Cumulative impact assessment

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Outline of webinar

- First some theory…
  - what are cumulative impacts?
  - what challenges do they pose for impact assessors?
  - types of cumulative impact
  - broad approaches
  - some tools for cumulative impact assessment

- Then some interesting stuff…cases!

Defining cumulative impact assessment

"Cumulative impacts are those that result from the successive, incremental, and/or combined effects of an action, project, or activity …… when added to other existing, planned, and/or reasonably anticipated future ones…….impacts that would not be expected in the case of a stand-alone development." (IFC, 2013)

Examples of cumulative effects:

Fish & Fish Habitat: destruction of habitat of the same fish population from multiple physical activities.

Aquatic Species: shoreline destruction from multiple physical activities resulting in the removal of several patches of a marine plant.

Socio-Economic Conditions: environmental effects from multiple physical activities resulting in the decline of a bivalve population on which an Indigenous group depends as a source of income.

Physical and Cultural Heritage: damage caused to sites associated with the creation of legends, ceremonial functions, personal vision quests etc. as a result of multiple physical activities.

Current Use of Lands and Resources: effects on use of traditional fishing grounds owing to decreased fish population which results from multiple physical activities.

Archaeology: disturbance of an archaeologically significant site due to construction activities associated with multiple physical activities.

Canadian Environmental Assessment Agency (2018) p.3

For example

- Port expansion
  - will require removing an area of mangroves which is the habitat for various bird species, so will reduce the local populations of a number of birds by about 25%
  - Project EIA identifies this impact, and considers that reduction is not significant given remaining local populations.
- But at the regional/national scale, one of the bird species is already suffering severe impacts from various human actions. More projects are being developed or are planned that will add to those impacts. And our port proposal would affect the last major breeding area for the species.

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Project-based assessment of cumulative impacts (part of EIA)

versus

Resource-based or area-based assessments of cumulative impacts (strategic assessments)

Contrasting Views of the Need for Impact Management

"The ESIA for a metals refining operation in an emerging market country concluded that because the concentration of heavy metals in the discharge to a river would be lower than the country's discharge standard the project should proceed as designed. No additional mitigation was identified.

However, the river was already badly degraded; the ambient concentrations of heavy metals already exceeded the ambient water quality standards, human health was being compromised, and officials in the city downstream were struggling to find ways to improve water quality. In this context, either project relocation or additional mitigation to reduce the discharge of heavy metals to the maximum extent possible would have been appropriate, together with other mitigations to reduce the loading from existing sources.

This case illustrates the importance of informed strategic level resource planning, such as integrated resources plans, which often are critical to successful CIAs."

IFC (2013) p.30

Look at cumulative more closely

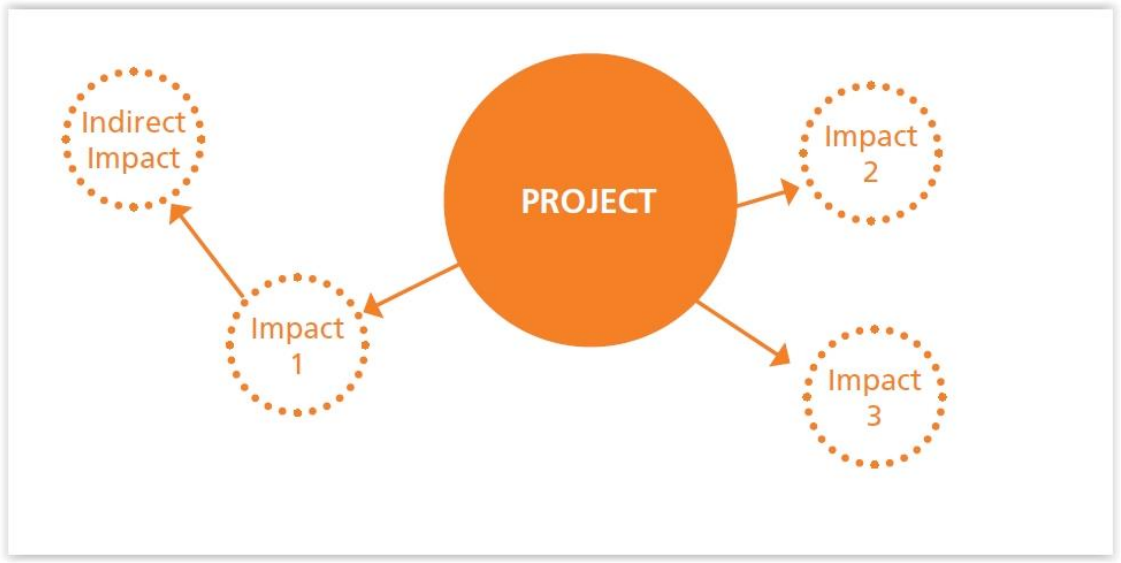
- Aggregate effect of multiple activities (esp projects) on a defined geographical area, or specific resource/sector
  - can be many of the same activity, or many, varied activities;
    - many hotels along the coast or marine farms in a bay;
    - sand extraction close to existing hotels, with adjacent fishing and agriculture
  - can be existing activities, or planned activities, or a mix of both,
  - current state of the environment, but also likely future state…..

Types of cumulative impacts

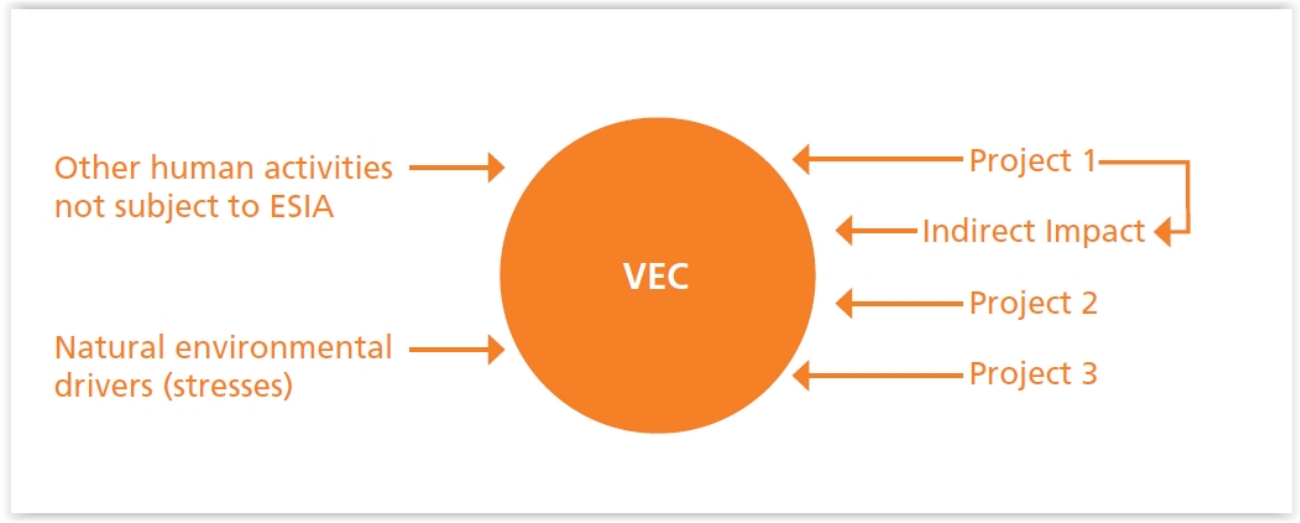
Type	Main character	Examples
Time crowding	Frequent and repetitive effects on an environmental system	Fish takes, or forest harvesting, that exceed natural recovery
Space crowding	High spatial density of effects on an environmental system	Numerous pollution discharges to local waterways; multiple noise sources in residential area.
Fragmentation	Increasing disconnection in previously contiguous areas	Forests reduced to islands of trees; neighbourhoods separated by roads.
Compounding effects	Interaction of effects from multiple sources	Pollution created by interaction of separate constituents (PAN in smog; N and P in eutrophication processes)
Triggers and thresholds	Dramatic shifts in environment behaviour	Climate change; breakdown in social/civil order.

adapted from CEQ (1997)

Changing perspective….



Project EIA suits many situations, but when we recognise cumulative impacts need to be addressed, we need to change the perspective of the impact assessment….from project centred to resource/area/valued component centred



Diagrams from IFC (2013), pp. 29-30

Broad approach

- Follow same broad IA steps…..
  - scoping, baselines, impact analysis, significance, responses, management and monitoring plans…

…..but modified for the cumulative focus

- Some approaches use VECs (reflecting a Canadian influence on guidance documents), others don't ("generic")

…..but both approaches emphasise that the focus is on the affected resource/area/environmental component

A generic approach….

Eight-Step Approach for Developing a Cumulative Impact Analysis

1. Identify Resources to Consider in the Cumulative Impact Analysis
2. Define the Study Area for Each Resource
3. Describe the Current Health and Historical Context for Each Resource
4. Identify Direct and Indirect Impacts of the Proposed Project that Might Contribute to a Cumulative Impact
5. Identify Other Reasonably Foreseeable Actions that Affect Each Resource
6. Assess Potential Cumulative Impacts
7. Report the Results
8. Assess the Need for Mitigation

Washington State Department of Transportation (2008) p.5

Using the 8-Step Approach: A Hypothetical Example

To assess the potential for cumulative impacts, the practitioner determines the potential for past trends and current and reasonably foreseeable future actions, in combination with the proposed project, that affect the health of the resource.
Below is a brief outline of how to use the steps, with a hypothetical example for wetlands:

***Step 1*:** The project will have direct or indirect impacts to wetlands; therefore, wetlands are included in the resources to consider for cumulative impacts assessment.
Step 2: Based on consultation with environmental biologists and wetlands specialist, you determine that the relevant resource study area (RSA) is the drainage basin.
Step 3: The context: currently the area is being used for some farming and rural housing, and has relatively intact wetland complexes. The urban growth boundary has recently been moved and now includes this area. Current resource study area size: 1,000 hectares. Historically (pre-settlement), the area contained abundant wetlands. The wetlands have been disturbed by agricultural activities over the past 150 years. In recent years, urban development has increased the pace of wetland loss. The trend: rapid development is continuing, and is expected to accelerate over the next 20 years.
Step 4: This project will have two hectares of direct and indirect impacts to wetlands in the Resource Study Area.

contd./

Step 5: You have identified reasonably foreseeable actions in the wetlands Resource Study Area, and the associated impact to wetlands. These reasonably foreseeable actions include two new housing developments, a new business park, and several transportation improvements. Based on available environmental documents, discussions with wetlands experts, and other information you have collected about these actions, you estimate that 200 hectares of wetlands will be adversely affected by reasonably foreseeable actions.

Step 6: You used a trends method to analyze the cumulative effects on the wetlands loss over time. You also consulted with environmental biology staff and regulatory experts to analyze the effect of cumulative stresses (fragmentation, pollution, sedimentation) to the values and functions of wetlands in the Resource Study Area.

Step 7: You concluded that there will be substantial cumulative impacts to wetlands within the Resource Study Area given past, current, and reasonably foreseeable actions. Your analysis shows that your project will account for two hectares of the 200 hectares of potential cumulative impacts to wetland. You conclude that the wetland impacts associated with your project will contribute minimally to the impacts of other current and reasonably foreseeable projects.

Step 8: Based on your analysis of the status of wetlands in the Resource Study Area, you recommend that compensatory mitigation for the direct and indirect project impacts be near existing wetland mitigation areas or wildlife refuges. If practicable options for cumulative effects mitigation exist, disclose them and suggest possible mitigation to those agencies responsible. Remember to include in your disclosure any avoidance and minimization that has been done.

Tools for cumulative impact assessment

- Many familiar, some less so
  - more emphasis on system-wide analyses, characterisation
  - less emphasis on detailed prediction

Method	Description	Strengths	Weaknesses
Questionnaires and Interviews	Useful for gathering broad information about the range of activities to consider, and their effects. Valuable for involving stakeholders early in process	Deal with subjective information Promote inclusion Can be used by most people	Broad and subjective information, not technical detail or analysis
Checklists and Matrices	Based on previous experiences with various activities, so useful to guide scoping, etc.	Provide organised frameworks, and systematic	Can be hard to find relevant lists, matrices. Don't address cause-effect pathways, interactions, etc. Can miss issues if not in the device used.
Network and Systems Analysis/Diagrams	Promote exploration of cause-effect pathways, linkages, flow-on effects, etc.	Promote deeper thinking about direct, indirect impacts, cross-sectoral links, based on systems concepts.	Can be overwhelming detail, hard to separate important from less important issues; weak on spatial and temporal context.
Indicators and Indices	Key variables (indicators) and aggregated variables (index) as measures of state of a system, or of key characteristics (e.g. carrying capacity, or limit of acceptable change)	Broad system measures, provide quick way to assess current state, potential stresses, proximity to resource limitations, etc. Use in scoping, monitoring, management of impacts	Standard indicators and indices may not be relevant to the study area. Establishing new ones requires data, specialist analysis, etc. *contd./*

Numerical Models	Models based on established processes, usually quantified, to allow evaluation of comparative impacts of alternatives	Allows simulation of real systems, to predict likely outcomes under different conditions. Can be used to inform policy/project design work	Require good data, proven numeric relationships. Users may ignore or not realise the limits on the models. Numeric findings given too much weight.
Trend Analysis	Used to establish past, current state and likely future state of a resource/system. Informs baselines, nature and influence of stressors.	Provide dynamic perspective, potential influence of human activities and natural variation over time. Can suggest scenarios for modelling, etc.	Data hungry. Extrapolation into future challenging. Emphasis on overall state of system, not cause-effect relationships.
Spatial Analysis	GIS provide the ability to map, analyse and model spatial relationships, from biophysical to socio-economic and cultural	Characterises spatial, and temporal, patterns; map impact footprints; model and map impacts across landscapes. Visual presentation of information for public, stakeholder, decision-makers	Mainly direct impacts. Mainly additive analysis of cumulative impacts. Requires good technical skills, software, and access to imagery, and mappable environmental and socio-economic data

Enough about theory….let’s look at some cases!

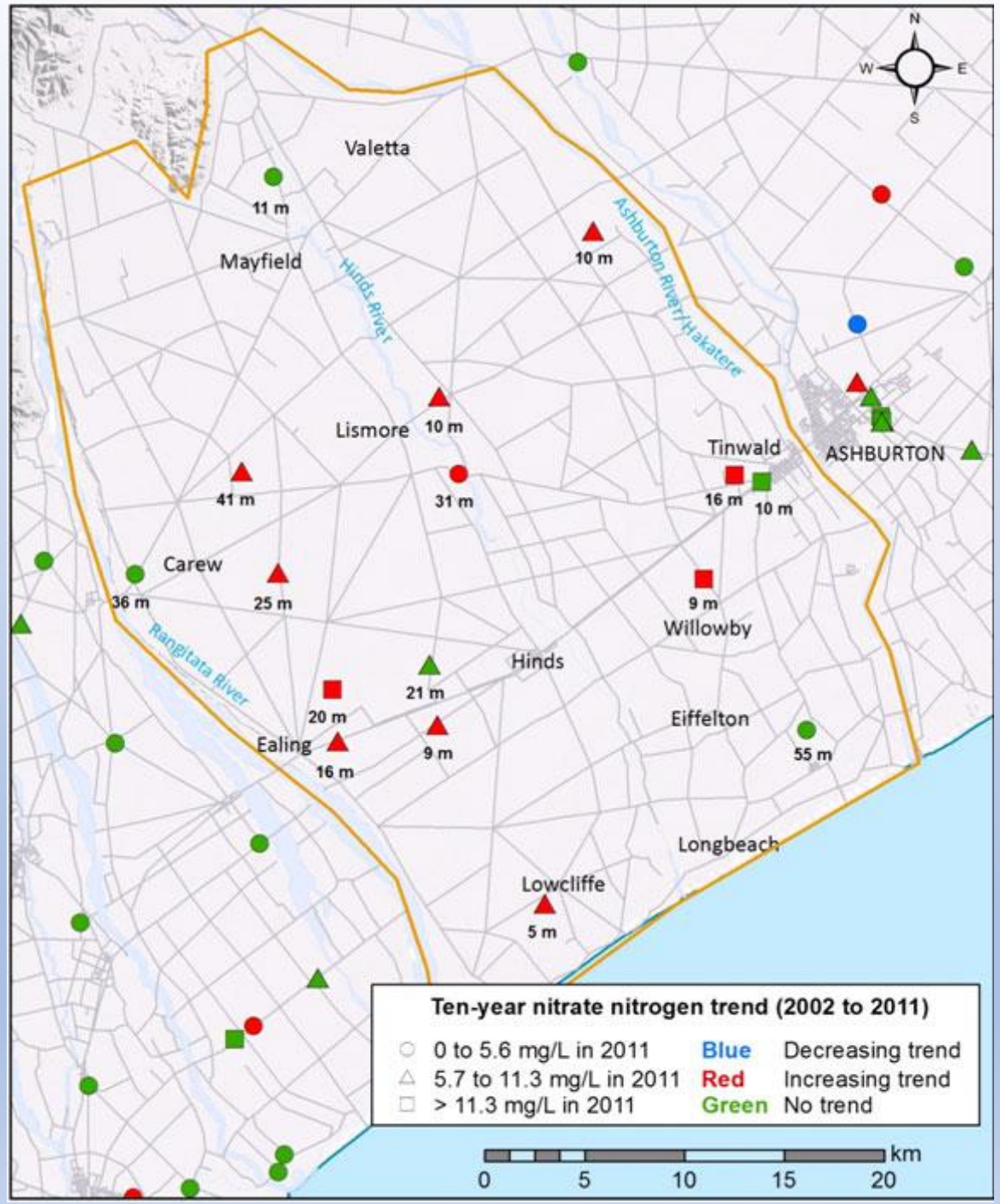
Hinds Catchment (Canterbury) Nitrogen Levels (spatial and 10-year trend data)

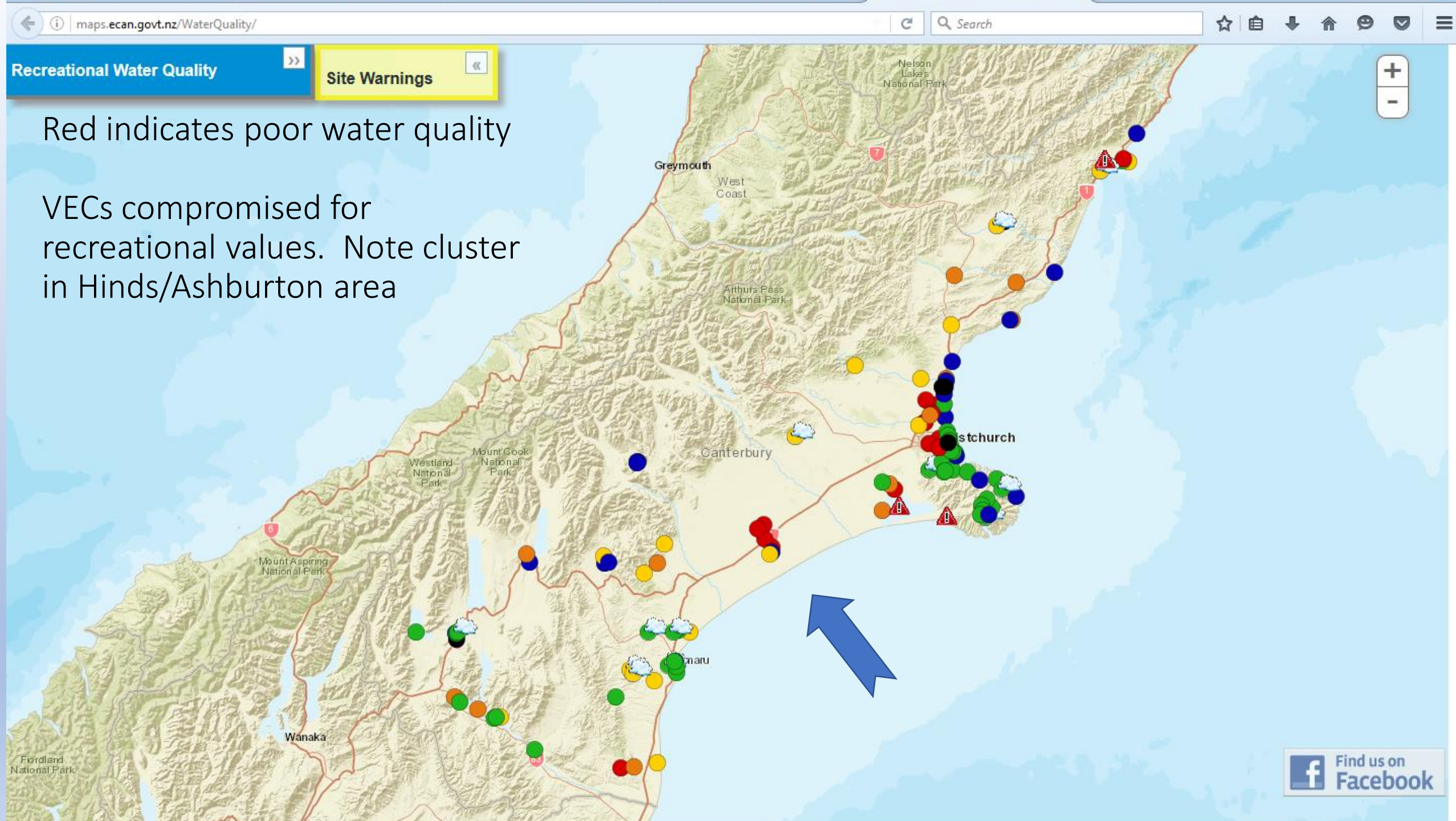
Compounding impacts of more nutrients/less dilution from an area with additional intensive farming over time

Red symbols are an increasing trend

Squares are high levels

Source: Environment Canterbury




maps.ecan.govt.nz/WaterQuality/
Search
Recreational Water Quality
Site Warnings
Red indicates poor water quality
VECs compromised for recreational values. Note cluster in Hinds/Ashburton area
Nelson Lakes National Park
Greymouth
West Coast
Arthurs Pass National Park
Canterbury
Westland National Park
Mount Cook National Park
Mount Aspiring National Park
Wanaka
Fiordland National Park
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Strategic assessment of freshwater management – national level

National policy statement to set requirements for activities that pose risks to freshwater and freshwater ecosystems. National standards designed to:

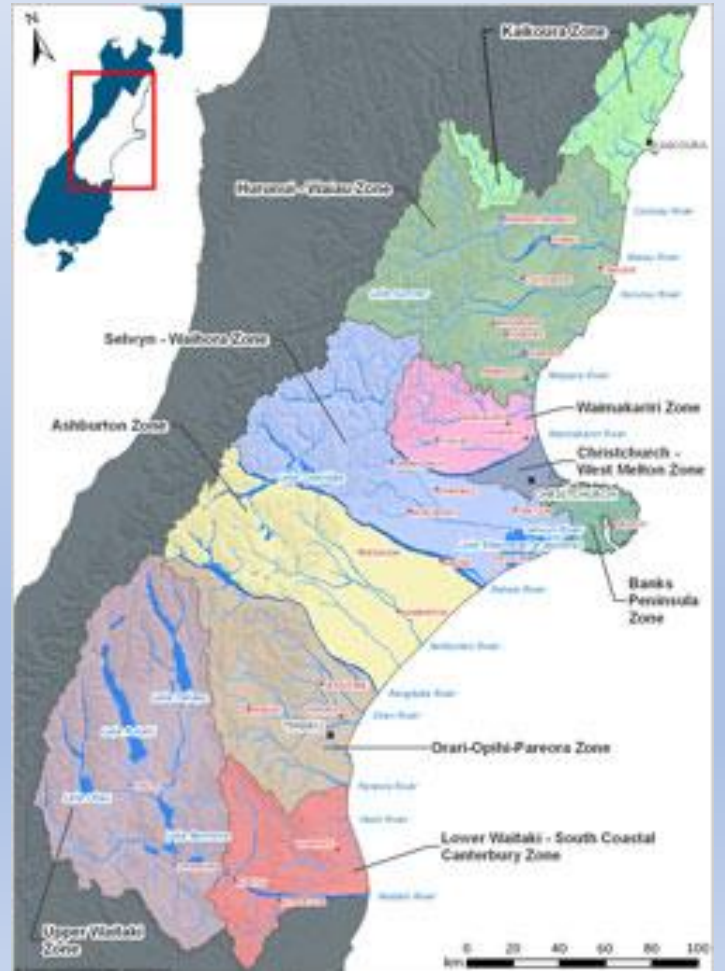
- protect existing inland and coastal wetlands
- protect urban and rural streams
- ensure connectivity of fish habitat (fish passage)
- improve farming practices
- restrict agricultural intensification
- limit the discharge of synthetic nitrogen fertiliser to land, and require reporting of fertiliser use

See www.mfe.govt.nz/fresh-water

Strategic assessment of freshwater management –regional level

SEA for Canterbury regional zones (catchment level) policy and plans for land and water. Focus on key outcomes for people and communities:

- Economic
  - On and off farm employment and business activity
  - Viable populations and communities
- Drinking water:
  - Risks to infants, public health outbreaks
  - Costs for households with shallow wells, eg protection/deeper wells
  - Costs of community supplies, new infrastructure
- Water-based recreation:
  - Contact recreation
  - Ecosystem changes
  - Cyanobacterial risks
  - Visual/aesthetic effects
- Cultural impacts
  - Mahinga kai (cultural and personal health)

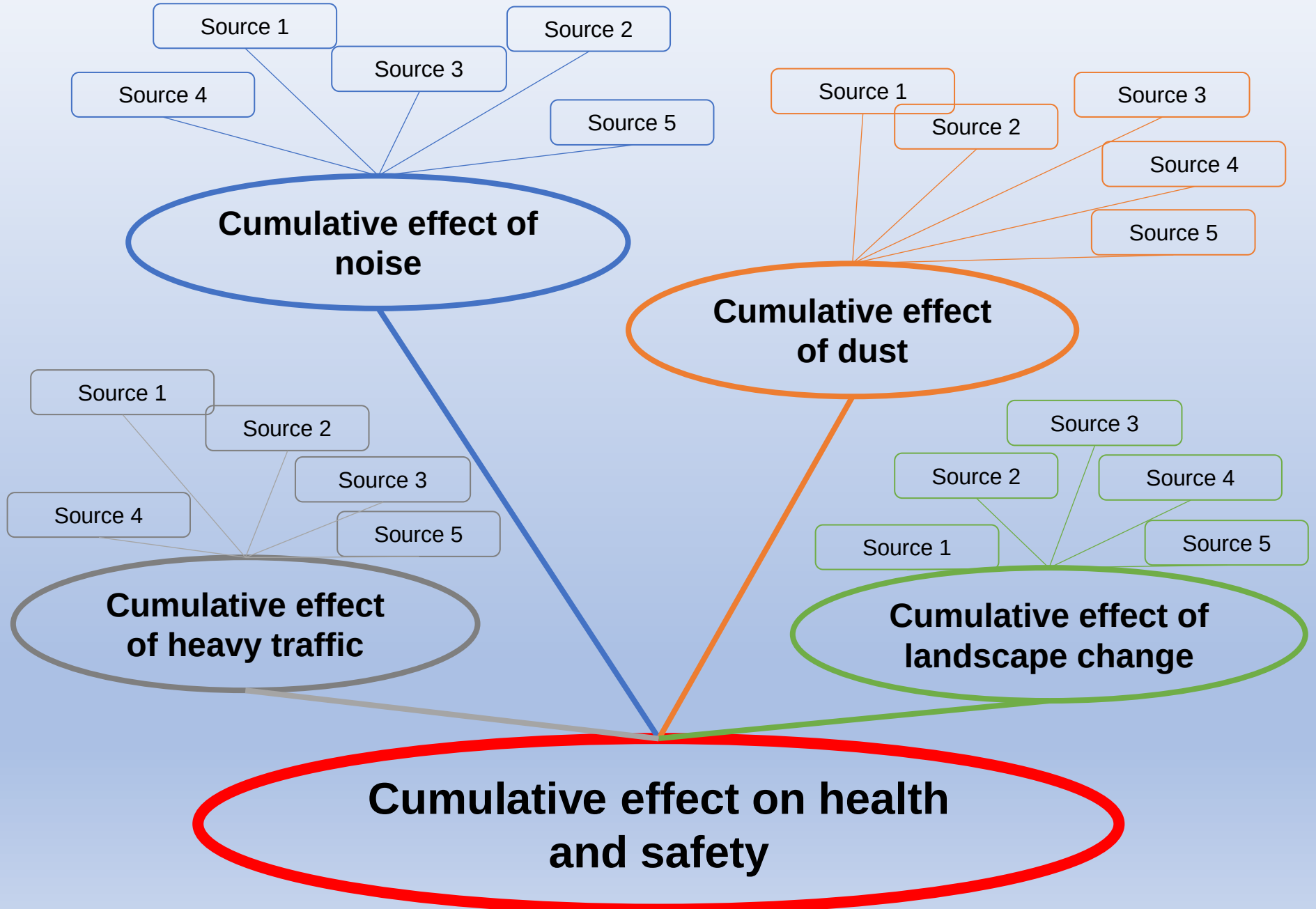


Aggregates quarry - effects of dust (health focus)

- A health risk from prolonged exposure to fine dust containing crystalline silica includes the lung disease “silicosis” and also lung cancer
- Shorter term risk is airway inflammation, coughing and bronchial asthma
- (symptoms evident in a nearby area -close to Christchurch)

Effects of noise

- University of Auckland head of audiology Dr David Welch said when someone felt troubled by a sound, it could "start to have a really big impact on them"
- Welch said a study he was involved in showed noise sensitive people living near noise sources like motorways and airports had poorer health
- Repeated [ie long term] exposure to noise could interfere with people's sleep, diet, immune system and cardiovascular system
- Eg wind farms, quarries …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Source 3
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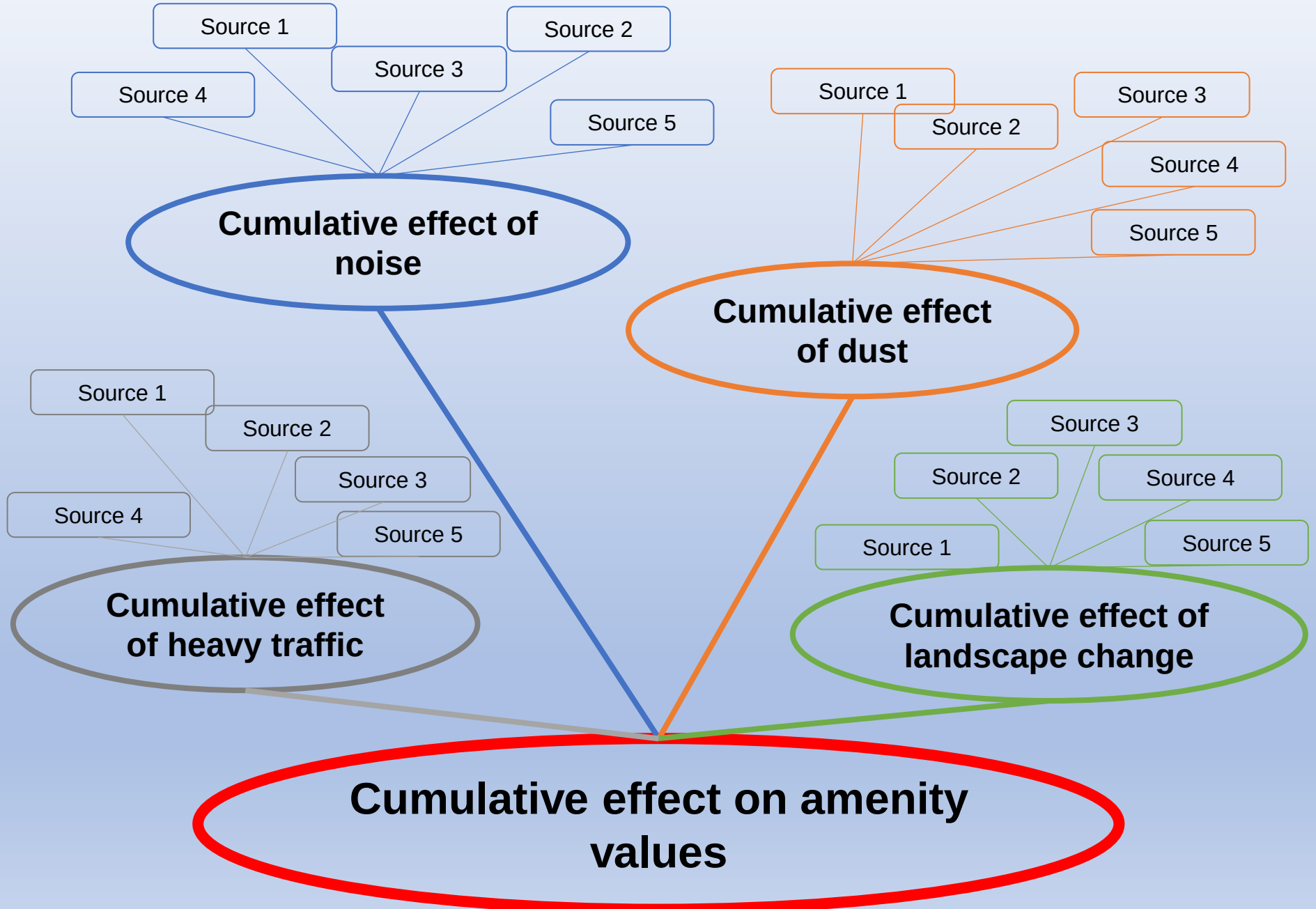
Source 5
Cumulative effect of noise
Source 1
Source 2
Source 3
Source 4
Source 5
Cumulative effect of dust
Source 1
Source 2
Source 3
Source 4
Source 5
Cumulative effect of heavy traffic
Source 1
Source 2
Source 3
Source 4
Source 5
Cumulative effect of landscape change
Cumulative effect on health and safety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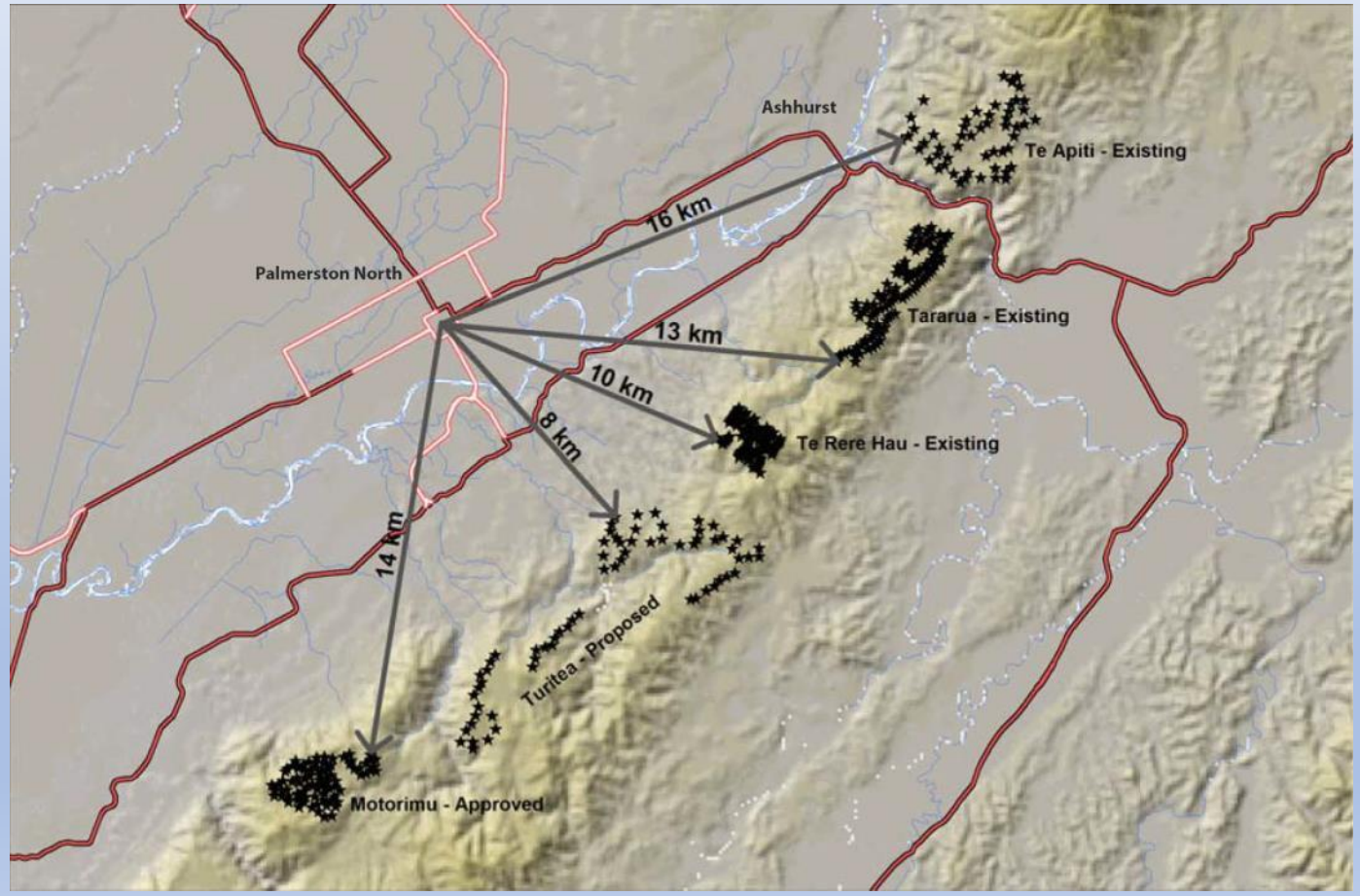
Cumulative effect of landscape change
Cumulative effect on amenity values

Windfarm example – Increasing community resistance to additional projects

noise and visual impacts on amenity values of near neighbours



Bonriki Airport expansion, Tarawa

Where to put the fence?

Successive expansions of the airport impacting:

- Land rights
- Access and security
- Village dynamics
- Housing
- Food production
- Water catchment
- Recreation
- Employment and business development

Where to put the fence?

Irrigated taro production – cumulative impacts from multiple sources over time on Rarotonga. Discussion?

Sources on cumulative impacts assessment

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Thank you everyone….

We are happy to take questions, discuss examples, etc….