter provides a ranking of environmental degrees.

Then, from the late 1970s there were graduates with generalist environmental degrees, and students with these degrees who aimed to undertake specialist postgraduate study were likely to have specialized (taken *majors* or double majors) in one of the standard disciplines as they progressed through their undergraduate studies. However, they also had gained at an undergraduate level a breadth of environmental knowledge. Their progression to enter a higher degree program would be no different to a student who had specialized from the onset. But, these experts would have, based on their generalist undergraduate degree, broader knowledge than those who had specialized throughout their university study. This would be beneficial in their future work.

A Need for *Specialist* Generalists

A question not asked in the past was do we need highly trained environmental generalists? Some years ago, the medical profession recognized the importance of raising the level of training for its generalists, the folk called general practitioners, abbreviated to GPs in Australia, New Zealand and the UK, and family physicians in Canada and the USA. Today, these medical practitioners are required to go beyond their previous level of skill and become *specialist* generalists, members of their own medical college.

This concept has not taken hold in the environment profession. I believe this is a major problem, particularly for EIA practice. We need very good generalists (*all-rounders)* to oversee the EIA process: from establishing the terms of reference for EIAs and, if we get to undertake them, SEAs; to selecting an appropriate team for a specific project; to managing that team; to checking the output from each team member; and, to seeing the *big picture* as the results of the individual disciplinary assessments are integrated. Practitioners with these skills are needed in the large environmental consulting firms, in the government agencies that commission, oversee and assess EIAs, and in industry and public-interest organizations. More than a few of these specialists are needed. I hesitate to nominate the number. What is essential is to recognize this need and encourage graduates of generalist undergraduate environmental degrees to continue their study and research as environmental generalists.

A doctoral dissertation as a specialist generalist would be the highest achievement.

In the medical field, the role of the specialist generalist is to be the first point of call—the first contact—for a person of ill health. If the ailment does not require specific medical treatment, the patient is treated in the local (family) surgery. If upon preliminary diagnosis additional tests and treatment are required, the patient is referred to another specialist, such as a cardiologist. The generalist environmental practitioner will work in a similar fashion to the medical generalist, dealing with a range of environmental matters for which a specific specialist expertise is not needed; but, as necessary, will refer a client to an appropriate particular specialist, or call one in as a sub-consultant.

The idea of training specialist generalists in the environment field is yet to be given due consideration by the universities and by the leaders in the profession. I am of the opinion that this is a problem. While there are some environmental practitioners who, after many years of practice in a generalist capacity, can rightly be described as such, I am of the opinion that many more are needed. One does not learn enough skills in sufficient depth in a three- or four-year undergraduate environmental degree to be capable of dealing with the wide range of, often difficult, matters to be resolved in major EIAs. More often than not, an honors degree does not help in this regard, as most tend to be in relatively narrow fields of interest to the student's supervisor. Considerably more study than presently undertaken is required due to the breadth of environmental issues one is likely to face as a generalist.

As a general rule, expect most recognized experts in most fields to have a doctoral degree, but be mindful that there are disciplines where this is not the norm. For example, it is only recently that lawyers would undergo that level of training, and the same can be said of architecture, town planning and engineering. In the health sciences field, it is very rare that folk will undertake a doctoral degree—though note the amount of study to become a specialist medical doctor is substantial.

Medical Education Compared to Environmental Education

In the field of medicine, one can only become a specialist after completing a set course of study before proceeding to study in a specialist field; that is, all medical doctors undertake the same base program of study before undertaking more study, on the journey to seek accreditation as a specialist of one of the medical colleges. This is the case whether the student undertakes the dual degrees of a Bachelor of Medicine and Bachelor of Surgery (MBBS) or a postgraduate Doctor of Medicine (MD).

Medical training in New Zealand and Australia (see Box 19.1) is very similar, although terminology tends to differ. Training in these countries differs in a limited extent to that in Canada and the USA. However, there is a fundamental point to recognize, which is that medical training in all countries which were once part of the British Empire does not diverge significantly from a common core of disciplinary material—this makes sense, anatomy and physiology are the same for all humans. This common core of learned knowledge is one reason why we find many Indian medical doctors practicing throughout the once-British Empire.

To be admitted to an undergraduate medical degree, one has to have done extremely well in high school. This is not the case for an undergraduate environmental degree, although a number who enter this field have done very well in high school. To be accepted into a postgraduate medical degree, one has to have very good grades in an undergraduate degree. To be accepted into a coursework master's degree in the environmental field, the normal qualification is an undergraduate degree—grades do not matter. The point is that it is easier to enter the environmental field than the medical field, yet it would be a courageous soul who would claim that understanding the environment and managing the manner in which people treat it is easier than dealing with the health of humans. This is the basis for my call for serious reform of environmental education.

Box 19.1 Training to Be a Medical Doctor: The Australian Example

An undergraduate medical program is divided into two phases called *pre-clinical* and *clinical*. Over six years (or its equivalent in more intensive programs of three rather than two semesters per year) the first half of the program is devoted to the subjects of anatomy, pathophysiology and pharmacology and their numerous sub-disciplines, plus a few other essential subjects. The clinical years are spent in hospitals being trained in medical practice. The students get to see and understand the total range of medical conditions and procedures as they move around different departments of a hospital.

On the successful completion of his/her university studies, a *pro-tem* medical doctor enters into a pre-vocational internship. Most, possibly all, of this is undertaken in a hospital, although some part of an internship can be undertaken in a family doctor's surgery. The student is given practical experience of all the major arms of medicine, by a process of rotation through the disciplines. An internship lasts for a year, followed by one or two years as a hospital *resident* (otherwise a *junior doctor)*. This stage is a form of apprenticeship, which means the resident/junior doctor is paid while being supervised. At the conclusion of this stage, a prospective medical practitioner has been in training for eight to nine years—and is still some years before becoming a specialist.

Next comes a period of training leading to recognition as a specialist and, on completion, the status of a Fellow. Specialist training takes from four to six years (or more) depending on the specialty. In total, a medical practitioner will spend between 13 and 16 years before becoming a specialist. This is much more time than that taken by other professionals who gain that status on graduating with a PhD after a total of seven or eight years of study.

The Crucial Role of Internships

Clinical practice, that is in-hospital training, is a fundamental part of medical training. Its equivalent in the environmental field would be an internship, following the three or four years of classroom study in an undergraduate degree. Some environmental degrees, especially if they are of four years duration, build in a compulsory internship; but none are comparable in duration and diversity of sub-disciplines as those in medicine; I have not been able to identify an environmental internship any longer than a full semester (of 14 weeks). There are examples of very brief internships and there must be some doubt of their value.

Compulsory internships need to become a component of an environmental undergraduate qualification, with a minimum duration of 24 weeks of full-time work in a four-year undergraduate degree; in other words, approximately one-fifth of an undergraduate degree. Note that this is far less than the internship of a medical practitioner. The internship would need to engage the intern in a set of disciplines as is the case for medical interns. Who would take the students on as interns? In the environment field there is no equivalent to the designated training hospitals. The possible candidates are environmental arms of government, research organizations with a broad environmental charter and, probably, large environmental consulting firms. Rotation would be essential.

Conclusion

What I am proposing is a radical improvement in environmental training. Considerable thinking, planning and, ultimately, organizing is going to be needed. If we recognize that we need very competent Earth Doctors, we are obliged to train them properly.

In the next chapter, I sketch out the disciplinary components of a generalist undergraduate environmental degree. My position is that on the basis of this degree, a student seeking a higher level of professional status has the same options as a student seeking to be a medical practitioner: that is, study to become a specialist generalist or study to become a specialist in any of the fields of environmental practice. The specialist generalist field is to build on the breadth of a generalist undergraduate degree and explore at an advanced level the natural sciences (biology, chemistry, physics and their sub-disciplines), plus economics and the social sciences.

I have used this chapter to start a forward-looking conversation on how we might improve the education of environmental practitioners. I have taken the conversation well beyond the existing, and evolving, efforts undertaken by existing professional organizations, such as the EIANZ. This body is the world leader in environmental professionalism and has been doing excellent continuing-development work through the CENVP Program, and the mentoring available to young professionals. That work must continue. The organization is, furthermore, accrediting environmental undergraduate degrees in Australia and New Zealand; however, this is a major task for voluntary organization and will be a slow process. My manifesto is for a journey which will end when environmental practitioners are recognized as Earth Doctors.

Appendix: Ranking of Environmental Degrees

There are three highly rated ranking systems for university degrees on a global scale. The QS World University Rankings is one of them. However, there are degrees of subjectivity in all the systems, and there are no commonly agreed rankings. When it comes to disciplines and subject matter, the disagreement is exacerbated—and it is not helped by the universities in naming their degrees. For example, environmental degrees can be badged under three broad categories: environmental science, environmental management and environmental studies, yet the same subjects could be—not necessarily will be—taught under each of the degree programs. Then there are sustainability science degrees, some of which include the same material as an environmental degree. When it comes to the ranking organizations, their results reflect, in part, how they interpret the terminology and subject descriptions provided by the universities. As an example of the problem they face, in the early days of the Griffith University Bachelor of Environmental Studies degree, graduating students were awarded a Bachelor of Science. In that degree there were four economics subjects none called economics!

By reference to the QS rankings, if we focus on the 25 top-ranked universities in the field of environmental science/management, we find by country the number of universities.

USA	9
Australia	4
Britain	3
Netherlands	2
Singapore	2
Switzerland	2
China	2
Canada	1
TOTAL	25

Relying on the same system, if the focus is the top 50 universities, there are 9 Australian universities and 1 New Zealand university offering degrees in environmental science/management. In the top 150 universities, there are 17 Australian universities offering environmental science/management. This equates to approximately half the Australian universities offering degrees in this field.

Outside of the three commonly quoted ranking systems, there are others. The US News Best Universities has one Australian university in the world's top ten offering an environmental degree. It is the University of Queensland.

20

The A to Z of Environmental Qualifications

Introduction

As the title explains, this chapter is the *A (for anthropology) to Z (for zoology)* of a generalist undergraduate environment degree. Obviously, it is a multidisciplinary, interdisciplinary and, if it can be achieved, a transdisciplinary program. The latter is a work in progress. These descriptions are defined as follows: multidisciplinary, where various disciplines are applied to a problem, but each from a distinct disciplinary perspective; interdisciplinary is the synthesis of disciplines such as economics and geography becoming economic geography, and ecology and economics becoming ecological economics; transdisciplinary is where interdisciplinarity leads to a completely new perspective, going beyond the synthesis of two or more disciplines, back to the natural philosophers!

To a large extent, the work in undertaking an EIA is multidisciplinary, tending to be interdisciplinary. As multidisciplinary work, botanists describe the vegetation and zoologists form a view of what animals are likely to live on the site and then go into the field in search of animals. As an interdisciplinary undertaking, human geographers describe the local population and economists gather data on the local industries, and in

T. Hundloe, *Environmental Impact Assessment*, Palgrave Studies in Environmental Policy and Regulation, https://doi.org/10.1007/978-3-030-80942-3_20

combination, various socio-economic features of the region can be described. What is essential is the expertise the various specialists bring to the task.

In the remainder of this chapter, I sketch the disciplines relevant to undertaking EIA and practicing as an Earth Doctor. Only some disciplines are able to be fitted into a generalist undergraduate environmental degree due to the limited years of study at this level, a three- or four-year program of study. The ones which cannot be squeezed in at this level will need to be mastered in the postgraduate study of one form or the other. I shall pay greater attention to these disciplines because of their neglect at the undergraduate level.

Anthropology

Anthropology is the study of humans. Nothing can be broader and, one might suggest, more important. However, in the modern era, a vast number of disciplines focus on humans, from evolutionary biology to neuroscience, and hence the practice of anthropology tends to be confined to cultural anthropology, otherwise known as ethology, or ethnography which is the study of particular human societies.

Anthropology was one subject out of 24 in the world's first environmental science degree. I was the tutor in the subject. Today anthropology as such is not common in environmental science or environmental management degrees. As a speciality, anthropology tends to be taught in master's degrees. In undertaking an EIA, the major anthropological issues are most likely to pertain to potential impacts on indigenous culture. The terms of reference for an EIA should make clear whether or not a specialist anthropologist should be engaged. It is possible that this will not be required, for example, if indigenous rights, including those pertaining to land and resources, have been established before the EIA is undertaken.

In a crowded curriculum anthropology need not be included as a subject in a generalist environmental degree. Nevertheless, anyone graduating from such a degree should understand the role of anthropologists and archaeologists. The necessary insights can be gained by accessible, good-quality literature. There is no better introduction to human cultures and their relationship to natural, cultural and economic environments than Jared Diamond's 1997 book *Guns, Germs and Steel*. In an age where there tends to be a tendency to dismiss the role of textbooks and prescribed readings—because there is a misguided belief that students will find all they need to know relying on the internet and scribbled lecture notes—*Guns, Germs and Steel* should be compulsory reading for first-year environmental students.

This book, by an author who can claim credentials in biological science, physiology, ecology, history and geography, opens the reader's eyes to the history of human movements around the world—colonization he calls it, newcomers displacing the early arrivals, often violently. Waves of colonization are a basic feature in the history of humankind from the time our ancestors came out of Africa. This fact tends to be overlooked when our glance reaches no farther back than Columbus arriving in the Americas. Great civilizations in Egypt, Persia, China and India had developed a very long time before then. There were relatively advanced societies in Central America before Columbus found himself in the West Indies. Ancient animal species had come and gone—forever—tens of thousands of years before. Understanding human history at the global scale can only help us understand modern human societies and today's conflicts.

The particular natural environments which various groups of people found themselves in as they migrated out of Africa—at the extremes, into the tropics or tundra, verdant or vegetative vacant—determined their cultural, economic and technological evolution—not to overlook their skin color which, sadly, has become a means of defining an *other*.

One group found itself removed from the major migrations which occurred across most of the globe, and continual tribal warfare, of which we know much from the study of ancient history. These people were cut-off by the sea-level rise as the last ice age ended—they were the first people to Australia. They were left in isolation in a mainly dry continent with poor soils and no animals capable of domestication. The dingo came to Australia with the later arrivals as a domesticated dog.

Archaeology

Archaeology is the science of searching for and interpretating physical evidence of the distant past. One would have to be without a television set to be ignorant of archaeological digs—Ancient Egypt, Persia, China, Greece, Rome, Mexico and Britain, as a short list. One does not necessarily have to dig to come across wonders of the ancient world. Who does not know of Stonehenge in Wiltshire, England! The list of digs in the UK is among the most extensive in the world.

Due to both natural forces and human action, much has been buried. Yet, we keep learning about ancient engineering and architecture—and human life—through the painstaking digging, sifting, brushing and laboratory analysis (in recent times using sophisticated devices, including uranium-series dating). It is not only the human past which is being dug up. Think of Lake Mungo National Park, a part of Wilandra Region World Heritage Area in south-western New South Wales. In the digs there, not only human remains 30,000 to 40,000 years old were discovered (known as Mungo Man and Mungo Woman) but animal bones, such as those of hairy-nose wombats (at least 10,000 years old), and identifiable parts of diprotodons, the giant wombat, one of the Australian *mega-fauna* which disappeared about 40,000 years ago.

The Americas provide a fascinating list of old and ancient finds. In the USA, amongst numerous others, there is the intriguing Cliff Palace in Mesa Verde National Park, the first major city Cahokia, and Wyandotte Cave with its 10,000-year-old signs of mining aragonite. In Canada there is the famous site of the first European landing in the Americas, the Viking village of L'Anse aux Meadows. Archaeological sites in Mexico and South American countries fascinate us as we learn, in televised documentaries, about the Maya, Aztecs and other ancient tribal people.

The South Pacific has held human imagination for centuries. How did those tiny, mid-ocean islands come to be settled? Anthropologists, such as the Norwegian Thor Heyerdahl, set out in his extraordinary voyage to test the *from South America thesis.* Proved to be wrong. Such fabulous adventures aside, there is much to learn from archaeology. For example, this discipline is well-established in New Zealand. The first humans to arrive in New Zealand, Maori, came sometime not long before AD 1300. Middens are prime sites for archaeological research. An animal which has fascinated people is the very large (up to twice the height of the average human) flightless bird, the moa. Its bones have been discovered in numerous middens, indicating it was eaten by Maori. On the basis of carbon-14 dating, it is estimated that moas were extinct within 100 years of the arrival of humans. This is just one of the many additions to human knowledge archaeology can provide.

In terms of EIA, archaeology is a specialty to be called on when needed. A generalist environmental practitioner need to know no more about this discipline than what is shown on the various good-quality television programs. However, an environmental practitioner needs to be aware of what important physical evidence of the past could be expected to be uncovered in projects which involve digging into the ground, or in areas where middens are known, or expected, to exist. This suggests that the pre-history, as well as the history of a nation, needs to be a component of the environmental practitioner's undergraduate degree, although there will not be space found for archaeology as such. However, there is not a country where a reliable book on the subject has not been written—for some countries, the choice will be a challenge.

Biology

Biology is the overarching discipline which deals with living things. In this context, animal biology is zoology; plant biology is botany; ecology is a broad sub-discipline of biology. Do not be surprised that some will define biology as a sub-discipline of ecology. You will easily fathom out what is going on here. It is nothing of importance in terms of subject matter. Since the advent of environmental science and management as a major field of study, ecology has become the common descriptor for the combination of a number of the sub-elements of biology. For this reason, most today use ecology as the anchor for all these sub-disciplines, in combination or individually. Regardless of terminological differences, biology in its various forms must be a common core—academics will understand the notion of a *vertical core*—taught in every year throughout a degree.

Botany

As noted above, botany can be considered as a sub-discipline of ecology, and hence is to be subject matter taught in a generalist degree throughout the program of study.

Chemistry

An understanding of biochemical cycles is one of the foundations of the natural sciences. The most important cycles are the water cycle, the carbon cycle, the nitrogen cycle, the phosphorous cycle and the sulfur cycle. It is via these cycles that elements and compounds, such as water, move. Furthermore, the fundamentals of chemistry are a prerequisite to understanding the effects of pollutants. This is a field of knowledge and practice in its own right, called ecotoxicology. Given the importance of chemistry to the sciences which build on it, the discipline needs to be introduced in the first year of study in an environmental science and management degree.

Both a theoretical understanding plus on-the-ground exploratory and laboratory analytical work are essential. With that as a goal, field exercises in studying some, if not all, of the key cycles, is important; for example, how to take samples of potentially polluted water and then analyze them is something relatively easy to teach. The same applies to soil samples. The use of scientific equipment and how it does whatever it does is an important part of the field and laboratory exercises. It is important to get students to understand not just what a scientific tool does, but how it does it—there are too many *black boxes* today. While students are not likely to need the same level of exposure to chemistry as to biology, it should feature throughout their degree, built in where appropriate.

Climatology/Climate Science

Basic climatology cannot be denied a place in an undergraduate degree. This could be taught early on in the degree, whereas the broad discipline of climate science should be taught as a separate component in the degree program. There is more than enough material in the series of reports by the IPCC on which to construct a subject. There is much more than climatology in these reports.

Demography

Given the importance of human population numbers on the health of the planet, demography is a very important sub-discipline of human geography. At the time of writing, the human population is expected to reach 9.8 billion by 2050 and either 11.2 billion or fall back to about 9 billion by 2100. The highest fertility rates, at about 4.3 births per woman, are in the least developed countries, and 26 African countries are predicted to double their population by 2050, while population decline is predicted for most of the advanced countries. I quote these numbers to illustrate just how important this subject is.

Given the impact that human numbers have on demand for food and water, plus the effect on greenhouse gas emissions, other pollutants and resource degradation, demography and its relationship to the planet's human carrying capacity deserves to be a separate subject in an environmental science and management degree. Obviously, the global scale is the key to understanding, and being able to model likely futures. At a project level, demography can be important, especially in terms of cumulative EIAs. It is possible to make demography a major component of human geography, rather than teach two separate subjects.

Ecology

I have discussed ecology in the context of biology. However, it deserves additional comment here. Ecology is one of the two fundamental streams of learning in an undergraduate degree in environmental science and management. On completion of an honors degree and researching a thesis in the field of ecology, a graduate should be knowledgeable enough to undertake a PhD in ecology; alternatively, a future highly qualified generalist will make ecology one of the fundamental bases of his or her learning and research.

A simple definition of ecology is the relationships between animals and plants with land, water and air. Its Greek derivation is *oikos* meaning *home*, and based on this, it becomes the study of the home and its surrounds. The discipline of economics is based on the same Greek route and means the management of the home. The term "ecology" was coined by Ernst Haeckel in 1866, making it a very young discipline.

As noted above, ecology's foundations are in various fields of biology, most importantly, zoology, botany, ethology plus physical geography, hydrology, biochemistry, elementary physics and elementary earth science. As a crucial field of learning, ecology has to be a vertical stream throughout a degree in environmental science and management, commencing in first year and extending into an honors year.

Physical geography is more appropriately studied as a geography subject with its companion subject human geography (discussed in more detail below). Some academics are inclined to put climate science in with ecology. I prefer treating climatology as a separate, although related, field.

It is extremely important that considerable fieldwork is undertaken as part of an environmental degree, and this has to be built into the ecology subjects. Book learning is one thing, but one learns so much quicker with a field guide in hand, trampling around the countryside, in pristine forests, vast deserts or immense savannas, or with pollution-monitoring equipment in rat- and fly-infested landfills—in fact, anywhere and everywhere is a field site. The practicalities—the trials and tribulations—of obtaining statistically valid sample data are learned by encountering real-world situations.

Obtaining water, air and noise measurements, including understanding the measurement instruments, is learning by doing. With the rapid development of high-quality cameras, animal life can be recorded, both on land and under water, without as much trampling and diving as in the past. Then there is the use of drones (both fixed wing and multi-rotor), particularly useful in landscape ecology. Students need to know what these tools do, how they do it and be able to decide when to use them. Drones, or as formally called *Small-Remotely Piloted Aircraft*, are presently being used for environmental surveys in search of endangered species in the central Australian desert environment at Uluru-Kata Tjuta National Park. Not only are animal counts possible, but biomass can be measured, and grass and plant species can be identified by the use of drones.

Economics

Economics in consort with the other social sciences is the other major stream, with ecology, in an environmental science and management degree. Putting economics in this position is both radical and necessary. It is radical due to the fact that many people who have a concern for the health of the planet are prone to consider economics *the problem*; that is, the cause of most, if not all, of our environmental problems. If that were to be true, we would be obliged to elevate the study of economics to the highest order. In other words, to fix something there is nothing gained by blaming it, and everything to be gained by fixing it, and that requires understanding it. A major reason that we make very slow progress in addressing environmental failures is a lack of understanding of economics. Economics can be made compatible with planetary protection. Slow progress has been made in recent years, but with the development of environmental and ecological economics, we are witness to a changing paradigm—although it tends to live in the textbooks and not venture out into the real world. This it can do via university study.

It is not true that economics is the sole or even main cause of environmental degradation; nevertheless, it is so important that the manifesto for sustainable development, the Brundtland Report of 1987, called for the marriage of ecology and economics in all levels of decision-making. What that report implied is that we will not achieve sustainable development or its components, such as nature conservation and clean energy, without utilizing economic incentives and disincentives—in other words without understanding human economic behavior and using economic tools.

As is the case with ecology, economics needs to be a vertical strand throughout an environmental science and management degree. Sufficient economics needs to be taught to permit an honors research project in the discipline, leading on to a PhD in the field, if a student is to specialize in the field of environmental economics. For those desiring to become a high-level specialist generalist, economics has to accompany ecology throughout a research program.

The sub-fields of economics which need to be included are introductory micro and macro economics, environmental and natural resource economics, development economics and applied welfare economics. As with ecological fieldwork, much is to be gained by requiring fieldwork of an economic and social science nature. Fieldwork in economics involves visiting factories, power plants, dam sites, farms, ports, tourist resorts, waste dumps, hospitals—basically anywhere humans live and work.

Ethics: General and Professional

The concept of sustainable development, the overarching idea of modern environmental decision-making, requires the application of two key ethical principles: intergenerational equity and intra-generational equity, fairness across generations and fairness within generations. These we have discussed throughout this book. Fairness can be viewed as derived from the *golden rule*—do unto others as you would want them to do to you.

The principles and the instruments of sustainable development can be incorporated in the economics stream of degree and, hence, sustainable development need not be an individual subject. Students should be encouraged to read a mix of the good books on ethics (or moral philosophy, as these two descriptors are used interchangeably by some authors). A.C. Grayling is a prolific writer on moral philosophy, and his books are very easy to read. In the case of a professional ethic, this should be introduced early on in a student's program and reinforced throughout it.

Geography: Physical and Human

With geography we have the foundation of environmental science and management. As anatomy and physiology are the cement on which medicine is built, so human geography and physical geography are the equivalent in our field of study. It is not simply the geography of a particular country, but that of the planet which matters. In terms of climate change the world is one. Likewise, we live in a truly global economy—even if we were able to dodge the *2007 Global Financial Crisis*, we are impacted by world trade; the strength of our currencies and political events are not of our individual doing, they are also global. This is not recognized by those who do our future no benefit by attempting to divide us by identity politics. The COVID-19 pandemic has been a stark—some would say, dark—reminder of the global interconnections, not only in the spread of the disease but of its global economic effects. The two geography subjects, both interesting to students, and basic to the rest of their degree, should be taught in the first semester of the first year. However, see previously the comment on demography. There is enough material in physical geography for a separate subject.

Hydrology

Hydrology is a sub-discipline of geography (some would suggest it fits better in ecology), but due to the dependence on water for agriculture, and conflicts in its allocation, it deserves to be a separate subject, taught in advanced years of a degree.

Psychology

For reasons not clear, psychology tends to be overlooked in the construction of environmental degrees. It was included in the first undergraduate degree in environmental science, the one commencing in 1975 at Griffith University. As a discipline it is very broad with many sub-fields. The one which is germane to environmental science and management is social psychology—how groups of people come to have the values and attitudes they have and how these change—and can be changed.

In terms of environmental management, the fact can be overlooked that what we are attempting to manage is what we as humans do, not what the environment does. Social psychology goes to the role of *influencers* and their impact on public behavior. An influencer need not be an individual given elevated social status but can be the media in general.

While environmental psychology is a stand-alone discipline, it does complement the economic and the sociology subjects. A newly developing sub-field of economics is embracing psychology. A psychology subject warrants inclusion in an environmental degree.

Sociology

Sociology is the study of humans in groups. While anthropology tends to be focused on pre-modern societies (clans, tribes), sociology is directed to present-day societies. It is a very broad subject and, therefore, in terms of an environmental degree has two key foci: social capital as a key leg in the sustainable development stool, and the impact on local communities of major projects, such as a tourist resort or large mine. In addition to book learning, it is important that students obtain field experience in obtaining social data. Field exercises in sociology can be run in conjunction with economic fieldwork. A special subject on sociology is warranted in an environmental degree.

Statistics and Mathematics

It is essential that environmental graduates are numerate. Statistical analysis is likely to underpin study in a number of subjects; hence, it should be a foundation subject. Throughout their degree students must be familiar—and comfortable—with statistical analysis. In terms of mathematics, students will need to become used to graphical methods and simple models expressed in algebra. These quantitative skills warrant two subjects throughout a degree, one linked to analyzing data gathered in the ecological and economic/social science fieldwork exercises, the other more theoretical.

Zoology

As noted above, this subject is a key element in the ecology stream. Throughout a degree it is essential to return time and time again to the study of animals; and nothing makes field work more exciting.

Conclusion

The above is a brief overview of the subject matter that needs to be included in an undergraduate, generalist environmental education. I have suggested that there is a need for some graduates to specialize as generalists. In this day and age that is likely to mean undertaking a PhD, where the research topic entails expanding knowledge by drawing on these common disciplines.

I have not mentioned EIA, the subject of this book, as an individual subject. It is in many undergraduate degrees and, obviously, must remain so. It should be the capstone subject, based on real-world case studies. As I have explained, there is much yet to be done if EIA is to serve humans and the other animals with which we share Mother Earth.

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