

The state of New Zealand's environment:
Commentary by the Parliamentary
Commissioner for the Environment on
Environment Aotearoa 2015

June 2016



Parliamentary Commissioner
for the **Environment**
Te Kaitiaki Taiao a Te Whare Pāremata

Acknowledgements

The Parliamentary Commissioner for the Environment would like to express her gratitude to those who assisted with the research and preparation of this report, with special thanks to her staff who worked so tirelessly to bring it to completion.

Photography

Cover image: PCE archive

This document may be copied provided that the source is acknowledged.

This report and other publications by the Parliamentary Commissioner for the Environment are available at: **www.pce.parliament.nz**

Contents

1	Introduction	5
1.1	The reason for this commentary	7
1.2	What comes next	8
2	Assessing <i>Environment Aotearoa</i> 2015	9
2.1	The purpose of a state of the environment report	10
2.2	Structure reports by issues	12
2.3	Some issues cross domains	14
2.4	Choosing issues	16
2.5	Choosing indicators – relevance	18
2.6	Location matters (a lot)	20
2.7	Quality assurance	22
2.8	Looking ahead	24
3	Gaining perspective on our environment	27
4	Which environmental issues concern me the most?	29
5	Conclusion and recommendations	41
5.1	The purpose of state of the environment reporting	42
5.2	Structure of reports	43
5.3	Selecting indicators	44
5.4	Looking ahead	45
5.5	Making conclusions – judging significance	46
5.6	Responding to conclusions about the state of our environment	47
	Appendix	48
	Notes	50



1

Introduction

We New Zealanders are privileged to live in an exceptionally beautiful country. Aotearoa New Zealand is a land of stunning landscapes populated by plants and inhabited by birds and other animals found nowhere else.

For tangata whenua everything in the natural environment – the land, the animals and plants, the rivers and the sea – are interconnected. For Māori, the kinship of people and the natural world means that the state of the environment is a reflection of the state of the people. The mauri of the people is healthy when the rivers are clean, the forests are full of birds, and the seas are teeming with fish.

Visitors come great distances to experience what New Zealanders often take for granted, and this year the number of tourists is expected to reach a record of over three million. Much of our economy is based on production from the land and the sea. The lifestyle and opportunities provided by New Zealand's environment are a primary drawcard for expatriate New Zealanders returning home and new New Zealanders migrating here to live and work.

But the environment does not look after itself, and we spend millions of dollars on our efforts to protect it. To do this well, we need to understand the pressures it is under and the effects they are having. We need to understand and measure the state of our environment.

Some years ago I was surprised to discover that the country that brands itself 'clean and green' was the only one in the OECD without an ongoing commitment to reporting on the state of its environment. This has now changed with the passage of the Environmental Reporting Act last year.

However, the natural and physical environment is vast and complex, and the number of potential environmental statistics is infinite. So is the potential cost. How can the task of reporting on the state of the environment be bounded?

The answer is to have a purpose that is crystal clear. Any information that does not serve that purpose can be excluded. A collation of environmental data without a clear purpose risks being pointless.

What then should be the purpose of a state of the environment report? It should fundamentally be a diagnosis of the health of our environment. It should give all decision-makers – elected representatives, iwi leaders, businesses, environmental groups, and members of the public – a firm basis for comparing one environmental issue with another.

Much environmental concern is reactive, and to some extent subject to fashion. We need both evidence and reasoning to be able to judge which environmental issues we should worry about the most. We also need to know which environmental issues we should worry about the least – and which we should worry about somewhat. We need perspective on the state of our environment.

This report is a commentary on *Environment Aotearoa 2015*, the first complete state of the environment report prepared under the Environmental Reporting Act.

1.1 The reason for this commentary

In 1997 and in 2007, the Ministry for the Environment produced state of the environment reports, although it was not required under law. This has now changed with the enactment of the Environmental Reporting Act in 2015.

Under this Act, the Secretary for the Environment and the Government Statistician must produce a 'synthesis' state of the environment report every three years. Between synthesis reports, they must also produce reports on five environmental 'domains' – one domain report every six months. The five domains are:

- Air
- Atmosphere and climate
- Fresh water
- Land
- Marine

Two reports have been produced as 'pilots' by the Secretary for the Environment and the Government Statistician prior to the commencement of the Act – one a domain report and one a synthesis report. These are the *2014 Air Domain Report* and a synthesis report titled *Environment Aotearoa 2015*.

The Parliamentary Commissioner for the Environment also has a role to play in this new system. Under section 18 of the Act, I, and those who succeed me as Commissioner, may choose to prepare independent commentaries on the state of the environment reports.

Last year I released a commentary on the first 'pilot' report, the *2014 Air Domain Report*.¹ In this commentary, I identified seven aspects for improvement in future reports, and it is pleasing to see a response to some of my concerns in the synthesis report. Examining the data on air quality piqued my interest in air quality policy, and the commentary grew into an investigation. I concluded my report by recommending a review of the management of the tiny air-borne particles that is our only significant air quality problem.

This report is my commentary on the second 'pilot' report, the synthesis report, *Environment Aotearoa 2015*.

1.2 What comes next

Chapter 2 is my assessment of *Environment Aotearoa 2015*. There are eight sections in this chapter, each dealing with an important aspect of state of the environment reporting.

Those interested in my high-level take on the state of our environment may wish to skip to chapters 3 and 4.

Chapter 3 is an outline of the criteria I use as a guide to thinking about the relative importance of different environmental issues.

In Chapter 4, I apply these criteria to the five different domains.

In Chapter 5, I make six recommendations.

The first five are to the Government Statistician and the Secretary for the Environment and are all aimed at helping them improve future state of the environment reports.

The sixth recommendation is to the Secretary for the Environment, and is concerned with the need for a response to the findings of both *Environment Aotearoa 2015* and this commentary.

Finally, an Appendix describes responses to the recommendations I made in my commentary on the *2014 Air Domain Report*.



2

Assessing *Environment Aotearoa 2015*

In the Environmental Reporting Act 2015, section 18 describes the role of the Commissioner in the new environmental reporting system.

The Commissioner may choose to comment on matters that “include , but are not limited to, –

- a) *analysing environmental reports:*
- b) *identifying trends:*
- c) *discussing the implications of environmental report findings:*
- d) *recommending responses to environmental report findings.”*

This chapter is focused on the first of these. In it, I examine *Environment Aotearoa 2015*, and identify eight areas for improvement in future state of the environment reports. My focus is on the printed report of *Environment Aotearoa 2015*.

Along with this printed report, the Ministry for the Environment and Statistics New Zealand produced a website that contains maps, graphs, tables, and information on methodologies, a website from which datasets and analyses can be downloaded, and a summary infographic.

Although this commentary refers only occasionally to the websites, my staff found them to be a very valuable resource. Ready access to such information increases transparency and therefore trust – it is important that these websites be maintained.

The environment is vast, much is unknown, and the task of reporting on the state of the environment is a great challenge. Those who worked on *Environment Aotearoa 2015* are to be commended for producing an entire synthesis report so soon under the new system. I hope that this commentary will help those charged with the responsibility of preparing future reports.

2.1 The purpose of a state of the environment report

What should be the purpose of a state of the environment report? When it comes to producing yet another government report, we should always ask why.

The purpose stated at the beginning of the Environmental Reporting Act does not help. It is only “... to require regular reports on New Zealand’s environment”.

However, ‘regularity’ is not a purpose. There are many kinds of reports that can be written on New Zealand’s environment with a variety of purposes. A set of natural resource accounts is one kind, an evaluation of policy effectiveness is another, and meeting international reporting requirements is a third.²

The purpose stated at the beginning of *Environment Aotearoa 2015* is focused on the provision of information. It refers to encouraging discussion and informing decision-making. But discussions and decisions about what? There are no limits. Because the environment is so vast and complex, without limits there is no end to the kinds of statistics that could be collected.

Articulating a clear purpose for reporting on the state of the environment is essential. It is important that all those involved in the preparation of such reports should understand and work towards a common purpose.

For much of the time I have been Commissioner, I have been thinking about how to do state of the environment reporting well.³

In my view, its primary purpose should be to help New Zealanders to assess different concerns about the environment, and thus to improve the way we manage and protect it.

To do this, it needs to contain clear conclusions.

The key findings of *Environment Aotearoa 2015* on pp. 9-12 and the infographic go some way toward conclusions. But there needs to be a reasoned explanation for why these are considered to be ‘key’. Moreover, some are clearly not ‘key’ – for example, the decline in carbon monoxide emissions from transport and the percentage of land used for farming and forestry. However, the former is a minor issue, the latter merely a number without context.⁴

A state of the environment report should leave its readers with perspective on things that affect, or potentially affect, the health of the environment – on issues they are already concerned about and issues they might become concerned about.⁵

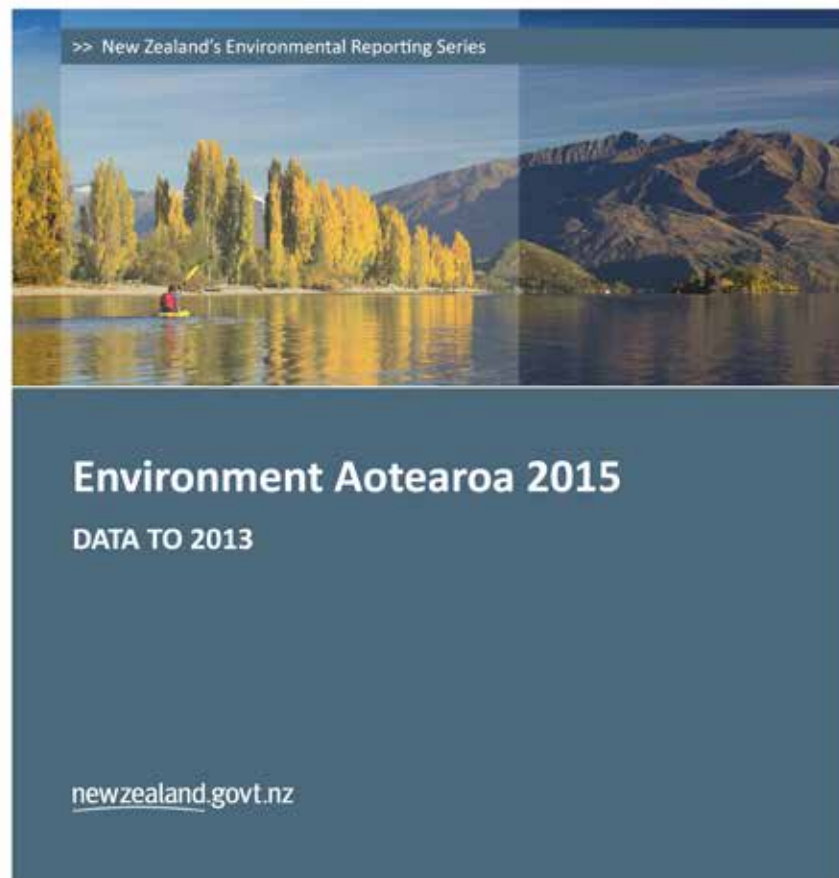


Figure 1 This commentary is focused on the printed report of *Environment Aotearoa 2015*.

2.2 Structure reports by issues

The structure of *Environment Aotearoa 2015* is major problem. This is most easily illustrated using the Atmosphere and Climate chapter because there are only two issues – climate change and ozone depletion.

The underlying structure of the chapter is shown on the left of Figure 2.

- The first section covers the *impacts* of climate change and ozone depletion.
- The second section covers the *pressures* causing climate change and ozone depletion.
- The third section covers the *state* of the atmosphere and climate.

The structure is problematic for two reasons.

The first is that beginning with *impacts* undermines the logic of the pressure-state-impact framework.⁶ The logic of the framework is that *pressures* cause changes to the *state* of the environment, and these changes have *impacts*.

The second is that cutting back and forth between the two separate issues of climate change and ozone depletion within each section leaves the reader bemused.

Fundamentally, a state of the environment report should be a set of coherent ‘stories’ about different issues. Each ‘story’ should be a mix of explanation and evidence, and incorporate the logic of the pressure-state-impact framework.⁷

My recommended structure is shown on the right of Figure 2.

I have another concern with the way the pressure-state-impact framework has been used – the use of the *term*, ‘natural pressures’.

For example, weather and topography are classed as natural pressures on air quality because in some towns and cities, the physical form of the land can lead to the formation of temperature inversions in cold weather, trapping air pollutants close to the ground. But weather and topography are entirely different from the pressures caused by human activities. We have no control over them but they are important because they help explain where and when air quality is poor.

For this reason, internationally, state of the environment reporting typically focuses on assessing the impacts of human pressures on environmental quality, while explaining any natural amplifiers.

Atmosphere and climate	
Current structure	Recommended structure
<p>1. Impacts</p> <ul style="list-style-type: none"> • Economic effects (CC) • Water availability (CC) • Glacier extent (CC) • Health effects (CC + O₃) <p>2. Pressures</p> <ul style="list-style-type: none"> • GHG emissions (CC) • Ozone depleting substances (O₃) • Oceans (CC) • Climate oscillations (CC) <p>3. States</p> <ul style="list-style-type: none"> • GHG concentrations (CC) • Ozone concentrations (O₃) • UV intensity (O₃) • Average temperature (CC) • Rainfall (CC) • Extreme weather (CC) 	<p>1. Climate change</p> <p>Pressure: GHG emissions</p> <p>↓</p> <p>State: e.g. Sea level</p> <p>↓</p> <p>Impact: e.g. Coastal flooding</p> <p>2. Ozone depletion</p> <p>Pressure: CFC emissions</p> <p>↓</p> <p>State: Stratospheric ozone</p> <p>↓</p> <p>Impact: e.g. Melanoma incidence</p>

Figure 2 The structure of the Atmosphere and Climate chapter of *Environment Aotearoa 2015* is shown on the left. (CC refers to climate change and O₃ refers to ozone depletion).

My recommended structure for use in both domain reports and synthesis reports is on the right.

2.3 Some issues cross domains

Another reason for structuring reports by issues is that many issues cross domains.⁸ Trying to confine an issue within a single domain will often result in an incomplete picture.

For instance, ocean acidification is a major *impact* of climate change that is already evident. But it is also a change in the *state* of the ocean and a *pressure* on marine biodiversity. In *Environment Aotearoa 2015*, it is covered in the Marine chapter but only mentioned briefly in the Atmosphere and Climate chapter.

It belongs in both and should not be split between domains. As a reader, I want to know why climate change is acidifying the oceans and what this will do to shellfish. (See Figure 3.)

Another example of a major issue that spans domains and needs to be presented in both in a linked up way is erosion and sedimentation. Erosion is a change in the *state* of the land and a *pressure* on fresh water and coastal habitats. Erosion-sedimentation is an issue that belongs in Land domain reports, Freshwater domain reports, and Marine domain reports.

Environment Aotearoa 2015 contains separate chapters for each domain. If future synthesis reports are structured around issues, climate change-ocean acidification and erosion-sedimentation need only be presented once.



Source: Matthew Gough/Shutterstock

Figure 3 The acidification of the ocean is an issue that crosses domains – it belongs in the climate change domain and in the marine domain.

The photograph shows green-lipped mussels (kūtai or kuku). It will become increasingly difficult for molluscs such as these to form shells as the ocean becomes more acidic.

2.4 Choosing issues

By necessity, structuring a state of the environment report by issues begins with choosing the key issues.

Figure 4 contains ‘working’ lists of issues in each of the five domains.⁹ They are not intended to be definitive, but could serve as a starting point and be developed over time in response to expert advice and public concerns. I envisage such lists forming tables of contents in domain reports.

A synthesis report need not be bound by domain divisions and can bring these issues together in ways that make most sense. This has been done in the biodiversity chapter in *Environment Aotearoa 2015*.

To be clear, I am using the word ‘issue’ to mean a change in the state of the environment that people are concerned about. As such, ‘issues’ are completely different from the pressure, state, and impact ‘topics’ referred to in s19 of the Environmental Reporting Act. An ‘issue’ is a change in the state of the environment that is (partly) caused by human activities (pressures) and has consequences (impacts).

Emerging issues should also be included. So should issues that indicators show to be relatively unimportant. Part of gaining perspective on the state of our environment is knowing what we do *not* need to worry about.

Most importantly, the choice of issues should not be dictated by the availability and quality of indicators. This is the subject of the next section.

Atmosphere and climate	
Climate change Stratospheric ozone depletion	
Air	
Particulates Nitrogen oxides Other pollutants	
Land	
Erosion Soil health Contaminated land Native forests Other native habitats Forest and field birds, and other threatened animals Invasive species - plants and animals Solid waste	
Fresh water	
Pathogens Sedimentation Nutrient pollution Heavy metal contamination Native fish, etc. Invasive species Wetland loss Low river flows Groundwater levels	
Marine	
Climate change – acidification, temperature, etc. Fisheries – sustainability Bycatch Marine mammals Sea birds Bottom trawling Coastal pollution Coastal habitats (incl. sea level rise and aquaculture) Invasive species Oil spills Plastic pollution	

Figure 4 Environmental issues in the five domains.

2.5 Choosing indicators - relevance

The primary criterion for choosing an indicator in a state of the environment report should be its relevance to the issue being analysed. Relevance should always trump other criteria for choosing indicators.

For instance, relevance may be in conflict with accuracy. If the accuracy of an indicator is questionable, then a caveat can be added. Imagine if the reverse were to be done – presenting an indicator that is very accurate and adding a caveat to the effect that it is not particularly relevant.

Part of relevance is ensuring that indicators measure what they purport to measure. At the end of the Land chapter in *Environment Aotearoa 2015*, ecosystem function is measured using the poor proxy of the amount of carbon sequestered in forests. This indicator is, however, highly relevant for climate change so should have been included in the Atmosphere chapter.

The choice of indicators can sometimes convey impressions that may not be intended. For instance, a figure on p.44 shows how small New Zealand's emissions are on a global scale, and this could be taken to indicate that it is pointless to try to reduce them. A figure showing our greenhouse gas emissions per capita compared with other countries would convey an entirely different impression.

It is not always possible (or may be prohibitively expensive) to measure what is relevant. Inference from indirect measures can be very powerful. During my investigation into the pesticide 1080, I was both startled and disturbed to discover that only on about one-eighth of the conservation estate was there any control of possums, rats, and stoats. This tells me a great deal about what is happening to our native forests and to the birds, and other creatures that live within them.

These state of the environment reports are being written for the general public, their elected representatives, and other decision-makers. One dimension of relevance is to ask what they would want to know. Clearly, when it comes to the Fresh Water domain, people are concerned about 'swimmability'. This was omitted from *Environment Aotearoa 2015* because of concerns about accuracy.¹⁰ But if an issue is important, ways to report on it should be found even when the data is limited. (See Figure 5.)

Another example is the two indicators used for the sustainability of fisheries in the Marine chapter – "*the proportion of fish caught from stocks subject to overfishing*" and "*the proportion of stocks [i.e. fish populations] that are subject to overfishing.*" These summary indicators are particularly opaque – what I really want to know is which fish species are in trouble.¹¹



Source: Tom Ackroyd, Flickr

Figure 5 Water quality in rivers and lakes that are popular swimming spots is important to many New Zealanders. There is some inconsistency in the way in which regional councils determine 'swimmability'. One of the benefits of the new national environmental reporting system is that over time it will drive more consistent monitoring and analysis by regional councils.

2.6 Location matters (a lot)

An environmental issue may be very significant in one part of the country, but trivial in another. A state of the environment report should show us where different issues are significant and where they are not.

Environment Aotearoa 2015 gives us very little information about how good or bad different aspects of the environment are in different parts of the country. For this the reader must search the supporting information on the website.

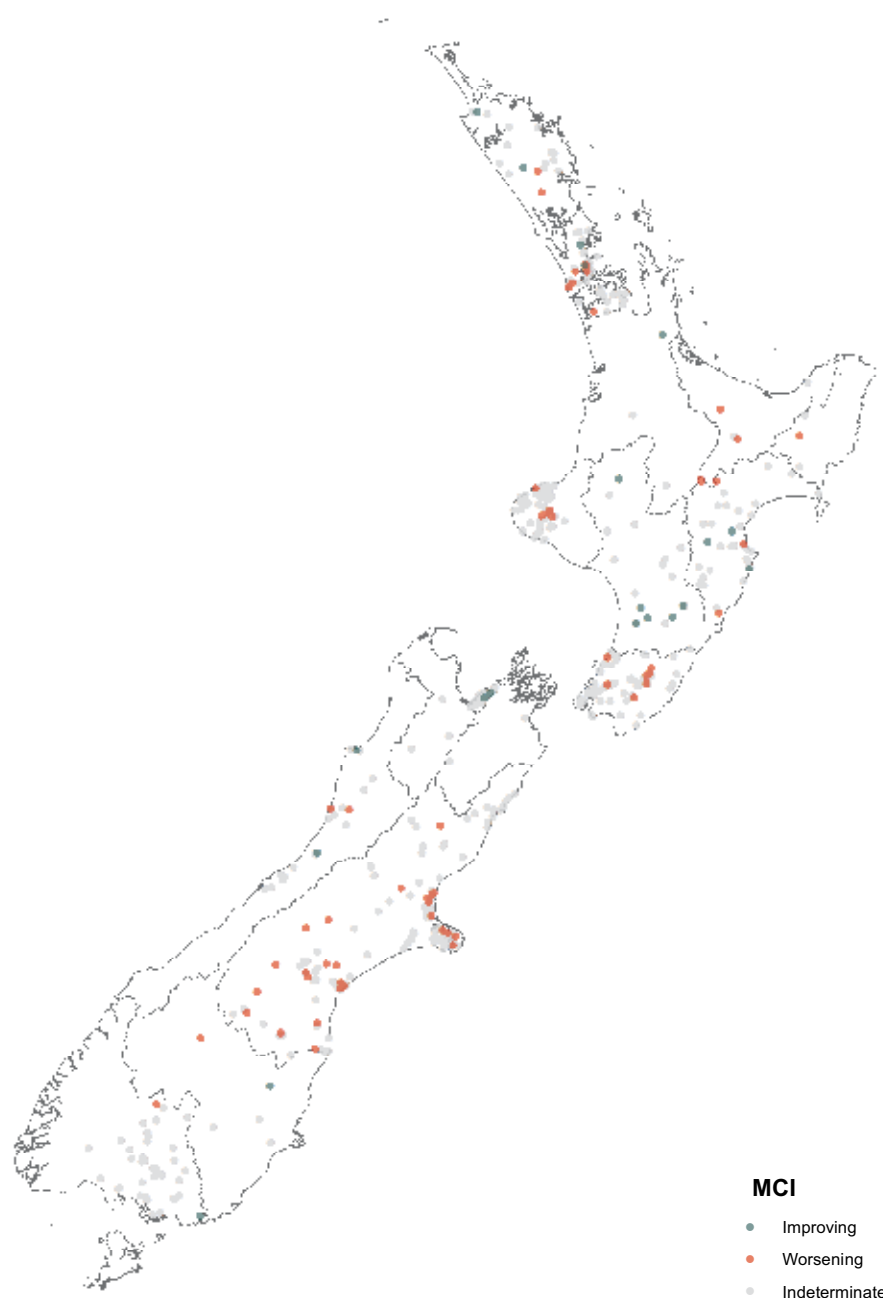
‘Overall’ trends tell us nothing when environmental issues are local or regional, as indeed most are.

For instance, we are told that there is no overall trend for nitrate in groundwater – that nitrate concentrations have increased at 22 monitoring sites but decreased at 13. But I need to know where – it may be that all the increases in nitrate concentrations have occurred in one part of the country and it is a serious issue there.

In my commentary on the *2014 Air Domain Report*, I stressed the importance of reporting on location.¹² It is pleasing to see the response – the maps on pp.33-34 in the Air chapter of *Environment Aotearoa 2015* do this very well.

But overall, there are few maps in the report, although there are many on the website. Some of the maps on the website are excellent, including the map showing wetland loss.

Most of the maps that are in the report provide information on the *environment*, but not on *environmental issues*. For instance, the Fresh Water chapter has two maps – one showing river sites monitored by NIWA and the other showing the extent and location of aquifers. But these do not tell me anything about what is happening to our rivers and aquifers. A much more useful map is shown in Figure 6 because it shows significant changes in an indicator of freshwater ecology.¹³



Data source: MfE and NIWA

Figure 6 Changes in macro-invertebrate community index (MCI) between 2004 and 2013 at over 400 river sites. MCI is an indicator of overall fresh water ecosystem health. MCI has improved at 20 sites and worsened at 59 sites.

2.7 Quality assurance

A state of the environment report must be built on a bedrock of scientific understanding that is based on a weight of evidence and communicated clearly. *Environment Aotearoa 2015* does not always do this.¹⁴

The scientific explanation of climate change is particularly problematic.

For instance, on p.95, it is stated that sea level rise is “... *probably due to the expansion of warming waters, and ice sheets or glaciers melting...*”. What should have been stated is that sea level rise is “... *due to the expansion of warming waters, and the melting of both ice sheets and glaciers*”.^{15,16}

The presentation of indicators also needs to be done with an understanding of the science. On p.96, the figure showing tidal gauge data from various ports has been presented in its raw form, leaving the impression that the sea is much higher above the land in Auckland than in Wellington.

New Zealand’s three big water quality problems are pathogens, sediment, and nutrients. But sediment scarcely features in the Fresh Water chapter. The website does contain a brief description of what sediment is, where it comes from, and the destructive effect it has on rivers and the life within them, but this cause-and-effect relationship is fundamental to understanding water quality in New Zealand and belongs in the report.

Cause-and-effect relationships sit at the heart of science and require careful analysis. Establishment of an effect often relies on comparison with a control or baseline. Table 1 on p.64 shows trends in water parameters at the 77 NIWA river sites. However, 32 of these monitoring sites have been deliberately chosen as controls because they are near the headwaters of the rivers where water quality would be good and not expected to change. (See Figure 7.) But because all 77 sites have been pooled together to look for ‘overall’ trends, the control sites have not been used as they should be. The upshot is that any important changes in water quality related to human activities cannot be detected.¹⁷

Another important aspect of tracing cause-effect relationships is using time series that span the appropriate period, allowing ‘before’ and ‘after’ comparisons.

One very important pressure on New Zealand’s environment has been the expansion and intensification of dairy farming. A figure on p.78 shows livestock numbers beginning in 2002, although this big change in land use began about a decade earlier. Any time series dealing with this land use change should begin around 1990.

After raising this time period issue in my commentary on the *2014 Air Domain Report*, I was pleased to see that the Air chapter showed how particulate pollution in Auckland has become much less significant over the last 50 years. On the other hand, a major conclusion of my commentary is that the health impacts of *long-term* exposure to particulates are much greater at a population level than the impacts of *short-term* exposure. This important scientific result is absent from the Air chapter.



Source: Tony Graham, Flickr

Figure 7 One of NIWA's control sites for monitoring water quality is at Kaitoke on the Hutt River.

2.8 Looking ahead

In my commentary on the *2014 Air Domain Report*, I stressed the importance of making clear conclusions on the state of the domain, so it is good to see conclusions on air quality in the synthesis report. It is also good to see a clear account of the causal links between the pressures in the Fresh Water chapter and water quality.

But *Environment Aotearoa 2015* does not provide a diagnosis of the health of our environment – it does not give perspective on the seriousness of different environmental issues. A state of the environment report cannot do this without including forward thinking.

Quoting from my commentary on the *2014 Air Domain Report*:

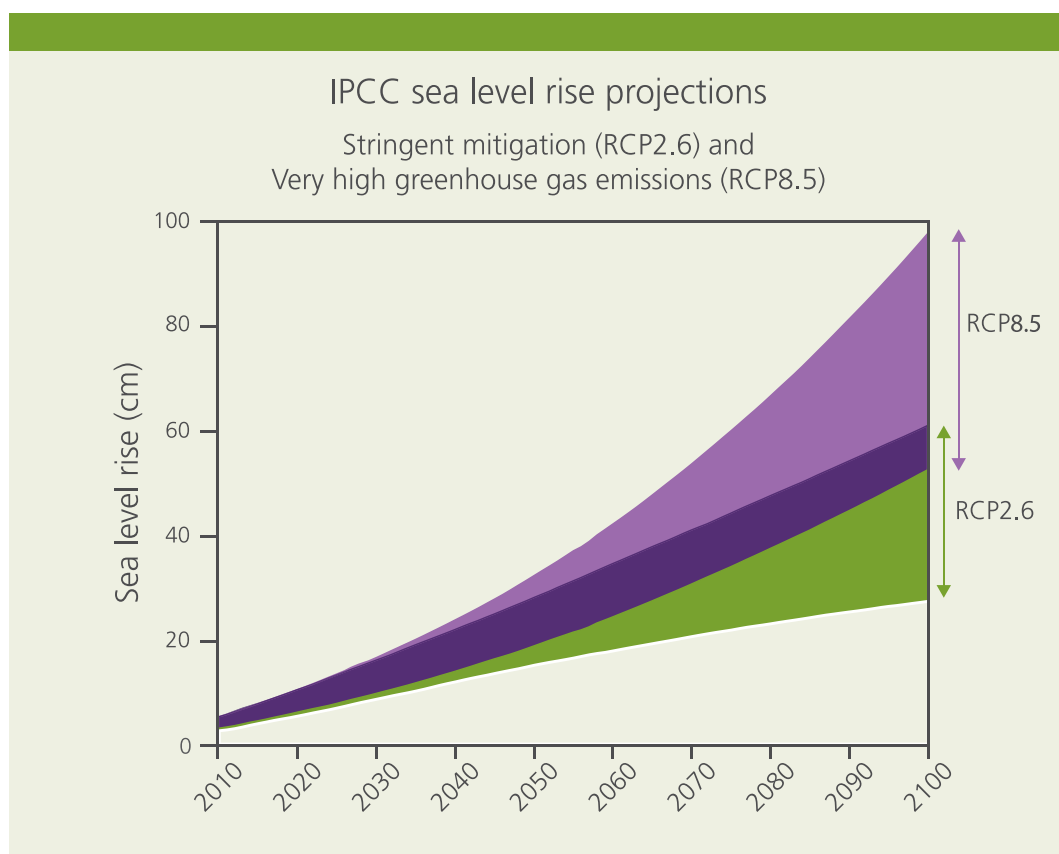
“Another dimension of judging how serious this issue is in New Zealand is to consider the underlying ‘drivers’ of changes in air quality – to look back at how and why sources of pollutants have changed in the past, and to contemplate how they can be expected to change in the future.”

It is because I looked forward as well as backward in that commentary that I was able to conclude that air quality was no longer a major environmental issue in New Zealand.

A straightforward way to incorporate a look forward is to do what Australia does – each chapter in Australia’s state of the environment report ends with an Outlook section.¹⁸

In some cases it will be appropriate to include quantitative projections in a state of the environment report. (Figure 8 is an example.) Science can not only tell us about how things are, but can also model how they are likely to be.

The need for forward thinking is crucial when it comes to the most serious environmental issue of all – climate change – where the future is so much more important than the past. For instance, it is very important to convey to the reader that the sea will continue to rise for centuries to come even if global greenhouse gas emissions stopped tomorrow.



Data source: IPCC, 2013

Figure 8 An example of quantitative projection that would be appropriate for inclusion in an outlook section.

The graph shows the most recent projections of global mean sea level rise by the IPCC relative to 1986–2005 under its lowest and highest greenhouse gas emission scenarios – ‘stringent mitigation’ and ‘very high greenhouse gas emissions’.



3

Gaining perspective on our environment

In my role as Parliamentary Commissioner for the Environment, I am free to choose topics for investigation. This brings with it the responsibility to choose wisely – to use the resources of my office to investigate the important not the trivial.

In 2008, I delivered the State of the Environment address at Lincoln University, and titled it *“Prioritising environmental challenges: What matters most?”*. In that address I proposed criteria for ranking different environmental issues for the first time.

That thinking was developed further in my 2010 report, *How clean is New Zealand? Measuring and reporting on the health of our environment*. A state of the environment report must contain information that will help us to prioritise different environmental issues – to put them in perspective.

Earlier in this commentary, I pointed to the need to focus state of the environment reports on issues that are important to New Zealanders. Inevitably, the choice of issues will involve value judgements. However, because much environmental concern is reactive, and to some extent subject to fashion, evidence and reasoning has a critically important role to play.

This is where my criteria can help. They are in the form of questions.

Is the issue being considered:

- Irreversible?
- Cumulative – building up over time?
- Large in scale or pervasive?
- Increasing in scale and/or distribution, especially if it is accelerating?
- Able to tip a natural system over a threshold into another state?

The more questions answered with a ‘yes’, the more reason there is to consider taking the issue seriously. Collectively, the criteria convey a sense of urgency – *if* we want to do something about an issue with many ‘yeses’, we need to get on with it.

It is important that answering these questions is not seen as a ‘tickbox’ exercise. For instance, the extinction of a species is by definition irreversible.¹⁹ But in many cases, irreversibility is a matter of degree or timeframe.

Note that the criteria are all physical and measurable. Some may choose to view an issue as minor despite all five questions being answered with a 'yes'. Conversely some may care deeply about an issue despite all five questions being answered with a 'no'.

Doubtless, these five criteria could be improved, and certainly should not be used as some kind of magic formula that spits out answers with no need for further thought. But in my office we have found them to be very valuable in informing our judgement of the relative seriousness of different environmental issues.

Should these, or some other criteria, be applied to different environmental issues in making conclusions at the end of a state of the environment report? I think they should because answering these questions provides a transparent basis for prioritising our concerns.

What should be done in response is an altogether different question and involves value judgements, consideration of opportunity costs and trade-offs, and so on. Such considerations do not belong in a state of the environment report.



4

Which environmental issues concern me the most?

So what is the state of the environment? What are the main messages that I would expect to see coming through clearly in a synthesis report?

This chapter is my high-level take on the state of our environment – my summary of what stands out for me in each of the five domains.

In part, this is based on the work of my office and the knowledge I have gained after nearly a decade in my role. But information alone is not enough. In order to make judgements on the relative significance of different environmental issues, some sort of rational ranking system is required. Thus, I have explicitly used the five criteria outlined in Chapter 3 as a guide to my thinking.

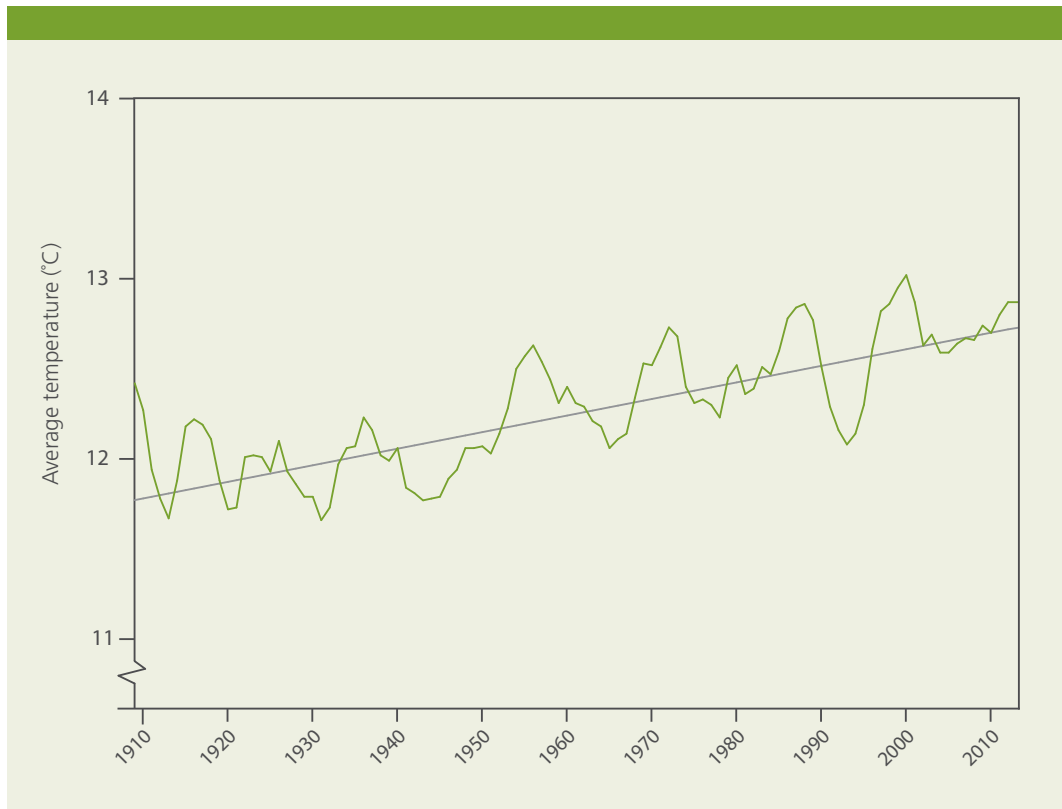
At the end of each domain, I have added some comments on what could be done in response to the issues that stand out. This draws on my earlier work and is not intended to be comprehensive.²⁰

I begin with the *atmosphere*. Stratospheric ozone is a good news story, but climate change is a far greater challenge.

Currently, there is no basis for thinking the problem is reversible. Greenhouse gas emissions accumulate in the atmosphere and heat accumulates in the ocean. The scale is global – the world is beginning to feel the effects. Global emissions (including New Zealand's) continue to rise. With the exception of the 'stringent mitigation' scenario, the scenarios in the IPCC's latest report all bend upward, indicating the impacts will be felt at an increasing rate. And there are some alarming potential tipping points like the thawing of the 'methane ice' in the Arctic.

There is no question that climate change is by far the most serious environmental issue we face. Moreover, it will have big impacts on virtually every other aspect of our environment.

However, I remain optimistic. In April this year, over 200 countries signed the Paris Agreement in New York, all acknowledging the nature of the problem we face. There are some really significant developments in technology underway – I expect my next car to be electric.



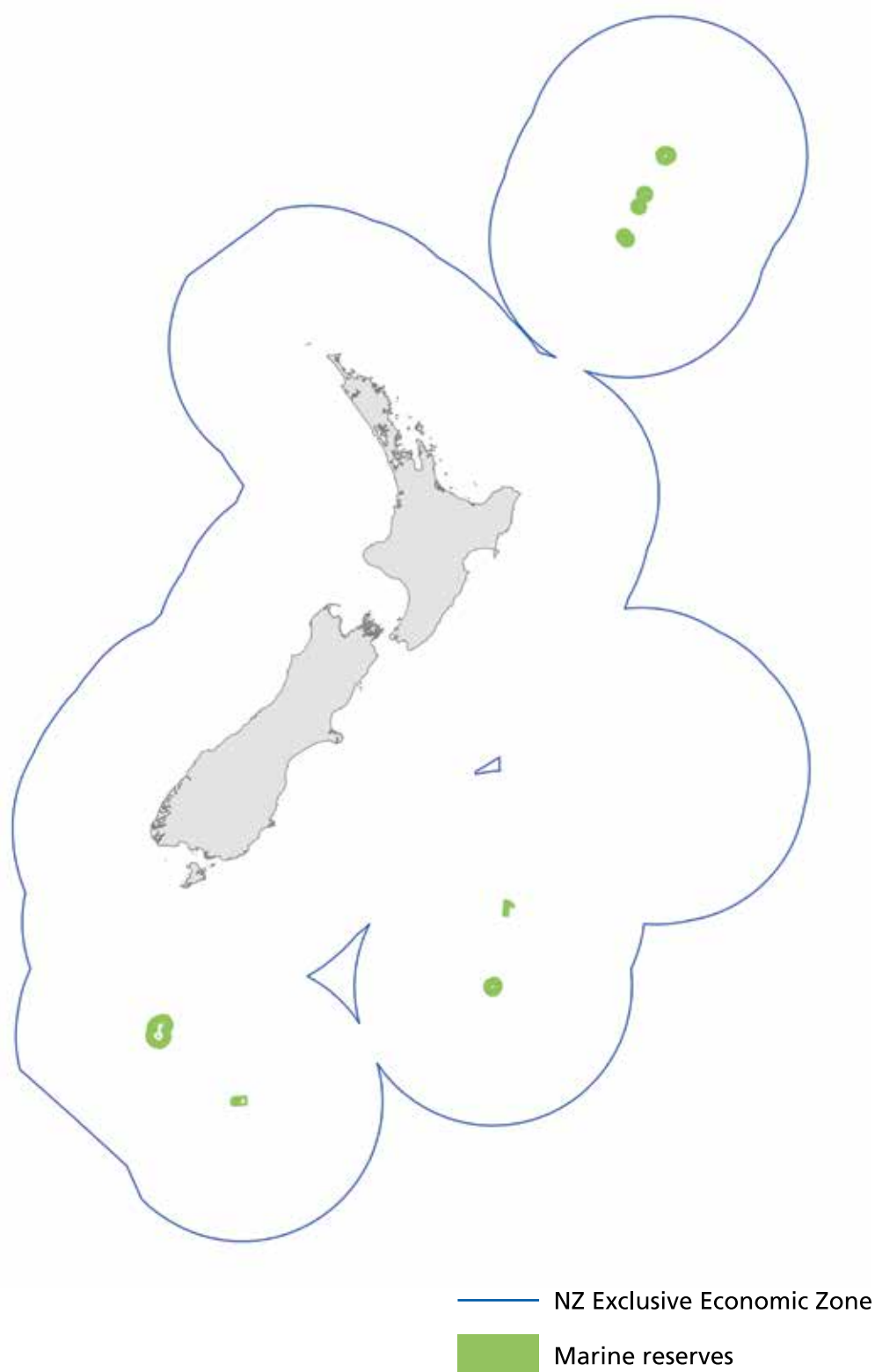
Data source: MfE. 5-year rolling average.

Figure 9 Average annual temperature in New Zealand has risen by nearly one degree Centigrade between 1909 and 2013.

Importantly, climate change is already affecting the *marine* environment. Most troubling is the irreversible cumulative effect of more and more carbon dioxide dissolving into the ocean and making seawater increasingly acidic, affecting the ability of zooplankton and shellfish to form shells. Eventually, marine foodwebs will become undermined. Further, the warmer the surface water of the ocean becomes, the less oxygenated it becomes. In warm, oxygen-poor, and acidic seawater, some species such as jellyfish will thrive but many other species will not.

Nearer in time, other human activities continue to put stresses on the marine environment. Run-off from land damages marine habitats around much of the New Zealand coast. While the focus is on the sustainability of our commercial fisheries, there is much we do not know about the effect of fishing on the sustainability of marine ecosystems. We do know that nine of our forty endemic seabirds are now listed as critical or endangered, on the point of tipping into extinction.

The Law of the Sea has made New Zealand the guardian of a vast area of ocean. We have a long and proud history of protecting precious places on land. In contrast, Figure 10 shows how little of the ocean we are responsible for is protected in reserves. We need to do more.²¹

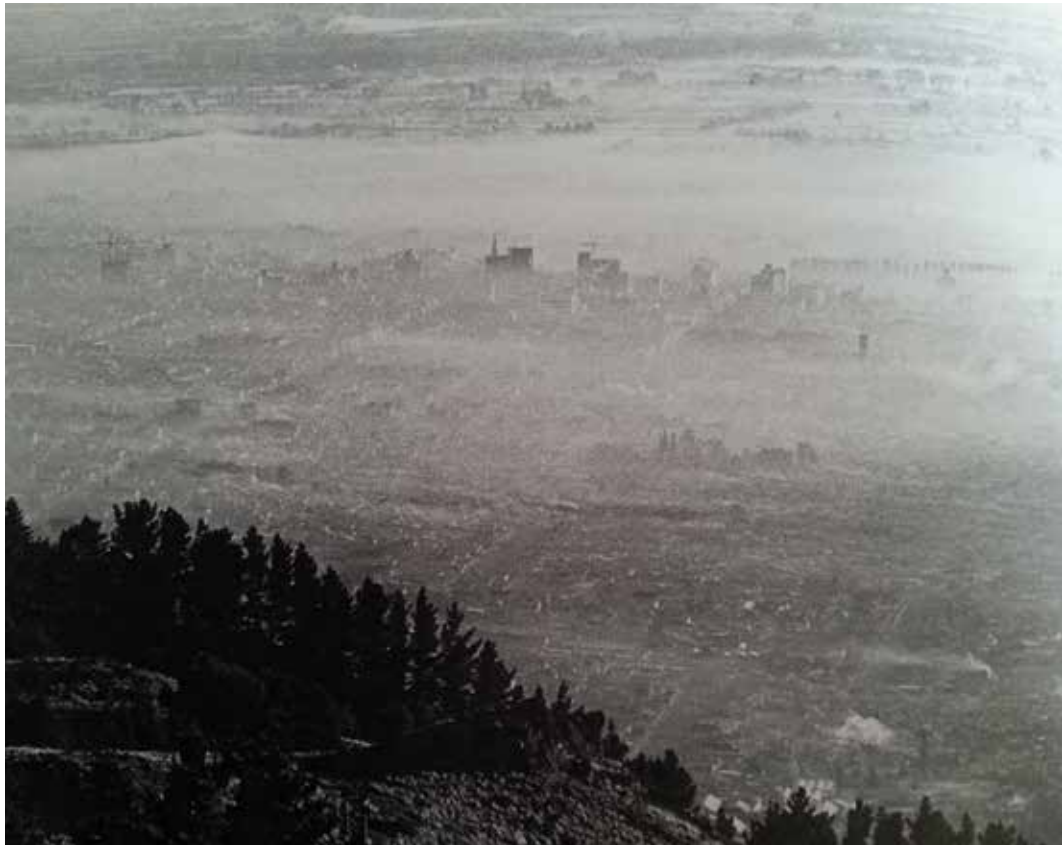


Data source: MfE; LINZ

Figure 10 New Zealand's 'no-take' marine reserves. Those around the mainland are too small to show up on this map. Benthic protected areas where bottom-trawling is forbidden and marine mammal sanctuaries are not shown.

In contrast with these global changes, *air* quality in New Zealand is a good news story.

High levels of the tiny particles that are our main air quality problem are temporary, although the damage they do to the health of exposed populations accumulates. On most days of the year, air quality is excellent. Over the last 50 years, emissions have fallen due to technology changes and government intervention, and I expect this to continue. Even Christchurch once famous for its smog, almost 'complies' with the most important of the World Health Organisation guidelines. However, high winter spikes will continue to persist in cold parts of the country prone to the formation of temperature inversions. There are no tipping points.



Source: Temple, P. 1987, *Christchurch: A city and its people*, Auckland: Pacific Publishers.

Figure 11 Christchurch as it used to be on many still winter days. If you squint you can see the spire of the Cathedral.

The two big environmental issues in the *land* domain are erosion and pests.

A century of clearing bush on unstable hill country has left a legacy of erosion. An enormous amount of topsoil has been, and continues to be, washed into waterways. Erosion is irreversible and cumulative. Vast areas of land are eroded, particularly in the east of the North Island. Trees have been planted to stabilise soils in some areas, but this has little overall effect at a national level because eroded areas are so extensive. Climate change is projected to lead to more intense and frequent heavy downpours, exacerbating the problem. An eroded area will tip into another state when plants cannot re-establish because so much fertility has been lost.

Planting trees and supporting native forest regeneration on unstable hill country would bring many benefits besides slowing erosion – reducing the amount of sediment washed into rivers and streams, ameliorating flooding, storing carbon, and providing habitat.

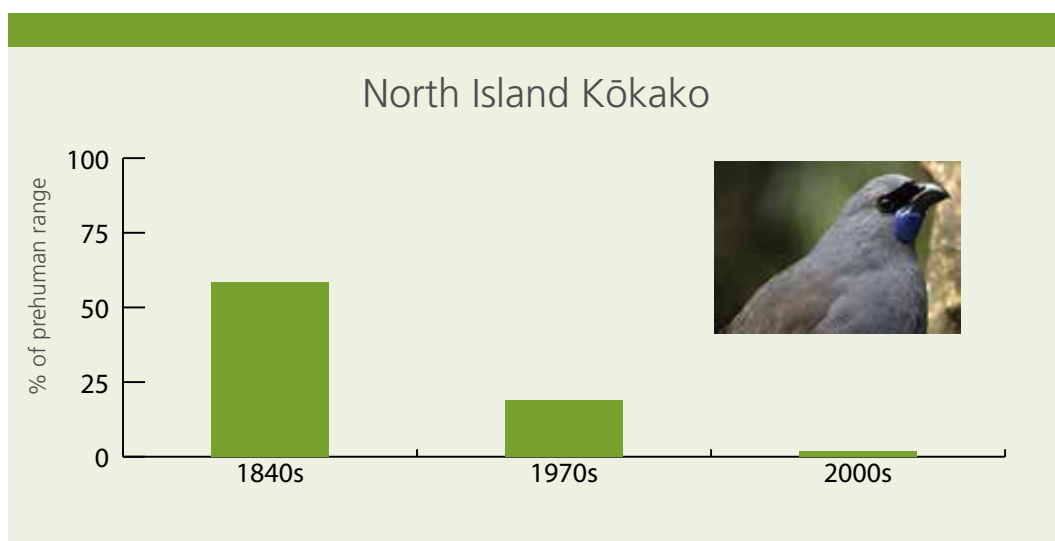


Source: Peter Scott

Figure 12 A century of clearing bush on unstable hill country has left a legacy of erosion. An enormous amount of topsoil has been, and continues to be, washed into waterways.

The very uniqueness of New Zealand's plants, birds, and other animals makes them especially vulnerable to invaders, whether they be feral cats or hieracium. Extinction is irreversible. Invasive species that thrive here multiply rapidly and the damage accumulates. The tipping point for a species is functional extinction when a population has become no longer viable – this can occur long before the last individual dies. Ecosystems tip into downward spirals when critical links are broken or weakened.

Three particularly destructive mammal pests – possums, rats, and stoats – have pervaded almost all our forests. The worst damage occurs in 'mast' years, when fuelled by huge amounts of seed, populations of rats and stoats soar to plague proportions. This is happening again. I am encouraged that the Battle for the Birds is to be recommenced, although more is needed in order to win the war against predators.



Data source: DOC

Figure 13 The kōkako is my favourite bird because of its haunting song. It is a poor flier and particularly vulnerable to introduced predators. Like many other native species, the kōkako has suffered from a loss of habitat as well as from pests.

What we do (and have done) on the land largely determines what happens to the fifth domain – *fresh water*.

Water quality has become the focus of much environmental concern in New Zealand. While much of the fresh water in New Zealand is in an excellent state, water quality has declined markedly in many places. National averages are meaningless.

Sedimentation and nutrient pollution (nitrogen and phosphorus) work in tandem to degrade water quality and damage fresh water ecosystems.

Some sediment is washed out to sea, but much is not and builds up in layers on riverbeds and lakebeds. Much of the phosphorus carried into water is stored in the sediment. The nitrogen that pollutes water is mostly in the form of highly soluble nitrate, so if it is in rivers and streams, it is washed out to sea. But the damage it does to freshwater ecology while it is present is not readily reversible.

In general, the more 'contained' a water body is and the more slowly water flows through it, the more pollutants will accumulate. Thus, lakes are particularly vulnerable. A particularly worrying accumulation problem is the sediment that has built up in most of our estuaries.

Rivers that are pristine inland become increasingly degraded as they flow down developed catchments. The conversion of both sheep country and forests to dairy land has greatly increased the amount of nitrogen in freshwater, where together with phosphorus, it fertilises unwanted plant growth. Throughout the country, wetlands – the 'kidneys' of catchments – have been cleared and now occupy only a small fraction of their former extent.

Changes on farms such as spraying effluent on to land, fencing and bridging streams are helping reduce pathogens, sediment, and phosphorus pollution. But it is much harder to stop nitrogen getting into water, and impossible to stop the 'load to come' – the nitrate in groundwater that has accumulated over decades and is slowly making its way to lakes such as Taupō.

Enough sediment and nutrients 'tip' freshwater ecology into another state. Layers of sediment smother the tiny creatures that live within stony streambeds. Water enriched with enough nitrogen and phosphorus becomes infested with trails of slime and covered with algal blooms in summer. Mayflies and stoneflies are replaced by snails and worms, and fish suffer from a lack of habitat, food, and oxygen.

The debate about water quality has become less polarised over recent years, and there is an increasing focus on finding solutions, but the 'proof will be in the pudding'. Turning around the decline in water quality that is particularly evident in lakes and in lowland rivers and streams will be neither easy nor quick.

But it has long been part of our way of life to go down to the nearest river and jump into a swimming hole on a hot day. The high value placed on clean clear fresh water will ensure that improving water quality will remain a priority for New Zealanders.



Source: Wikimedia Commons

Figure 14 Kōura – New Zealand freshwater crayfish live among stones on streambeds and thrive in water that is free of silt.



5

Conclusions and recommendations

This report is my commentary on *Environment Aotearoa 2015* – the first national state of the environment report produced by the Secretary for the Environment and the Government Statistician.

A state of the environment report must draw conclusions and help us identify the most pressing environmental issues. *Environment Aotearoa 2015* presents environmental statistics and a range of key findings, yet it generally stops short of drawing clear conclusions on the state of the environment.

What conclusions can then be drawn on the state of New Zealand's environment?

Air quality is generally good in most places most of the time. Water quality is very good in undeveloped parts of the country, but is poor in many catchments. Much of this is a consequence of historic bush clearance on unstable soils and increasingly intensive farming. Lakes and estuaries are particularly vulnerable. Our native plants and animals are in serious trouble with most of our iconic bird species in decline. When it comes to the state of our ocean, we simply do not know very much. We do, however, know that climate change is by far the most worrying environmental issue. Already, global temperatures are increasing, the surface waters of the ocean are acidifying, and the level of the sea is rising.

This chapter contains six recommendations.

The first five recommendations are to the Government Statistician and the Secretary for the Environment, and follow from the assessment of *Environment Aotearoa 2015* in Chapter 2. Each identifies an aspect for improvement in future state of the environment reports.

In my commentary on the *Air Domain Report*, I recommended that the Government Statistician and the Secretary for the Environment develop a code of practice for preparing state of the environment reports. Such a code – called a Good Practice Guide – is being developed. I hope that it will be seen as a 'live' document that will not only incorporate my five recommendations for improvement in this commentary, but will be updated through a process of continuous improvement.

The last recommendation is to the Secretary for the Environment and seeks a response to the findings of *Environment Aotearoa 2015* and this commentary.²²

5.1 The purpose of state of the environment reporting

The environment is both very large and very complex, and the number of potential environmental statistics is infinite. Articulating a clear purpose for reporting on the state of the environment is essential. It is important that all those involved in the preparation of such reports should understand and work towards a common purpose.

That purpose should be a diagnosis of the health of our environment, that is, an aid to prioritising different environmental issues.

This purpose is largely reflected under the heading *Why do we do environmental reporting* in a 2014 Ministry for the Environment and Statistics New Zealand document.²³ I have reproduced this statement with a few but significant amendments in my recommendation below.²⁴

I recommend that:

- 1. The purpose of state of the environment reporting be to inform the public and decision-makers of the current state and long-term trends in the environment. It should identify and explain environmental issues, including their causes and location, and contain conclusions about their significance.**

5.2 Structure of reports

The structure of the synthesis report is a major problem. Each domain is dealt with in a separate chapter, although many issues cross domains. Within each chapter, the impacts on the domain are first described, followed by the pressures, and finally the state.

This structure makes the report hard to understand. Importantly, it makes it almost impossible to capture the causality of the pressure-state-impact framework that underlies every environmental issue.

It would be much better – for both the reader and the writer – to structure both domain and synthesis reports around environmental issues. A coherent ‘story’ can then be written about each environmental issue, using both explanation and quantitative indicators, and drawing on the logic of the pressure-state-impact framework.

Further, if an issue is important to New Zealanders, the lack of high quality data should not preclude its inclusion.

I recommend that:

- 2. Environmental issues form the basis for structuring domain and synthesis reports.**

5.3 Selecting indicators

Section 14 of the Environmental Reporting Act prescribes how indicators ('statistics') are to be selected. It refers to the Government Statistician following "*best practice principles and protocols*" and deciding on "*procedures and methods*".

The environment is new territory for Statistics New Zealand, and selecting environmental indicators is, and will continue to be, a challenge. In contrast, economic and social statistics have been developed long ago by economists and social scientists, and are well-established and widely accepted. What is 'best practice' for economic and social statistics will not be the same as 'best practice' for environmental statistics. The environment can only be understood and measured using the tools and methods of science, and a lack of clear scientific explanation is evident in places in the synthesis report.

Indicators should be chosen primarily because they are directly relevant to assessing environmental issues. This will require more input from, and interaction with, a variety of technical advisors. Because the significance of most issues varies with location, national averages should be the exception, not the rule.

I recommend that:

3. **Relevance to environmental issues be used as the primary criterion for selecting environmental indicators with more input from a variety of technical advisors.**

5.4 Looking ahead

The significance of an environmental issue cannot be judged without looking ahead.

If the pressures that are damaging an aspect of the environment are expected to decrease, then there may be less reason for concern. If significant policy and regulation changes have been put in place to address the issue, again there may be less reason for concern. But if a tipping point is approaching or the scale of the problem is accelerating, there will be more reason for concern.

Chapters in both domain and synthesis reports should end with outlook sections as is done in Australia's state of the environment reports.

I recommend that:

- 4. Both domain and synthesis reports contain outlooks for different environmental issues.**

5.5 Making conclusions - judging significance

A state of the environment report becomes much more useful to the public and decision-makers when it provides a sense of the relative significance of different environmental issues. The environment is so multi-faceted and complex that we cannot rely on the facts to speak for themselves.

In this commentary, I have presented the five criteria that guide my thinking about the importance of different environmental issues. Note that because these criteria are all physical and measurable, they inform the selection of indicators.

Note also that they do not incorporate value judgements. For instance, the environmental issue of wilding pines scores highly on the criteria. But people are still free to decide how much they care about this environmental issue. Some may see wilding pines positively because they store carbon and stabilise soil; others may see wilding pines negatively because they mourn the change in high country landscapes. But a 'high score' on the criteria tells us that if we do care, we need to act with some urgency.

Whatever criteria are used for making judgements, state of the environment reports should contain conclusions on the relative significance of different environmental issues.

I recommend that:

- 5. Both domain and synthesis reports contain conclusions on the relative significance of different environmental issues. The conclusions should be made transparently on a reasoned basis.**

5.6 Responding to conclusions about the state of our environment

The Environmental Reporting Act requires state of the environment reports to cover pressures, states and impacts, but to stop short of reporting on 'response' – the policies that could be put in place to address different environmental issues. I support this approach. But in the end the point of reporting on the state of the environment is to improve the way we manage and protect it.

The Ministry for the Environment is the agency charged with providing high quality policy advice on environmental management and protection. Thus the Secretary for the Environment has the key role in preparing the 'response' to a state of the environment report by undertaking policy analysis and giving advice on options for improving the way we manage and protect our environment.

This should begin with the preparation of a report to the Minister for the Environment that outlines priorities for action following *Environment Aotearoa 2015* and this commentary. This 'response' report should be made available to the public.

In my view, there are four areas that stand out for particular attention.

- a) There is no question that climate change is by far the most serious environmental issue we face. It will impact on the health of our sea, land, and fresh water, our unique and precious biodiversity, and our economy. Urban areas are key to reducing global greenhouse gas emissions, particularly those from transport. We must plan and develop our cities so that they are low-carbon as well as affordable.
- b) On land, we have a long and proud history of protecting precious places in national parks and reserves. At sea, in contrast, we have made very slow progress. The laws for creating marine protected areas to reduce pressure on our diverse and valuable marine life are obsolete and an overhaul has been proposed. It is critical that real progress is made.
- c) Planting trees and supporting forest regeneration on unstable hill country is an environmental win-win. It can slow erosion and the loss of valuable topsoil, reduce the sediment washing into rivers and streams, store carbon dioxide, and provide habitat for native plants and animals.
- d) Our native birds and animals are under sustained attack from predators. The Government's 'Battle for our Birds' has been successful in preventing the damage from 'masts' in some areas. But we must lift our sights from battles that 'hold the line' to figuring out how to win the war.

I recommend that:

6. **The Secretary for the Environment prepare a report for the Minister for the Environment, outlining priorities for action in response to the findings of *Environment Aotearoa 2015* and this commentary, and make this report publically available.**

Appendix

This Appendix describes responses to the recommendations made by the Commissioner in her commentary on the *2014 Air Domain Report*.

Recommendation 1: Improve environmental reporting

The Commissioner commended the Government Statistician and the Secretary for the Environment for producing the *2014 Air Domain Report*, the first report under the new system. She acknowledged that there will never be a perfect 'state of the environment' report, so the challenge is one of incremental improvement. Her commentary identified the following seven aspects for improvement in future reports.

- 1) Clear conclusions on the state of the environmental domain are essential.
- 2) The development of national indicators should be treated as a 'work-in-progress', and the indicators chosen not given undue weight. All relevant information should be considered when drawing final conclusions.
- 3) Location matters. It is important to make it clear where an environmental issue is significant and where it is not.
- 4) Indicating the degree of uncertainty in major results is important. This should include statistical testing of observed differences.
- 5) Modelled results should always be 'ground-truthed' wherever possible.
- 6) The limitations of models should be explained.
- 7) Future air domain reports would benefit from more analysis of natural sources of air pollution.

The Commissioner recommended that: the Government Statistician and the Secretary for the Environment publish a code of practice for preparing environmental reports that incorporates the improvements listed above.

In response, Statistics New Zealand staff have drafted a 'Good Practice Guide' and advised that it "*reflects the recommended improvement aspects*". The Guide will be published in October 2016, which will allow time to incorporate responses to the recommendations in this commentary.

The first three aspects for improvement – the need for clear conclusions, the relevance and accuracy of indicators, and the importance of location – are covered further in this commentary.

The second three aspects for improvement have not been a focus of this commentary. However, responses to them are evident in *Environment Aotearoa 2015*. For example, the report notes when trends have been statistically tested for significance, and a webpage outlines testing methods. The final aspect for improvement was specific to the Air Domain.

Recommendation 2: Review the PM₁₀ rule

The Commissioner's 2015 commentary also identified a number of scientific and policy issues with the 'PM₁₀ rule' in the National Environmental Standard on Air Quality. She recommended that:

The Minister for the Environment initiate a review of how particulate matter is managed that determines:

- a) Whether PM_{2.5} should be measured across the country in airsheds where there is likely to be a problem;
- b) The value of setting rules for PM_{2.5} and for long-term exposure;
- c) Whether the PM₁₀ short-term rule still has value;
- d) The impact of air quality rules on other public health issues, such as cold damp homes; and
- e) How air quality policies might be designed so as to achieve progressive improvement.

In response, the Minister for the Environment, Dr Nick Smith, announced in a speech to the Environmental Defence Society conference in August 2015 that:

"We will be consulting on standards for air quality ... [following] a substantial report from the Parliamentary Commissioner for the Environment on improvements we should make in how we regulate particulate pollution."

Notes

¹ Parliamentary Commissioner for the Environment 2015, *The state of air quality in New Zealand: Commentary by the Parliamentary Commissioner for the Environment on the 2014 Air Domain Report*.

² It is clear that what is intended is state of the environment reporting because the Environmental Reporting Act makes it clear that the standard pressure-state-impact framework is to underlie the reports. This framework (and extensions of it) are used around the world in state of the environment reports.

³ For some years it was expected that the task of producing a state of the environment report would be given to me and my successors. I am pleased this has not occurred because the role of independent commentator is consistent with my primary functions under the Environment Act. However, it was this expectation that led to my decision to undertake the investigation that resulted in the 2010 report, *How clean is New Zealand? Measuring and reporting on the health of our environment*. If the job was coming my way, my staff and I needed to do some preparatory thinking.

⁴ Another problem is that the form of the infographic partly controls its content. It prompts four key findings for each domain. Yet there might be only one key finding in one domain and ten in another.

⁵ I usually try to avoid using the anodyne word 'issue' and considered using the word 'problem' here instead. But 'problem' implies that a judgement about its seriousness has already been made.

⁶ I understand the decision was made to begin with *impacts* to give the reader reason to care about the state of the domain. Indeed the first section in the Atmosphere and climate chapter is titled *Why the condition of our atmosphere and climate is important*. However, this can be done in an introduction.

⁷ I do not wish to imply that each 'story' should be broken up with pressure, state, impact headings.

⁸ This is acknowledged in *Environment Aotearoa 2015* on p.114.

⁹ The domains in this figure are in their 'natural' order, not the alphabetical order used in the Act and in the synthesis report. Atmosphere precedes Air – the air we breathe is a very small part of the atmosphere. Land precedes Fresh Water because what happens to our waterways is largely caused by what we do on the land. Marine follows because rivers flow to the sea.

¹⁰ Regional councils determine the suitability of water for swimming by collecting samples of E. coli bacteria from popular swimming spots. Data on 'swimmability' was not included in *Environment Aotearoa 2015* because "some inconsistencies in monitoring methodologies mean the data are neither representative nor comparable across all sites." (p.59).

¹¹ This can be found on the website but it takes quite a lot of clicking.

¹² Parliamentary Commissioner for the Environment 2015, *The state of air quality in New Zealand*, p.21.

¹³ The data used to create the map in Figure 6 has been taken from MfE's data service website (MfE obtained the data from NIWA). It includes data from regional council monitoring sites as well as from the NIWA national network. Due to differences in the way MCI data are collected, not all sites or years could be used. Consequently, some of the results may differ from those reported by individual councils. It is important that the national environmental reporting team work with regional councils and other experts to standardise data collection and analytical methods.

¹⁴ But to their credit, the Ministry for the Environment and Statistics New Zealand included links to datasets and analytical methods as part of *Environment Aotearoa 2015*, and published a list of errors that were discovered after the report was first released.

¹⁵ Another example is on p.42. The statement "*If temperatures continue to rise, it is likely that the extent of glaciers will shrink further*" should have been written "*As temperatures continue to rise, the extent of glaciers will shrink further*".

¹⁶ See also p.47 where carbon monoxide is described as if it is a significant greenhouse gas, on a par with methane and nitrous oxide.

¹⁷ See the National River Water Quality Network on the NIWA website.

¹⁸ Nine 'domains' are reported on in Australia's state of the environment report – atmosphere (including air quality), inland water, land, marine environment, Antarctic environment, biodiversity, heritage, the built environment, and coasts.

¹⁹ That said, some scientists are working on 'de-extinction' – bringing extinct species back to life using their DNA.

²⁰ As discussed in sections 5.5 and 5.6, a state of the environment report should include conclusions, but not responses to its findings.

²¹ Parliamentary Commissioner for the Environment. *A New Marine Protected Areas Act: Submission to the Minister of Conservation, the Minister for the Environment, and the Minister for Primary Industries*. 11 March 2016.

²² Section 18 of the Environmental Reporting Act states that the Commissioner may choose to comment on matters that include "*recommending responses to environmental report findings*".

²³ Ministry for the Environment and Statistics New Zealand, 2014, *A framework for environmental reporting in New Zealand*, p.5.

²⁴ My most significant amendment is the deletion of "*national-scale*". The same purpose should apply to a regional state of the environment report. The term 'national-scale' can be taken to mean that indicators should be national averages.

