The Institute for Governance and Policy Studies, School of Government at Victoria University of Wellington

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Environmental Issues

The Institute for Governance and Policy Studies, School of Government at Victoria University of Wellington

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Editorial – Making Peace With Nature

'Humanity is waging a war on nature', said António Guterres, the UN Secretary-General. Accordingly, he argues, 'making peace with nature is the defining task of the 21st century'. It is hard to disagree. But how to secure such a 'peace'? What must be done?

This special issue of *Policy Quarterly* offers some answers. In so doing, it draws on the insights, experience, and wisdom of leading environmental lawyers, ecologists, and social scientists. Collectively, they address many of the formidable global and local ecological challenges facing humanity – climate change, biodiversity loss, the pollution of freshwater resources, and the ever-growing accumulation of waste.

But they also tackle wider constitutional, legal, political, and economic issues. What constitutional and institutional reforms, for instance, may be needed to help Aotearoa New Zealand navigate the increasingly treacherous waters of the 21st century (see especially the contribution of Sonia Mazey and Jeremy Richardson)? What regulatory frameworks are required to protect critical environmental values? How can economic and environmental policy making be better integrated? Is an economic strategy based on the goal of 'green growth' viable over the longer term? Alternatively, must this country – and eventually almost every nation – embrace the concept of 'degrowth' (in one or other of its different forms)?

Climate change is central to all such questions. Significantly, the special issue comes less than two months after the release of the final of the three massive reports which comprise the sixth comprehensive assessment of the Intergovernmental Panel on Climate Change (IPCC). All three IPCC reports – covering, in turn, the physical science basis, adaptation, and mitigation – make for grim reading.

At the release of the IPCC's report on mitigation issues, António Guterres was blunt and forthright:

> The jury has reached a verdict. And it is damning. This report … [highlights] a litany of broken climate promises. It is a file of shame, cataloguing the empty pledges that put us firmly on track towards an unliveable world. We are on a fast track to climate disaster. Major cities under water. Unprecedented heatwaves. Terrifying storms. Widespread water shortages. The extinction of a million species of plants and animals. This is not fiction or exaggeration. It is what science tells us will result from our current energy policies.

This special issue also coincides with the release of the Labour government's draft National Adaptation Plan and long-awaited Emissions Reduction Plan. Given the timing of these latter two documents, coverage of their policy proposals and initiatives has not been possible here. That task must await another occasion.

Summarising the detailed analyses, findings, and policy proposals outlined in the 12 articles in this special issue is beyond the scope of a short editorial. But several matters deserve specific mention.

First, making peace with nature will require thoroughgoing legislative reform. In their contribution, for instance, Sir Geoffrey Palmer and Richard Clarke propose a new Natural Environment Act. This would be based on the many principles and instruments of international environmental law negotiated since the Stockholm Declaration in 1972. In particular, it would enunciate clear environmental limits, impose demanding obligations on governmental decision-makers, impose new systems of monitoring and enforcement, and establish a new environmental watchdog with substantial powers.

Second, making peace with nature will require a proper integration of environmental and economic policy-making. Murray Petrie recommends three key mechanisms to achieve this end: enhanced National State of the Environment Reporting; expanded environmental target setting; and mainstreaming the environment in fiscal policy and the annual budget cycle.

Third, making peace with nature will require learning from our many mistakes. In this regard, the various contributions of Mike Joy (on the lamentable management of our freshwater resources), Tim Chambers and his colleagues (on the defective regulation of drinking water), Shelley Fischer (on our depressing record of poor environmental monitoring), Judy Lawrence and her colleagues (on our slow progress in preparing for, and adapting to, the impacts of climate change), and Hannah Blumhardt and Liam Prince (on our similarly slow progress to minimise waste) all provide compelling examples of regulatory and political failure, together with thoughtful and constructive suggestions for reform.

Fourth, making peace with nature will require reforms that are both transformative and properly joined up. The article by Sasha Maher and Adam Forbes on a responsible climate-centred forestry policy provides one such example – notably, the urgent need for a proper linking of climate change mitigation and biodiversity protection.

Ralph Chapman's analysis of how to reduce carbon dioxide emissions in our urban centres supplies another good example. It is not enough simply to encourage electric vehicles. A more radical approach – one which tackles the current problems of urban sprawl and car dependence – is essential.

Finally, despite the many grounds for deep concern, there are also reasons for hope. Contributors to this special issue mention a range of significant policy reforms currently underway across different levels of government. They also note how communities throughout the country are rising to the challenge of environmental degradation and taking positive actions. Community efforts to reduce biodiversity loss, as exemplified by Bruce Clarkson's contribution, are but one example. Many more efforts, of course, are needed. But the required transformation of hearts, mind, and behaviours is clearly underway. For this we can be thankful.

Jonathan Boston, Editor

Geoffrey Palmer and Richard Clarke

A new Natural Environment Act is Needed—Now

Abstract

This article advocates a new mindset to protect the natural environment following repeal of the Resource Management Act (RMA). The proposed new legislation will be insufficient to protect the natural environment, which has deteriorated during the life of the RMA and now requires urgent action. A new Natural Environment Act is needed that focuses on the natural environment and embraces principles that governmental decision makers are obliged to follow. Limits must be laid down. The principles must be simple and clear and based on the many international law instruments negotiated since the Stockholm Declaration in 1972. New systems of monitoring and enforcement must be devised, with a new environmental watchdog with substantial powers.

Keywords Resource Management Act replacement, natural environment, natural environment principles, Guardians of the Environment

The purpose of this article is to stimulate new thought and action about the next steps to be taken to protect the New Zealand natural environment, in order to uphold our responsibility to future generations.[1]

The proposals of the Randerson Report (Resource Management Review Panel, 2020) to develop a replacement for the Resource Management Act 1991 (RMA) are important and we support them. The proposals may, however, divert attention from the multitude of challenges that the natural environment will still face after the enactment of the replacement. The need for a new mindset or way of thinking about the natural environment is urgent. So is action. A new programme of work should begin now.

History tells us that episodic efforts made to address environmental issues in New Zealand often result in reform projects that take years to design and enact, and longer to bed in. Then there is a tendency for the government system to neglect the issues for years and fiddle around producing amendments until another major effort is required. Ways around an approach of expediency will have to be found if the interests of future generations in the natural environment are to be catered for. Proper consideration for the future is often sacrificed to the political pressures of the moment. The New Zealand history of climate change policy over the past 20 years provides a graphic illustration of the point.

It hardly requires argument to demonstrate how serious the plight of both the New Zealand natural environment and that of the planet are. We face major environmental problems. Climate change will require massive economic transformation that has hardly begun, but there are many others. The destruction of biodiversity, pollution of the seas, toxic substances, water quality and hazardous waste are only some of them. It is now vital that New Zealand urgently takes steps to protect the natural environment, or what remains of it. It is time for a clear vision, properly articulated, to be pursued with determination.

Sir Geoffrey Palmer QC is a former minister for the environment and prime minister. He is a global affiliated professor at the University of Iowa and a distinguished fellow at the Faculty of Law at Victoria University of Wellington Te Herenga Waka. **Richard Clarke QC** specialised in public law, commercial law and law drafting during his legal career.

The authors were centrally involved in the development of the Resource Management Bill in the late 1980s and 1990: Palmer was the minister responsible for the Bill and Clarke was involved with its drafting. The proposals in this article originate from work undertaken by the authors under a now completed contract with the Ministry for the Environment. The proposals are the authors' own, and the ministry does not currently hold any view on them.

What is needed is to establish a clear set of environmental principles designed to preserve the future of the natural environment, and an obligation on decision makers to follow them. To avoid the day-to-day political pressures, this will need to be done by an Act of Parliament.

The United Nations Environment Programme report *Making Peace with Nature* (2021) underlines the urgency of the crisis.

It is a sad commentary on the way New Zealand now does big law reform that, after the 2017 RMA amendments, an Act that had begun life in 1991 at 382 pages was now 796 pages.

As the secretary-general of the United Nations said in his foreword, 'Humanity is waging war on nature. This is senseless and suicidal. The consequences of our recklessness are already apparent in human suffering, towering economic losses and accelerating erosion of life on Earth.' The influential publication *Nature* in a March 2022 editorial expressed the view that 'there's now a consensus that human activities have irreversible environmental effects' and that the 50-year debate on the limits to economic growth needs to be brought to an end and action taken.

Clear messages must be sent to the New Zealand public about what is at stake here. Technocratic approaches will not cut it. The blueprint put forward in the UNEP report shows how loss of biodiversity and ecosystem integrity, with climate change and pollution, is undermining the march to sustainability. The science is clear. The planet cannot take any more.

This article will deal with the following issues in this quick canter across the agenda for the environmental future:

- why the RMA failed;
- why the RMA's replacement is not enough;
- why a new Natural Environment Act is needed;
- what a new Natural Environment Act would do;
- a clear statement of principles (the natural environment principles) that will provide the navigation lights for helping the natural environment;
- the appointment of guardians for monitoring and oversight of the environment in all its respects;
- a generational environment plan and natural environment directions;
- a glance at the international materials that seem often neglected in New Zealand, but from which much can be learned

Why the RMA failed

The RMA was a political response to the National Development Act 1979, which provided for the suspension of Acts of Parliament by Cabinet for any national development project. It was said that delays were intolerable and there were too many processes. The projects involved energy projects, the Clyde Dam and the proposed Aramoana aluminum smelter.

Repealing the National Development Act was one thing. Providing an adequate policy response was another. There had been an adverse independent report on the 1977 Town and Country Planning Act. The Ministry of Works was abolished. In 1986 the Environment Act was passed and the Ministry for the Environment was created. This ministry become the home for RMA reform.

Internationally at the time, the policy development process began a shift towards a sustainable development mindset. The policy development process for the RMA was inspired by the 1987 report of the World Commission on Environment and Development, *Our Common Future*, which enunciated the key principle of sustainability. The purpose provision of the RMA relied on the international thinking. The Act stressed sustaining the potential of natural and physical resources to meet the reasonably foreseeable needs of future generations. This vital principle was further developed by the international lawyer Edith Brown Weiss in her 1988 book, *In Fairness to Future Generations*. Sustainability and fairness to future generations were designed to drive the Act.

Yet it was not until a 2014 decision of the Supreme Court in the King Salmon case that the proper legal tests were propounded and embedded in the system. It was always intended that the RMA was an environmental protection statute. Instead it morphed into a planning statute. Externalities adversely impacting on the environment were not sheeted home to and reflected in the costs of the activities that engendered them. What went wrong can be summarised. Neither central government nor local government performed well. There was not sufficient central government guidance nor use of the available statutory instruments to produce sound environmental outcomes. Within local government there was confusion and some duplication between territorial authorities and regional councils. Urban development was not handled well. Plans were too numerous and too complicated. And the processes of the RMA became far too complex and various. Further, weak enforcement in New Zealand has been a critical problem.

It is a sad commentary on the way New Zealand now does big law reform that, after the 2017 RMA amendments, an Act that had begun life in 1991 at 382 pages was now 796 pages. The approach of passing a big piece of legislation and amending it seriously over time without re-examining the framework is a recipe for soggy incoherence and complexity. It caused the purpose of the RMA to be eroded and protections for the future environment were not delivered. The vision and the planetary boundaries were lost.

It is sad but hardly surprising that over the life of the RMA most environmental indicators have seriously deteriorated. For example, New Zealand net greenhouse gas emissions are now 60% higher than they were in 1990. In 2020 the Stockholm Resilience Centre translated the planetary boundaries to a New Zealand context to help the Ministry for the Environment better understand the responsibility for ensuring a 'safe operating space' for our environment. What the centre found was that New Zealand exceeds its fair share of all five planetary boundaries assessed.

Why the RMA's replacement is not enough

The Randerson Report proposed that the RMA be repealed and replaced. The government has accepted that view. We agree that the RMA should be repealed and replaced, but in our view that will not be

enough to sufficiently protect the natural environment.

The Randerson Report discussed the issues with the natural environment at some length. It recommended new Acts entitled the Natural and Built Environments Act and the Strategic Planning Act, which are to include greater use of specified mandatory limits for certain biophysical aspects of the environment, provision for targets, and greater use of mandatory directions. It also made important recommendations on te Tiriti o Waitangi and te ao Māori, and proposed new legislation for climate change adaptation, especially managed retreat.

Despite these important points, it all depends in the end on how the system is put together, and that depends on the final legislative drafting, which is not yet available. We have examined the report of the Environment Committee which conducted an inquiry on the Natural and Built Environments Bill (Environment Committee, 2021), which canvasses the above issues. But our concern remains that the Randerson Report recommendations are not likely to sufficiently protect the natural environment, due mainly to problems that dogged the RMA, namely:

- There are many New Zealand statutes which have an impact on the natural environment and a multitude of different decision makers throughout New Zealand: see, for example, the Conservation Act, the Local Government Act, the Land Transport Management Act, and the Acts listed in the schedule to the Environment Act. The statutes are not always coordinated or consistent. The Randerson Report applies to only some of these statutes and decision makers.
- A purpose of the Randerson Report is to enable development of land and other resources, subject to environmental considerations. The economic pressure to ignore environmental costs and externalities will continue. The danger is that the natural environment will continue to suffer from not being given sufficient priority.
- The Randerson Report will likely continue the present approach of leaving the protection of the natural environment to central and local government (as well as mana whenua). This approach has generally been a failure under the RMA, largely because of interest group pressure promoting economic growth at the expense of the natural environment. We believe that Parliament (rather than central or local government) should lay down the key principles for the protection of the natural environment and require them to be adhered to.

Why a new Natural Environment Act is needed

A new mindset is needed throughout the country as to the urgent need to protect the whole of the natural environment. Changing minds takes more than passing legislation; that is one lesson from the experience with the RMA. We need a new framework that hangs over all of the various statutory regimes to connect them together with a common set of principles that are followed in all of the various contexts.

We need a new framework that hangs over all of the various statutory regimes to connect them together with a common set of principles that are followed in all of the various contexts.

In 2021 the United Kingdom passed an innovative, far-reaching and ambitious statute, the Environment Act 2021. It contains many features that would be useful in New Zealand. Prime among them are:

- the setting of statutory environmental targets for air quality, biodiversity, water, waste and species abundance, and new tools to help meet those targets;
- a statement of five environmental principles, and the need for all government ministers to consider them when making policy;
- a new Office for Environmental Protection, with enhanced powers of oversight and monitoring.

We believe that New Zealand should follow the UK lead in significantly strengthening legislation protecting the natural environment.

Natural environment principles that are bottom lines for the protection of the natural environment should be set out in a statute. Limits for the protection of the natural environment can be derived from these principles and set from time to time. The statute should also require those making governmental decisions to use reasonable endeavours to ensure that those decisions are consistent with the natural environment principles. This will force government decision makers to give proper weight to the natural environment in their day-to-day decision making.

A new and powerful environmental watchdog should be established. We suggest that legislation establish a body called the Guardians of the Environment, with the parliamentary commissioner for the environment as chairperson and with greatly enhanced powers of oversight and monitoring. It could be said that three general oversight agencies already exist that can deal with environmental issues and complaints from time to time. These agencies are the ombudsman, the office of the auditor-general and the parliamentary commissioner for the environment. Their jurisdiction has been untouched during the various RMA reforms. However, it is our view that, unless oversight is beefed up, systemised and given real teeth, the possibility of policy failure for the Randerson Report reforms will increase.

Environmental issues involve a lot of science and research, and it is not likely that the ombudsman or the office of the auditor-general can carry out serious environmental work. Neither have a specific environment remit; they are general agencies and cover a wide range of government activity.

The parliamentary commissioner for the environment's office as it stands has done excellent work. The office is small and modestly resourced. Given the likely problems in the future, the commissioner needs to be provided with more heft against the bureaucracy of both central and local government, more ability to conduct dialogues with the public, more authority to blow the whistle, a higher public profile, and more capacity to provide analysis that questions the decisions made by the government of the day. And the government should be obliged to table a response in Parliament to recommendations made by the new watchdog system.

The new oversight system will need to exhibit:

- rigorous analytical examination of and warnings concerning likely future environmental issues;
- systematic and comprehensive reporting;
- a forward-looking and proactive approach;
- a high public profile and ability to intervene and blow the whistle;
- capacity to examine and report on the decisions made under the proposed Randerson Report legislation as soon as they are made and upon the subsequent success or otherwise of those decisions;
- rigorous examination and reporting on decisions on environmental limits and targets made by the government.

Climate change, the fate of the planet, and New Zealand's serious biodiversity loss necessitate much better oversight of natural environment issues. In other words, environmental oversight must be rethought to avoid failure. This is not an issue of general oversight of government agencies; it is oversight of a particular but enormous set of issues over which no agency has comprehensive supervision now. The natural environment is vital to New Zealand's future and must not be treated as an externality in decision making. The natural environment is what our society and our economy are built on; it constitutes the guard rails within which we must operate.

The state of the natural environment in New Zealand promises to be a much more important and salient issue in the future than it has been in the past. Today's tools will not be adequate. We suggest that the Environment Act 1986 be repealed and replaced by a new Natural Environment Act.

What a new Natural Environment Act would do

This new Act would:

- state the natural environment principles that are bottom lines for the protection of the natural environment, and various process principles, thus stating a clear vision and providing a guiding star for governments and decision makers;
- require those making decisions on behalf of the government, a Crown entity or a local authority that will or may affect the natural environment to use reasonable endeavours to ensure that those decisions are consistent with the natural environment principles and the process principles;
- provide for a generational environment plan and natural environment direct-ions;
- continue the office of parliamentary commissioner for the environment;
- establish a body called the Guardians of the Environment, with the parliamentary commissioner for the environment as chairperson;
- state the functions and powers of the guardians;
- consequentially amend other environmental legislation, including the legislation that results from the Randerson Report, to make it consistent with this new Act.

The state of the natural environment in New Zealand promises to be a much more important and salient issue in the future than it has been in the past.

Important provisions of the new Act should be entrenched in the same way as various provisions of the Electoral Act 1993 are entrenched. This will mean that the vital provisions of the new Act will be secure against repeal by a simple majority in Parliament.

Natural environment principles

The suggested natural environment principles are as follows:

Enjoyment of natural environment

People should be able to enjoy a healthy and sustainable natural environment, both now and in the future.

Environmental responsibility

People and organisations should have particular regard to kaitiakitanga and the ethic of stewardship of the natural environment and give effect to the concept of te mana o te taiao.

Protection of natural environment

The natural environment should be protected so that the essential processes of nature are not impaired.

Biodiversity

The intrinsic value of biodiversity should be recognised and promoted.

The biosphere

The functioning of the biosphere should be protected and improved by guarding against depletion of the ozone layer and limiting the emission of greenhouse gases.

The sea

Pollution of the sea should be prevented in order to provide for sustainable use and conservation of marine-living resources and prevent damage to human health.

Lakes, rivers, streams and wetlands

The ecological health of lakes, rivers, streams and wetlands, and the fish, plants and other organisms that live within them, should be protected and improved.

Water for human use

Adequate supplies of safe drinking water should be available for people, and sewage and other waste water should be safely disposed of.

Sustainable use and development

Any use or development of the natural environment should:

- be within any relevant environmental limits;
- avoid or remedy any adverse effects of the use or development on the natural environment; and
- not compromise the ability of future generations of people to meet their own reasonably foreseeable needs.

Pollution

The discharge of toxic substances and the disposal of hazardous wastes should be undertaken in a way that prevents damage to the natural environment.

The suggested process principles are as follows:

- positive outcomes for the natural environment are identified and promoted whenever practicable;
- risks of ecosystem degradation or collapse are identified and avoided, remedied or mitigated whenever practicable;
- a precautionary approach is taken where effects on the natural environment are uncertain, unknown or little understood, but have potentially significant or irreversible adverse consequences;
- an environmental impact assessment is carried out for proposed activities that are likely to have a significant adverse impact on the natural environment;
- economic instruments or other measures are used whenever practicable to ensure that those who cause or may cause

damage to the natural environment bear the cost of avoiding, remedying or mitigating that damage;
- rigorous scientific research and analysis is undertaken, and environmental technologies are developed whenever practicable, to facilitate solutions for environmental issues;
- demographic information and policies are taken into account where relevant.

All these principles have been distilled from international treaties and declarations negotiated by consensus and backed by high-quality analysis that began with the Stockholm Declaration of 1972 and has continued to this day, accumulating a formidable body of work that is further discussed later in this article.

The natural environment principles are short. They are easy to understand. They will fit on one page. They can be pinned to the wall in offices, factories, farmyards and schools. If well publicised, these principles should quickly become well known throughout the community and help promote a new mindset in the public on the importance of the natural environment.

However, past mistreatment of the natural environment and ongoing economic pressures will mean that strict adherence to the principles will not always be achievable. The new Act should therefore enable the government to soften the application of the principles by means of the generational environment plan and natural environment directions.

Guardians for monitoring and oversight

As already mentioned, we propose that the Environment Act 1986 be entirely rewritten to implement all the recommendations in this article that require parliamentary enactment. A prime ingredient of that is an oversight mechanism. We propose a new approach to oversight of the natural environment and all other environmental issues in New Zealand. The Environmental Reporting Act 2015 would also need to be strengthened and revised (as is currently proposed), to overcome reporting defects that could impinge upon the effectiveness of the new Natural Environment Act.

The intent is to create a new, well-resourced and powerful environmental watchdog. The parliamentary commissioner for the environment's position would be expanded and enhanced. That person would become chair of a group of environmental guardians who are invested with extensive powers of oversight, supervision, public statements and enforcement activities.

The parliamentary commissioner is appointed by the governor-general after his or her appointment has been agreed by a motion in the House of Representatives. Three of the guardians should sit ex officio, being the prime minister's chief science advisor, the secretary for the environment and the chair of the Climate Change Commission (so long as that commission remains in its present form). The other guardians should be appointed by the prime minister and will need to be top people covering a range of environmental skills. All the guardians would be required to act independently in the exercise of their functions, duties and powers.

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The oversight functions of the guardians would need to include:
- reviewing the performance and outcomes under all legislation affecting the natural environment;
- reviewing the adequacy of the natural environment principles and the process principles;
- reviewing each generational environment plan and natural environment direction;
- reviewing the adequacy of planning and management of the natural and built environments by local government and other public authorities;
- investigating complaints made by members of the public about the actions or omissions of the government or a local government or public authority in relation to the natural or built environment;
- investigating any matter in respect of which the natural or built environment may be or has been adversely affected;
- at the request of the House of Representatives, reporting to the House on any petition, Bill, or other matter before the House or inquire into any matter that has a substantial effect on the natural or built environment;
- undertaking and encouraging the dissemination of information relating to the natural or built environment;
- encouraging preventive measures and remedial actions for the protection of the natural or built environment.

The guardians should be required to report to the House of Representatives, and to such other persons as they consider appropriate, on the results of any investigation or review they undertake.

The new Act should provide that the guardians will be invested with substantial powers to enable them to carry out their functions. They should have investigatory powers of the same character as a commission of inquiry under the Inquiries Act 2013; the power to intervene in legal proceedings in the courts and bring applications for judicial review; and the power to give notice to environmental actors (including local authorities) specifying a failure to comply with the new Act and the steps that the guardians consider should be taken in relation to the failure, and requiring the person to respond to the notice saying what steps they propose to take. The guardians should also be authorised to make any public statements they think appropriate.

Generational environment plan and natural environment directions

The new Act should provide for making a generational environment plan that identifies the strategic environmental challenges that New Zealand faces and the measures that must be taken to improve the state of the natural environment over a 25-year time frame. The minister for the environment should be responsible for the preparation of the plan and the minister should be required to consult upon it and publish it in the statutory regulation series. The plan could be amended in the same way as it is prepared, but only in order to improve the natural environment.

Natural environment directions should also be provided for in the new Act. The purpose of these would be to establish environmental limits, targets, milestones, standards and methods in respect of matters of national significance relating to the natural environment. Methods of preparing the directions and amending them should also be specified in the new Act.

International materials

Before concluding, we wish to emphasise again the importance of policy analysts fully considering all the work that has been done at the international level and in other countries on environmental issues. The volume of this work is substantial, and we fear it is often forgotten in domestic New Zealand policy circles. There is always an attraction in reinventing the wheel, even though the analysis may have been done before and is already available. The international material has often been worked over by eminent experts in their field and negotiated by consensus. Many of the environmental problems around the world are similar: climate change, species extinction, pollution from all sources, water quality, land degradation, atmospheric damage, chemical pollution, plastic in the oceans, culminating in how to achieve sustainability.

> New Zealand, as a good international citizen, would be wise not to reinvent the wheel, but rather to translate those environmental principles into its domestic law.

Since the landmark 1972 conference in Stockholm that produced the Stockholm Declaration, the environment has truly been on the international law agenda. The conference stimulated New Zealand to be active in the environmental space, and in that year New Zealand first created a ministerial environmental portfolio and appointed a minister, Duncan McIntyre.

Many official international meetings have been conducted where treaties, conventions, protocols and declarations have been negotiated. These include both hard law and soft law instruments. Some soft law instruments, such as parts of the 1992 Rio Declaration, may have become by this time part of customary international law and therefore binding on nation states. Such international resolutions, declarations, statements of principle and the like by our count now occupy more than 130 pages of carefully negotiated text. These are very helpful, and we have drawn on this material for the recommendations in this article. UN General Assembly resolutions can also be instructive, such as the one that established the format and organisational aspects of the High-level Political Forum on Sustainable Development. Sustainability is, of course, what New Zealand has been trying, but has failed, to achieve.

The United Nations Environment Programme has produced much useful analysis, held many conferences, and published reports on specific topics. There have been many other efforts by the United Nations, but the work is not always easy to find and an effort must be made.

The volume of hard law treaties and multilateral conventions is truly astonishing, and we have relied on some of this material in this article as well. We have found, analysing the published material, that it covers more than 1,300 pages. Again, considering this body of law will help explain where environmental law has come from and, more importantly, where it is going. Literacy in this material is essential. The treaties and conventions cover a remarkable range of topics, including atmosphere, hydrosphere, lithosphere, biosphere, polar regions, economic and trade development, and war damage.

Policy designers in New Zealand also need to examine overseas domestic developments and the work of non-governmental organisations. As already mentioned, the United Kingdom passed in 2021 an innovative, far-reaching and ambitious statute, the Environment Act 2021, and it contains many features that would be useful in New Zealand. Prime among them is the new Office for Environmental Protections that we have referred to for our proposals for increased accountability, oversight and monitoring in New Zealand. It also should be noted that the UK statute has as a priority the natural environment, echoing the 2018 paper *A Green Future: our 25 year Plan to improve the environment* (HM Government, 2018). Part I of the Act is devoted to improving the natural environment. The Act deals also with nature and biodiversity, waste, water and air. The New Zealand legal system is similar to that of the UK and now they are out of the European Union their legislation may speak more plainly to us. That such an ambitious Act has passed in Britain should be a wake-up call for us, although it is not as bold in some respects as the original proposals for it.

More ambitious still is the massive and comprehensive Environmental Code of Sweden, which was adopted in 1998 and entered into force on 1 January 1999. The rules contained within 15 Acts have been amalgamated in the code. As many similar rules in previous statutes have been replaced with common rules, the number of provisions has been reduced. We have studied this and, while it is perhaps not suitable for our legal system, it shows what determination, and a sense of purpose, can achieve. It speaks loudly to us that New Zealand lags behind.

Other helpful sources include legal principles for environmental protection and sustainable development adopted by the General Assembly in 1986; the Rio+20 Declaration *The Future We Want*; the Johannesburg Declaration of 2002; the World Charter for Nature 1982; Agenda 21, 1992, which contains 40 chapters; and the Convention on Biological Diversity 1992.

Most of the sources mentioned here are to be found in the document supplement to Carlson and Palmer (2019).

Conclusion

New Zealand was at the cutting edge of environmental reform when the RMA statute was enacted in 1991. Processions of people from overseas wanted to know about it and wrote about it in books and international journals. We are no longer at the cutting edge.

International developments have overtaken us. Yet our mindset has not altered. The evidence is to be found in a mass of international and domestic environmental law work in other countries since 1991, which has produced contemporary legislative approaches and widely accepted environmental principles. That work should

inform New Zealand's approach. The natural environmental issues are now much sharper. And the need is more urgent. New Zealand's response to these issues must be greatly improved and quickly.

New Zealand, as a good international citizen, would be wise not to reinvent the wheel, but rather to translate those environmental principles into its domestic law. We believe there is a hunger for such principles, particularly among younger New Zealanders. A set of navigation lights is urgently needed to set the directions in which we are heading in critical natural environment areas.

1 Many of the ideas in this article are drawn from material in Carlson and Palmer (2019), and reviewing environmental literature regularly from before the first edition in 1994 until the most recent edition in 2019, not an experience that produces optimism about the future of the environment for the planet. The literature contains plenty of insights about the actions to take and the principles to be applied, but government action in many countries has lagged behind.

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Murray Petrie

Integrating Economic and Environmental Policy

Abstract

Integrating environmental policies into economic policy making is vital for environmental sustainability. This article explores three key integration mechanisms: enhanced national state of the environment reporting, expanded environmental target setting, and mainstreaming the environment in fiscal policy and the annual budget cycle. The article discusses environmental reporting, resource management and wellbeing budgeting in New Zealand, including recent reviews and proposed reforms. It outlines the rapidly developing international practices in green budgeting. Entry points are identified for operationalising the current wellbeing budgeting framework by progressively exposing environmentally harmful fiscal policies, highlighting win–win tax and expenditure policies that are good for both the environment and the economy, and exposing trade-offs for more transparent deliberation.

Keywords environmental reporting, environmental targets, mainstreaming, fiscal policy, wellbeing budgets, green budgeting

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Integrating environmental policies into economic policy making has long been recognised as fundamental to the pursuit of environmental sustainability. As long ago as 1987 the Brundtland Commission called for the major central economic agencies of governments to be made directly responsible for ensuring that their policies and budgets support ecologically sustainable development (United Nations, 1987, ch.12, para 26). There was, however, little progress globally in the following 30 years in accountability for the environmental impacts of fiscal policies and budgets, aside from requirements in many countries for environmental impact analysis at the individual public investment project level.

At the strategic, whole-of-government level, fiscal policy and the annual budget cycle is arguably the critical instrument by which to integrate economic and environmental policy. While environmental regulation is also of fundamental importance, there is no government-wide regulatory policy cycle or strategic process through which environmental sustainability can be systematically mainstreamed and regularly updated. The annual budget is typically a government's single most important expression of its strategies and priorities and its most powerful cross-sector policy

integration tool (OECD, 2002, p.7; Petrie, 2021). Economic and fiscal strategy setting in most countries, however, remains dominated by assessments of economic and fiscal issues.

Since around 2010 there has been a growing interest in the interfaces between fiscal policies and the environment – often referred to as 'green budgeting' or 'climate budgeting' – which has burgeoned in the last few years. The interest was led initially by increasing concern over climate change and the impacts of fiscal policies on greenhouse gas emissions, as well as the negative impacts of climate change on public finances. More recently, comprehensive approaches have emerged that consider the two-way interactions between fiscal policies and all environmental domains, not just climate change.

This article explores three key elements required to integrate environmental sustainability into government economic strategies and policies (Petrie, 2018, 2021):

- reliable and regular national state of the environment reports on the physical state of the natural environment to establish baselines and identify trends and threats to sustainability;
- expanded setting of environmental targets and regular reporting on progress towards targets, and the integration of these into government strategic planning and in a dashboard of core indicators of social, environmental and economic progress;
- using fiscal policy and the annual budget cycle to progressively expose environmentally harmful tax and expenditure policies, to highlight win–win policies that are good for both the environment and the economy and to promote environmentally sustainable development.

Environmental reporting

New Zealand did not have a statutory requirement for regular national state of the environment reports prior to the Environmental Reporting Act 2015 (ERA) (Chapman et al., 2013). Previously there had been two ad hoc state of the environment reports, in 1997 and 2007. There are several weaknesses in the ERA (Petrie, 2018), some of which reflect weaknesses in the international DPSIR (drivers–pressures–state–impact–response) framework for national environmental reporting. Key deficiencies are that the DPSIR framework is backward looking and does not include forward-looking outlooks and identification of risks; that the ERA and reports under the Act cover only three of the five DPSIR elements (pressures, state and impact); and that governments are not required to respond to reports, seriously limiting their impact.

In his 2019 review of New Zealand's environmental reporting system the parliamentary commissioner for the environment concluded: 'If there is one thing that stands out from the first cycle of reports, it is the extent of what we *don't* know about what's going on with our environment' (Parliamentary Commissioner for the Environment, 2019, p.7). The main recommendations made were to change from three-yearly to six-yearly state of the environment synthesis reports, expand the reporting framework to include drivers and outlooks, refocus domain reports as commentaries on themes, and require ministers to respond within six months to state of the environment synthesis reports, commenting on what new policies are proposed or planned. The commissioner also recommended the establishment, under the Act, of a standing science advisory panel to advise the secretary for the environment on environmental reporting and research, monitoring and data needs.

In response, the Ministry for the Environment published a consultation document in February 2022 (Ministry for the Environment, 2022) containing ten proposed amendments to the ERA, incorporating most of the commissioner's recommendations and also recommending establishing a set of core environmental indicators, strengthening data collection, and requiring reports to describe the impacts that the state of the environment and changes to it may be having on te ao Māori. Perhaps most significant are the proposals to reduce the frequency of synthesis reports to

BOX 1 Suggested additional elements to be incorporated into the Environmental Reporting Act 2015

- The content of the forward-looking information in 'outlooks' should be deepened. The ERA should refer – in addition to outlooks – to forecasts of critical indicators, as feasible, and to identification of proximity to targets, limits, and potential thresholds and tipping points.
- A specific provision should be included specifying the technical independence of the secretary for the environment in conducting relevant functions under the Act.
- The technical nature of the proposed standing advisory panel to the secretary for the environment should also be buttressed – e.g., by referring to transparent selection criteria and processes for appointment to the panel.
- The technical independence of the process for producing each synthesis report would also be strengthened by including a requirement for external scientific peer review of a draft of the report at an appropriate stage.
- With respect to the government response to each synthesis report, the Act should refer to the number of years that the government action plan should cover and specify that it include interim milestones, existing and any new targets, and regular annual reports on progress; the government should respond within six months of publication of a report, as recommended by the parliamentary commissioner for the environment, rather than within the 12 months proposed by Ministry for the Environment, which would unduly draw the process out.
- While the parliamentary commissioner for the environment has full discretion under the 1986 Environment Act to comment on any issue he or she wishes, nevertheless the commissioner should be invited to comment on each synthesis report, within three months of its publication, with their assessment of the key trends and risks and recommended actions to address them.

BOX 2 The UK Environment Act 2021: integrating environmental and economic policies

The UK Environment Act 2021 contains strong provisions to integrate the environment into government strategy and economic policies, including:

- mandating the setting of long-term, legally binding targets covering at least air quality, resource efficiency and waste reduction, water and biodiversity;
- mandating net gain in biodiversity through the planning system, requiring a 10% increase in biodiversity after development compared to the level of biodiversity prior to the development taking place;
- legally obliging ministers to ensure that nature and the environment are proactively considered in the policymaking process;
- allowing government to require producers to pay the full net cost of managing their products at end of life and to incentivise them to design their products with sustainability in mind, and to introduce charges for single-use items.

once every six years, require the minister for the environment to respond to each report within 12 months with an action plan, and add drivers and outlooks to the reporting framework.

These are welcome initiatives and if implemented would bring New Zealand more into line with good international practices in national environmental reporting, while also introducing the important innovation of requiring a government response. There are, however, many areas where the ministry consultation document falls short. Some of these arise from or are made more salient by the fact that state of the environment reports would be produced only once every six years, which in a dynamic environment is a relatively long time. While environmental conditions generally change at a relatively slow pace, this is not always the case, and while reducing report frequency may allow more resources to be devoted to improving data and report quality, nevertheless a six-year interval greatly increases the government's flexibility and reduces the frequency of democratic oversight.

The consultation paper states that for other OECD countries the 'most common and maximum reporting cycle is five-yearly'. This is somewhat misleading. Many countries in Europe publish reports every four years, while some publish more frequently (e.g., the Netherlands published an annual report from 1995 to 2010 and a report every two years thereafter). While Australia publishes a report every five years, it is difficult to justify a statement that the most common reporting cycle is five-yearly. Certainly, to the author's knowledge no country publishes as infrequently as six-yearly.

Arguably, the strongest justification for this timing is that it aligns with New Zealand's current three-year general election cycle, so that a six-yearly report would be published in the ordinary course of events every two elections. The attractive feature of this is that the timing of each report could be specified in legislation in relation to the electoral cycle (e.g., midway between elections) so as to promote effective democratic debate and accountability. The ministry discussion document refers to the timing of the six-yearly report in relation to its long-term insights briefing, but this is second order in importance compared to the timing of the report in relation to general elections.

Nevertheless, it may well be preferable for synthesis reports to be published more frequently than every six years, perhaps every four years as is common international practice – and for which there is precedent in New Zealand in terms of the requirements that Treasury publish four-yearly reports on the long-term fiscal position, investment statements and wellbeing reports. The benefits of more frequent reporting seem likely to outweigh the advantage of alignment with the electoral cycle. Alternatively, the current three-yearly synthesis report could be retained and aligned appropriately with the electoral cycle, although the shorter time would represent an additional reporting burden. If the six-year gap is adopted, other elements of the reporting framework become critical. Box 1 sets out proposed additional elements to be incorporated into the ERA, irrespective of the frequency of reports.

A final issue in this review of the ERA is the issue of 'response', the last component in the internationally recognised DPSIR framework. Note that 'response' in the DPSIR framework is different from the proposal that the government respond to a synthesis report, although the two terms are at times confused in discussion of environmental reporting. As described by the ministry in the consultation document, the response component 'would list but not evaluate the current government and community interventions in response to pressures and impacts. Responses, in this case, would not provide alternative policy recommendations, nor would they explicitly remark on the effectiveness of the interventions' (Ministry for the Environment, 2022, p.79). Yet the consultation document rejected the inclusion of this anodyne component of environmental reporting. By some agile manoeuvring it lumped the option of including 'response' in with an option that left out the addition of 'drivers'. It then concluded that 'leaving out drivers and outlooks could imply that these were not to be used at all. Although this option would be an improvement, reporting would not be as effective as it could be' (ibid.).

But there is no reason that the option of including 'response' could not have been incorporated into an option that also added drivers and outlooks. This is either weak option building or an attempt to finesse the awkward issue of why New Zealand, highly unusually among advanced countries using the DPSIR framework, does not have the public sector capacity to publish even such descriptive 'response' material.

New Zealand appears to have a major problem in the capacity and willingness of the public service to provide, and for ministers to receive, advice on how well existing environmental policies are working. Policy evaluation is widely viewed as a critically important component of public management, albeit one that is systematically weak in New Zealand and to varying degrees internationally. The Ministry for the Environment does not have an evaluation capability; nor does any other government entity have a general responsibility for evaluating the effectiveness of environmental policies and interventions. The parliamentary commissioner for the environment does not have an evaluation function or capacity, and arguably it should in any case be the responsibility of the executive branch, with the commissioner providing review,

comment and recommendations, not being the primary actor.

One approach would be for a requirement to be inserted in the ERA for the government to publish a periodic report on environmental research, monitoring and evaluation midway between each synthesis report, describing its strategies and plans and reporting on progress in implementing them. The report could be the responsibility of a new independent Crown entity, possibly combining functions under the new Environmental Research Council advocated by the parliamentary commissioner for the environment (Parliamentary Commissioner for the Environment, 2020).

In the meantime, performance audits by the auditor-general appear to be the only current vehicle for Parliament and the public to be presented with independent evaluations of the effectiveness and efficiency of public spending on the environment. Recent value-for-money audits of climate change spending by the National Audit Office in the UK demonstrate the value of such initiatives (see, for instance, National Audit Office, 2020).

Note, however, that the New Zealand government has announced that it will issue sovereign green bonds in 2022. Part of the international framework for sovereign green bond issuers is a requirement to regularly report both on how the funds have been spent (an allocation report) and on the environmental impacts resulting from the activities funded by the bonds (e.g., reductions in greenhouse gas emissions, changes in freshwater quality) (International Capital Markets Association, 2021); see, for instance, the Irish Sovereign Green Bond report 2017/2018 (Government of Ireland, 2018). It is ironic how obstacles to providing the legislature and public with information on the environmental impacts of public spending financed by coercive taxes disappear when it comes to seeking voluntary financing from capital markets.

Environmental target setting and integration in fiscal strategy

The second component explored in this article on integrating environmental and economic policies is expanded setting of environmental targets and their integration into government strategic planning.

New Zealand has extensive and deep outcomes-focused management frameworks and accountability mechanisms for how governments manage fiscal policy and monetary policy. By comparison, for environmental stewardship there is a lack of requirements for ex ante transparency of environmental objectives, limits and targets and reporting against them (climate change mitigation aside). One long-standing exception to this is New Zealand's framework for fisheries management under the quota management system. But in general New Zealand governments have done no more than set longer-term unquantified 'feel good' goals for the environment – such as 'reversing loss of biodiversity', or 'cleaning up waterways' – without the discipline that comes from being required to report regularly to the legislature on the intended path to goals with specific targets, interim milestones and progress.

Internationally, Sweden is recognised as a pioneer in this field. In 1999 Sweden created a system of environmental quality objectives, which are set by Parliament and progress on which is reported annually (OECD, 2014, p.40). More recently, the UK Environment Act 2021 mandated that governments set long-term, legally binding targets for a small set of specific environmental indicators, in addition to other provisions to integrate environmental and economic policies (Box 2).

The international framework to address climate change under the Paris Agreement has resulted in a major global shift towards setting and monitoring targets for environmental outcomes. In New Zealand, the Climate Change Response (Zero Carbon) Amendment Act 2019 set new targets to reduce net emissions of greenhouse gases by 2050, establish a system of emissions budgets, require the government to develop and implement policies for climate change adaptation and mitigation, and establish a new, independent Climate Change Commission to provide expert advice and monitoring. The

Box 3 Possible legislative and regulatory changes to strengthen the integration of environmental and economic policies in New Zealand

The following additional provisions should be considered for incorporation into the Public Finance Act:

- A new principle of responsible fiscal management: 'When formulating fiscal strategy, having regard to the interaction between fiscal policy and the environment, including disclosures of the anticipated impact of existing fiscal policies and new fiscal policies being introduced in the next budget on environmental outcomes, indicators and government objectives.'
- The principles of responsible fiscal management (s26G) refer to having regard to efficiency and fairness when formulating revenue strategy. The section could be amended as follows (proposed new element in italics): 'when formulating revenue strategy, having regard to efficiency, fairness, *and environmental sustainability,* including the predictability and stability of tax rates *and the potential use of the tax system to improve environmental outcomes*'.
- A new provision in section 26J on the contents of the fiscal strategy report, to the effect that the fiscal strategy report must contain a range of specific information on the impacts of fiscal policies on the environment and on fiscal risks from environmental degradation – e.g., a new chapter, 'Fiscal policy and the environment'.
- Section 26NB(2) should be amended to state that the four-yearly wellbeing report is to be prepared by the Treasury, the Ministry for the Environment and the Ministry of Social Development, with specific policy domain responsibilities assigned appropriately. This process might best be conducted through an interdepartmental officials committee chaired by the Department of the Prime Minister and Cabinet.
- More generally, alongside a new requirement (proposed above) that the government disclose the anticipated impact of new budget policies on environmental outcomes, limits and targets, the *Cabinet Manual* should be amended to require the Ministry for the Environment to be consulted on all matters that may have a substantial impact on environmental sustainability.

Table 1: Selected country examples of green budgeting practices by stage of fiscal policy cycle

Stage in fiscal policy cycle	Selected country examples
National planning	
National Development Plan with environmental goals, targets.	China, Indonesia, Ireland, Nepal
Fiscal strategy	
Linked to environmental outcomes, climate change, SDGs.	Finland, Indonesia, NZ, Peru, Sweden
Macro-economic model incorporating climate aspects.	Denmark
Green tax review	Norway
Budget preparation	
Environmental impact assessments of infrastructure projects	Numerous countries
Climate change cost-benefit analysis	Thailand, UK
Climate expenditure tagging	Bangladesh, Kenya, Nepal
Comprehensive green expenditure tagging	France
Tagging of environmentally harmful expenditures	France
Carbon pricing	31 countries (March 2021)
Earmarked carbon tax for green spending	Costa Rica
Green expenditure floor	European Union
Application of green COVID-response criteria	Canada, France
Budget presentation	
Budget documents include environmental goals	Mexico, Norway
Mandatory disclosure of climate effects of new policies	France, Norway, Scotland
Advice to Parliament on budget's impacts on sustainability	Wales
Performance budgeting in environment sector	Italy, South Africa
Fiscal risk statements incorporate environmental risks	Philippines, UK
Budget financing	
Green bonds	Fiji, Indonesia, Ireland, Poland,
SDG bonds	Mexico
Budget implementation	
Green procurement	China, Japan, South Korea, Netherlands
Monitoring, evaluation, audit	
Performance indicators (green SDGs)	Mexico, Moldova, Nepal
Climate expenditure auditing	Bangladesh
Auditing, independent assessment of environmental effects	Canada, New Zealand
Fiscal reporting	
In-year reporting of climate spending	Mexico
Performance reporting in environment sector	Italy, South Africa
Reporting to green bond holders	Fiji, Indonesia, Ireland, Poland
Public participation in green fiscal policy	
Public engagement on carbon tax	Canada, South Africa
Public engagement on climate change adaptation spending	Fiji

Source: Petrie 2021, Table 4.1

Climate Change Commission delivered its advice to government on its first three emissions budgets and direction for its emissions reduction plan for 2022–25 in June 2021 (Climate Change Commission, 2021). The government deferred setting the first three emissions budgets out to 2035 and releasing the country's first emissions reduction plan until the 2022 budget in May 2022 (discussed further below). In addition, the government has announced that the public sector will be carbon neutral by 2025 (New Zealand Government, 2020b).

Beyond climate change, the National Policy Statement for Freshwater Management 2020 introduced requirements for councils to set outcome bottom lines and targets to improve degraded water bodies and maintain or improve all others, with regular reporting on progress (New Zealand Government, 2020a). Reforms to the Resource Management Act 1991 (RMA) aim to put in place clear environmental limits and positive outcomes for natural and built environments, with enhanced environmental reporting to track and assess performance in meeting limits and making progress towards environmental targets (Resource Management Review Panel, 2020). Under the RMA governments were enabled to set environmental targets and limits, but in practice they did so only to a very limited extent. An exposure draft of proposed replacement legislation – the Natural and Built Environments Bill – was presented to Parliament in 2021. It would require governments to promote 16 environmental outcomes and mandate that the minister for the environment prescribe environmental limits for six domains: air; biodiversity, habitats and ecosystems; coastal waters; estuaries; freshwater; and soil (Environment Committee, 2021).

Environmental goals, limits and targets then need to be integrated into the medium-term fiscal strategy process that drives the annual budget. Yet fiscal strategy setting around the world remains dominated by assessment of macroeconomic and fiscal goals, targets, statistics and associated risks. Information on environmental outcomes, goals, targets and risks, and interactions

between the environment and the economy, need to be integrated into government strategy and decisions on the medium-term fiscal strategy. Few governments have acted in this space (see Table 1).

In New Zealand the 2019 budget was presented as the Wellbeing Budget, in which a wider set of social, economic, environmental and cultural indicators and objectives was integrated into budget decision making (Treasury, 2019). This new approach was institutionalised in 2020 through changes to the Public Finance Act which require that the budget policy statement and the fiscal strategy report state the government's wellbeing objectives and how they will guide and have guided budget decisions. The 2019 budget has been described variously as introducing important new processes to incorporate non-economic goals, on the one hand (McCullough, De Renzio and Huang, 2020), and as being little different in substance to previous budgets (Ball, 2019). Subsequently the Covid-19 pandemic resulted in the government suspending its planned 2020 Wellbeing Budget. Its first Covid response package has been criticised for containing limited 'green' elements (Boston, 2020).

Further amendments to the Public Finance Act should be considered to strengthen the integration of environmental and fiscal policies in New Zealand. Box 3 sets out some proposals.

BOX 4 Parliamentary commissioner for the environment review of wellbeing budgets (Parliamentary Commissioner for the Environment, 2021)

The review's recommendations included:

- Improve the presentation and communication of critical environmental information throughout the budget process, including to ministers.
- Update the Living Standards Framework Dashboard to include an improved set of longitudinal environmental indicators representing the condition of natural capital.
- Develop baseline forecasts or outlooks that provide an indication of how future environmental conditions across different domains of the environment are expected to change over time.
- Develop new exploratory scenarios that describe alternative possible futures capable of identifying key environmental risks and potential mitigation strategies.
- Update the Treasury's wellbeing analysis template to better reflect the importance of the environment.
- Add new environmental values to CBAx for use within cost–benefit analysis.
- Modify the social discount rate to better reflect the longer-term, intergenerational costs and benefits that pertain to the environment.
- Develop a new, structured, multi-criteria analysis tool for scoring the impacts of budget initiatives.

Green budgeting and the progressive greening of fiscal policies

As noted, fiscal policy and the annual budget cycle are arguably the most powerful instrument to mainstream and prioritise environmental policies across the whole of government. In addition, taxation and government spending have major environmental impacts. Some of the impacts are positive: for example, carbon taxes and hybrid fiscal/regulatory instruments such as emissions trading schemes that 'correct' the prices of activities that generate unpriced social costs (externalities), such as the social costs of greenhouse gas emissions or pollution. Environmentally positive public expenditures by central, regional and local governments include environmental protection expenditures, funding of environmental regulation, monitoring and reporting, and environmental research and development. Other environmental impacts of fiscal policies are negative, such as subsidies for fossil fuels, deforestation or over-use of scarce fresh water, and those from public infrastructure projects such as new motorways that lock in environmentally damaging technologies and behaviours. In turn, environmental degradation is creating escalating fiscal risks for governments from the increased incidence of climate-related disasters and transition risks from policy and technological changes (Dunz and Power, 2021).

Reflecting the growing international interest in and recognition of the two-way interactions between fiscal policies and the environment, in 2017 the OECD launched the Paris Collaborative on green budgeting. The OECD green budgeting framework covers how the budget as a whole impacts on the environment, incorporating both taxation and expenditures; includes all environmental domains; incorporates both negative and positive environmental impacts; and uses green budgeting to mainstream environmental policies through integration into governments' core annual budget processes rather than setting up parallel processes (OECD, 2018).

Another important international initiative is the Coalition of Finance Ministers for Climate Action, formed in 2019 to promote national climate action, especially through fiscal policy and the use of public finance. The coalition states: 'Finance Ministers hold the keys to accelerating climate action. They know most clearly the risks posed by climate change, and recognize how taking action could unlock trillions in investments and create millions of jobs through 2030' (Coalition of Finance Ministers for Climate Action, n.d.). The coalition comprises members from 70 countries, including New Zealand. Its 2019 Santiago Action Plan includes work on mainstreaming climate change mitigation and adaptation and developing tools for green budgeting.

The burgeoning international interest in green budgeting is illustrated in Table 1, which presents selected practices that integrate environmental and economic policies at discrete points across the policy and budget cycles by countries at all levels of development.

New Zealand makes relatively little use of economic instruments for environmental management and the OECD has recommended expanding the use of environmentally related taxes, charges and prices such as road tolls, congestion charges, water tariffs and water pollution charges, and ensuring that petrol and diesel tax/charge rates take environmental externalities into account (OECD, 2017). The Ministry for the Environment is currently consulting on proposals to reduce waste, including a deposit refund scheme. New Zealand has, however, been a relatively early adopter of initial attempts to connect environmental

BOX 5 Entry points for green budgeting

- Green medium-term fiscal strategy incorporating environmental limits and targets
- Green budget tagging/issuance of sovereign green bonds
- Green budget tagging of environmentally harmful expenditures
- Disclosing the anticipated environmental impacts of new policies in the annual budget
- Environmentally sensitive public investment management processes
- Reviewing environmentally damaging taxes and subsidies
- Expanding the use of green taxes
- Green fiscal risk analysis
- Oversight of the environmental impacts of the state-owned enterprises sector
- Performance-oriented budgeting in the environment sector
- Periodic green expenditure review

Source: drawn from Petrie, 2021, pp.126–38

sustainability with fiscal policy and budgets. As noted, it has embarked on 'wellbeing budgeting', although the Covid-19 pandemic interrupted this evolution.

In a detailed analysis the parliamentary commissioner for the environment has assessed how environmental considerations were integrated into the 2019, 2020 and 2021 budgets, from the formation of strategic considerations through to the review of existing spending, the development and assessment of bids for new spending, and final decision making (Parliamentary Commissioner for the Environment, 2021). The review concluded that available environmental information is often deficient, and, for all the talk of wellbeing budgeting, the advice that is generated in the budget process is insufficient to facilitate investment in environmental expenditure that is orientated towards intergenerational wellbeing. 'The key message of this report is clear: key long-term environmental issues need to be explicitly acknowledged and responded to as part of the budget process' (ibid., p.10).

Box 4 contains some of the commissioner's key recommendations. The report suggests that at least every three years, officials should be required to provide the minister of finance with a report containing advice on how well existing policies and initiatives are addressing the environmental issues identified in the most recent state of the environment report. This briefing should include how much expenditure is allocated to each of the environmental issues and what is known about the effectiveness of that expenditure. The minister of finance should then, each year at the time of the presentation of the budget, publish a report that outlines how new fiscal initiatives, as well as any changes to baseline expenditure, respond to the environmental issues identified. This report should then be referred to Parliament's Environment Committee.

Looking ahead, the government has acknowledged that to address climate change a new approach to the budget process is required, in particular to enable significant investments across multiple budgets. To drive this, the government is to establish a Climate Emergency Response Fund. For the May 2022 budget this fund will focus on initiatives and programmes aimed at delivering the emissions reductions outlined in the government's first emissions reduction plan (Treasury, 2021).

Beyond that, there is a range of entry points for green budgeting (see Box 5). These point to an agenda for the progressive 'greening' of fiscal policy and the more complete integration of environmental and fiscal policies. They provide a framework for the 'how' of wellbeing budgeting that has been absent to date. How this evolves should depend on the assessed relative costs and benefits of alternative entry points, combined with the political economy of reforms.

Conclusions

Since around 2010 there has been a rapidly growing international interest and practice in more closely integrating environmental and economic policies through use of fiscal policy and the annual budget process. In New Zealand the direction of travel in recent years is positive, if uneven and only in the early stages. Current indications from the government's proposed reforms to the resource management system, the proposals for improving environmental reporting, and the prioritisation of actions to address climate change in the 2022 budget provide some prospect that environmental sustainability will receive more explicit attention in policy decisions. However, the proposals on environmental reporting do not go far enough, the proposed approach for setting environmental limits and targets may yet be watered down, and the promise of wellbeing budgeting is far from being achieved.

The parliamentary commissioner for the environment, in a series of influential reports, has aptly described the situation:

> Governments are elected to make choices. They can't do everything, and allowing environmental deficits to accumulate may well be the outcome of a given budget process. But any such outcome should be an informed one, for which New Zealanders should be able to hold the Government to account. (Parliamentary Commissioner for the Environment, 2021, p.10)

This will require greater transparency around environmental trends, goals and risks alongside economic and fiscal objectives, more attention to the possibility of win–win policies and more information on the nature of trade-offs between environmental and other goals.

There are, in fact, increasing opportunities for win–win policies – illustrated by the solar electricity revolution, the availability of international green finance, and the important role of public research and development of new technologies that catalyse the transformation required in private sector investment. There is growing awareness of the co-benefits of environmental policies, the risks from environmental degradation and the costs and inequities of inaction.

What is required now is to operationalise the wellbeing budgeting framework more fully and effectively. This includes revisiting the objectives of fiscal policy in the Public Finance Act, and progressively implementing a range of practical entry points for green budgeting. In short, the 'how' of integrating environmental and economic policies needs to be progressively implemented to achieve the promise of wellbeing budgeting.

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Michael (Mike) Joy

Changing Freshwater Management in New Zealand

looking to the future we must look back

Abstract

Freshwater management policy in New Zealand is currently undergoing major upheaval. It is abundantly clear that the existing policy failed its stated goal, to protect freshwaters for future generations. Therefore, this is a crucial time to look back and see where policy failed so we can avoid repeating the same mistakes. The implementation failures included setting inadequate objectives, failing to monitor outcomes, and failing to adequately enforce even those compromised objectives. Furthermore, there were policy shortcomings, revealed by an almost total failure to deal with the diffuse nature of the biggest environmental impacts.

Keywords RMA, freshwater, future generations, compliance monitoring and enforcement

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The management of freshwater in New Zealand is currently undergoing major upheaval. It is crucial that any new policy development should involve looking back to see what worked and what didn't in the prior legislation. In this article I look back over the last three decades of the Resource Management Act 1991 (RMA) in respect of freshwater management, in an attempt to ascertain what can be learned.

I discuss issues with RMA implementation in the context of three fundamental aspects of freshwater management: a) the setting of objectives for freshwater ecosystem health; b) the monitoring of achievement against those objectives; and c) the setting of resource consent conditions and their monitoring and enforcement. The latter are particularly important because consents are a critical mechanism by which plan objectives are achieved.

In hindsight the processes that failed and the drivers of those failures are clear. My experience at the coalface included being involved in regional plan formation and changes, resource consent hearings, and Environment Court and Environmental Protection Authority boards of inquiry. While

the aims of the RMA were bold and well-intentioned, they were interfered with to the point of almost complete failure by the influence of vested interests – mostly industries dependent on freshwater exploitation. Thus, any new legislation must remove all opportunity for such interference. New independent monitoring and enforcement bodies must be established with transparent processes, isolated as much as possible from the influence of vested interests.

The intent of the RMA is unequivocal: that freshwater environments are to be protected for future generations. As the Act clearly states, its aim is 'safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and avoiding, remedying, or mitigating any adverse effects of activities on the environment'. The stated purpose of the Act was to allow sustainable management, defined in terms of use and development of resources, but with the crucial qualifier, the requirement to 'meet the reasonably foreseeable needs of future generations' (s5(2)). Specifically, in relation to freshwater contamination the Act appears explicit: 'No person may discharge any – contaminant or water into water' that 'changes or is likely to change the physical, chemical, or biological condition' of water (ss15(1), 2(1)). To my reading the Act does not define a particular contamination pathway, so 'diffuse' or otherwise should have been included. Thus, it is hard to imagine how the objective of the legislation to safeguard freshwaters for future generations could be better defined.

Looking back

Given that the RMA is clear that freshwater must be protected for future generations, we should expect that a review of the data would reveal that the state of freshwater has improved, and certainly not declined, in the three decades of its existence. What does the data reveal?

The picture is bleak, notwithstanding the fact that the agencies monitoring freshwaters are politically influenced and self-report their environmental achievement, both of which lead to downplaying the severity of the true state and trends (Joy and Canning, 2020). Independent analysis of data on freshwater starkly reveals that, contrary to expectations, over the last three decades freshwaters have significantly deteriorated (Julian et al., 2017).

The most comprehensive indicator of the state of freshwaters, the aquatic lifeforms that inhabit them,[1] reveal the harm done and deteriorating trends. Nationally, aquatic biodiversity is in severe decline, especially our native fish (Weeks et al., 2016; Joy et al., 2019). Three-quarters of New Zealand's mostly endemic native fish species are listed as threatened or at risk of extinction. This is up from a fifth when the RMA was enacted (Joy et al., 2019). This proportion of threatened fish species ranks among the worst in the developed world (Weeks et al., 2016).

The data on impacts on aquatic life reveals a comprehensive failure to protect freshwaters. Likewise, the physico-chemical measures of water quality show poor state and worsening trends. In the first three decades of the RMA river water quality significantly declined, especially at pasture and urban catchment sites (Ministry for the Environment and Statistics New Zealand, 2020). Eighty-five per cent of waterways in pasture catchments (which make up almost half of the country's waterways by length) now exceed Australasian nitrate guideline thresholds (ibid.). While urban waterways are the worst, they comprise less than 1% of the total length of waterways. In pasture catchments the major impacts on water quality are diffuse (run-off and through land). Urban water quality declines are mainly due to point sources, such as waste water discharges to freshwaters, the degradation of waste water infrastructure and lack of storm water treatment (Chakravarthy, Charters and Cochrane, 2019).

Groundwater quality is also deteriorating: in 2019, 62% of monitored bores showed significant increases in nitrate, 59% had faecal bacterial indicator (*E. coli*) concentrations that did not meet drinking water standards, and 64% had increasing trends in *E. coli* (Ministry for the Environment and Statistics New Zealand, 2019).

Like aquatic life and water quality, freshwater recreational opportunities are also in decline, with swimming in most rivers in farmed areas in New Zealand now posing a risk to human health from the ingestion of pathogens (ibid.). Farming intensification has also led to declines in recreational fisheries (Stewart et al., 2019). As well as the environmental impacts of land use intensification, increasing risks to human health are now emerging. Evidence is growing that links exposure to nitrate in groundwater-sourced drinking water, largely derived from intensive farming, to multiple negative health outcomes, including colorectal cancer, thyroid disease and neural tube defects (Chambers et al., 2020; Richards et al., 2022).

As if all that weren't bad enough, there are other emerging contaminants, such as pesticides and emerging organic contaminants (EOCs), increasingly showing up in waterways and aquifers (Close, Humphries and Northcott, 2021).

> … it seems that the best intentions of environmental policymakers count for nothing if the policies allow organisations charged with implementing them to be diverted from meaningful implementation.

Crucially, all of the factors leading to deteriorating water quality in our waterways will be exacerbated by climate change, adding further risk through changes to water temperature (Ling, 2010) and shrinking glaciers (Milner et al., 2017).

The summary above reveals a comprehensive failure to protect freshwaters. In retrospect, it seems that the best intentions of environmental policymakers count for nothing if the policies allow organisations charged with implementing them to be diverted from meaningful implementation. Outlined below are the key areas where implementation has failed.

Limit setting

A core problem has been the use of so-called 'limits' and 'environmental bottom lines', which, without a mechanism to prevent the decline of ecosystems to that bottom line, are fatally flawed. Limits have become a de facto tool to mediate between the dichotomous objectives of facilitating economic development and environmental preservation. This inherently faulty concept of attempting to balance these antagonistic goals was doomed to fail in New

Zealand, as it has globally (Bradshaw et al., 2021).

During the limit-setting process vested interests have exploited multiple opportunities to weaken limits to the point where they no longer limit harm. These vested interests, often aided and abetted by regional councils, used their superior resourcing to ensure that the process weakened limits in their favour (Joy, 2021; Joy and Canning, 2020). There has been a lack of any will to implement limits when they are likely to force change. Brown has highlighted the notion of 'regulatory capture', a process by which 'regulation ... is consistently or repeatedly directed away from the public interest and toward the interests of the regulated industry by the intent and action of the industry itself' (Brown, 2017, p.6). In this instance the problem of the capture of officials occurs because under the RMA process 'someone' must set the limits. The process is one where there are huge incentives and opportunities for it to be captured, politicised and, as a result, watered down (Joy and Canning, 2020).

Thus, we ended up with objectives like limits and bottom lines not set at a sufficiently stringent level to protect the status quo, let alone lead to any improvement. They end up flawed in that they:

- are often narrow in their application and constrained by complex definitions;
- are flexible instead of limiting – this is when they allow for long transition times, with councils setting time frames for improvements to meet bottom lines that allow harm to continue for generations;
- like speed limits on roads, tend to become not limits but goals, with the potential to drive worse outcomes.

Monitoring and enforcement failure

Additionally, there has clearly been a failure to monitor the degree to which the environmental protection policies, plans and consent conditions were achieving their stated aims and being enforced. Councils are required under the RMA to monitor the efficiency and effectiveness of their plans and regional policies and their methods of implementation, and to monitor the state of the environment. National data (collected via the National Monitoring System)[2] indicates that regional councils have consistently failed to monitor their plans and policies for effectiveness, even when state of the environment reporting has shown degradation.

In the majority of cases authorities have a policy of 'working with' polluters, rather than taking a command-and-control stance.

Initially the objective-setting process failed, then the monitoring compliance with those, albeit flawed, limits was insufficient, and finally there was a failure to enforce compliance. In a comprehensive study of environmental policy outcomes, Brown concluded that environmental compliance-monitoring enforcement is given low priority and very limited resourcing, meaning that its implementation is uncertain, contestable, and therefore highly variable in practice. As with the limit-setting process, it is susceptible to regulatory capture (Brown, 2017).

Reviewing the progression of RMA implementation, it is evident that at every step of the process the Act's purpose and principles have been whittled away, almost always with business interests winning over environmental protection. Right from the regional plan-setting stage, and then at the consent hearing stage, the imbalance of resourcing has meant that the polluters have had disproportionate influence on the process (Joy, 2021). Finally, compliance and monitoring has been weighted in favour of exploiters (Brown, 2017).

My experience of environmental protection has been that across government there is a culture of adopting a 'compliance approach'. This results in the environmental regulatory authorities only acting on severe and repeated breaches. In the majority of cases authorities have a policy of 'working with' polluters, rather than taking a command-and-control stance. A 'compliance approach' is described in Wright as an approach whereby '[c]ompliance-minded regulators seek to build relationships with regulatees, the idea being that a co-operative approach will lead to better long-term results' (Wright, 2022, p.48). Because this approach is applied in a context where regulatory agencies deprioritise and under-resource compliance monitoring and enforcement (compared to consent processing), implementation and enforcement of council rules and policies has been ineffective. Compliance teams are necessarily risk-adverse, meaning that they require a high degree of certainty before acting on breaches. All of this plays into the hands of those with economic vested interests.

The findings above were backed up in the recent review of resource management in New Zealand by Judge Randerson (Resource Management Review Panel, 2020), who summed up the failings of the RMA as: a lack of clear environmental protections; a lack of recognition of the benefits of urban development; a focus on managing the effects of resource use rather than on planning to achieve outcomes; a bias towards the status quo; lack of effective integration across the resource management system; excessive complexity, uncertainty and cost across the resource management system; lack of adequate national direction; insufficient recognition of te Tiriti and lack of support for Māori participation; weak and slow policy and planning; weak compliance, monitoring and enforcement; capability and capacity challenges in central and local government; and weak accountability for outcomes and lack of effective monitoring and oversight.

There have been recent changes to freshwater policy, attempting to address some of the issues raised above, with the National Policy Statement for Freshwater Management 2020 and its previous iterations, commencing in 2011. This policy, almost two decades late in implementation, gives national guidance to councils, which up to that point were left to their own devices. It sets out a National Objectives Framework which the councils must use to set the parameters for freshwater use in their respective regions. Council freshwater planning (to be undertaken by 2025) must aim to achieve certain national values, and other values and aspirations agreed by the community. While these values are linked to national bottom lines for certain attributes, some of the pitfalls with the previous policy remain. For example, it is still too flexible: the pace of change towards achieving these values is only loosely prescribed (ambitious but reasonable, with the suggestion that this be within a generation) (New Zealand Government, 2020, p.12, 3.3(2) b, c). Words like 'ambitious' and 'reasonable'

in my experience just invite variable interpretation leading to litigation and once again failure to halt harm.

One of the key changes is the introduction of the concept and framework of Te Mana o te Wai. This is potentially a groundbreaking change as it puts the health of the water before all else. Specifically, 'it ensures the health and well-being of the water is protected and human health needs are provided for before enabling other uses of water' (Ministry for the Environment, 2021, p.1). The concept relies on mana whenua and community involvement to determine how it applies regionally.

New national standards and regulations relating to freshwater also prescribe specific constraints that industry must work within now and by set dates in the future. While none of these will give effect to Te Mana o te Wai, they provide the absolute minimum standards, and many have a large degree of flexibility to allow exceptions of 'bottom lines':

- National environmental standards for plantation forestry, 2017. These include rules aimed at controlling effects of forestry on freshwater, which have been criticised as not being integrated with freshwater policy (Wright, Gepp and Hall, 2019).
- National environmental standards for freshwater, 2020. These are intended to provide immediate protection for wetlands, streams and fish, and interim controls while freshwater plans are developed. Controls on intensive winter grazing have been repeatedly delayed, and flexibility built in is such that no change in practice occurs.
- Resource Management (Stock Exclusion) Regulations 2020: regulations to increase fencing and setbacks to keep stock out of waterways.
- National environmental standards for sources of human drinking water (in draft).

The government is also progressing the Three Waters reform, which proposes changes to the way drinking water, waste water and storm water are managed throughout Aotearoa New Zealand, and the Water Services Act came into force in 2021. Unfortunately, this legislation largely deals with the supply of drinking water as, bizarrely, somehow separate from the source water.

New environmental policy to replace the RMA is now in the pipeline, with three acts proposed in its stead. The Natural and Built Environments Act is intended to be the main replacement for the Resource Management Act, providing for land use and environmental regulation. In addition, a Strategic Planning Act is proposed to introduce regional spatial strategies, and a Climate Change Adaptation Act will address issues associated with managed retreat and funding and financing adaptation to climate change.

An exposure draft of the Natural and Built Environments Bill was released for public feedback in 2021 through an inquiry process; this feedback was considered by the Environment Committee, as well as recommendations in a departmental report by the Ministry for the Environment. So far the exposure draft has only provided an 'early look into key aspects of the legislation'. The draft introduced the proposed purpose of the Act and some of the key components, which include environmental limits, environmental outcomes and a national planning framework, but remains without detail as to the mechanisms to be used to mediate the inherent tensions between the twin objectives of facilitating economic development and environmental preservation. Given my analysis of the current legislation, crucial questions remain:

- who will set the objectives/limits?
- what will objectives/limits achieve?
- how will the undue influence of vested interests be avoided?

Conclusion

In looking to the future for freshwater, we must look back. After three decades of the RMA, with its clearly stated intent to protect freshwater for future generations, it is now patently and sadly obvious that it has failed. Failure has occurred for multiple reasons, including the lack of an effective mechanism to deal with diffuse discharges, politicisation of the process around limit setting, and the failure of compliance monitoring and enforcement. This clearly raises the question: why would we expect new legislation to be any more effective when the problem isn't so much the intent of the policy and lack of clarity around bottom lines, but rather its implementation (or lack of it)?

To achieve the stated goal of all New Zealanders to have healthy freshwaters, given the failures to date, the solutions I suggest are:

- to depoliticise the environmental limits issue by setting up a more independent national limit-setting commission, perhaps along the lines of the Reserve Bank;
- the monitoring failings of the past could be dealt with by taking monitoring and reporting away from local and central government and placing it within an independent framework like the parliamentary commissioner for the environment;
- regulatory capture and subsequent failures to enforce could be ameliorated by having an independent national enforcement organisation, again such as the parliamentary commissioner for the environment;
- that the Ministry for the Environment's statement of intent 2020–25 be dramatically strengthened by incorporating mātauranga Māori concepts of whakapapa and reciprocity based on mutual obligation.

I hope that the policymakers involved in the current revamp of environmental policy remember the words of Winston Churchill: 'Those who fail to learn from history are doomed to repeat it.'

1 Note that unlike snapshot physico-chemical water quality assessments, these aquatic lifeforms integrate water, ecosystem and habitat quality in space and time.
2 The NMS is a spreadsheet that councils fill in annually and submit to the Ministry for the Environment.

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Tim Chambers, Simon Hales,
Nick Wilson and Michael Baker

Improvements to Drinking Water

Monitoring, Reporting and Record-keeping Needed to Protect Health

Abstract

Taumata Arowai, the new independent water services regulator, recently consulted publicly on the drinking water rules for water suppliers. We use a case study on nitrate and official information requests to demonstrate the current weaknesses in the drinking water monitoring and reporting systems and why the reforms proposed by Taumata Arowai seem unlikely to substantively address many of these deficiencies. To ensure sufficient public health surveillance and robust epidemiological research into the potential health impacts of drinking water contaminants, Taumata Arowai should: 1) establish a national database for water supply and quality; 2) mandate the standardisation of reporting requirements across water suppliers; 3) increase the frequency and range of water quality testing; and 4) maintain a national map of water supplies. These upgrades are particularly important in an era of rapid land use changes and climate change.

Keywords Taumata Arowai, three waters, public health, drinking water, nitrate

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In 2016, Havelock North's water-related campylobacteriosis outbreak made much of an entire town sick (around 8,000 people), with 58 hospitalisations and four deaths (Gilpin et al., 2020; Wilson et al., 2021). The outbreak was an outcome of systemic flaws in Aotearoa New Zealand's regulatory system for drinking water, which were highlighted in the subsequent government inquiry (Government Inquiry into Havelock North Drinking Water, 2017). This inquiry led to the Three Waters review (Department of Internal Affairs, 2020) and subsequent reforms called 'Three Waters' that are responsible for reforming the waste, storm and drinking water systems in Aotearoa. A key initiative of the Three Waters reforms was the establishment of a new independent water services regulator, Taumata Arowai.

Taumata Arowai recently consulted publicly on the drinking water standards and quality assurance rules for water suppliers. The standards, which define the maximum permitted concentration of key contaminants, remain relatively unchanged under the new proposals (Taumata Arowai, 2021a). In contrast, there are some major changes proposed to the rules that regulate water suppliers, including source water protection,

filtration requirements, and the number of water supplies covered by the legislation (Taumata Arowai, 2021b). However, these new rules do not address a fundamental problem with water quality testing, monitoring and reporting mechanisms required for effective public health surveillance and research. In this article we use a case study on nitrate and official information requests to demonstrate the current weaknesses in the drinking water monitoring and reporting systems and why the reforms proposed by Taumata Arowai seem unlikely to substantively address many of these deficiencies.

programme did not require ongoing monitoring. For example, if nitrate levels were less than 25mg/L during the testing programme, then that water supplier was not required to monitor for nitrate. Consequently, very few water supplies had ongoing testing for nitrate levels (serving a total of 53,900 people, around 1% of the population) in 2020 (Ministry of Health, 2020).

Nitrate in drinking water and health

Nitrate is one of the most common drinking water contaminants in Aotearoa, largely driven by agricultural activity (nitrogen fertiliser application and livestock urine) (Morgenstern and Daughney, 2012). The regulatory limit for nitrate set by the World Health Organization and adopted by Aotearoa is 50mg/L, a level intended to prevent rare cases of methaemoglobinaemia, which causes potentially fatal cases of asphyxia in infants (Ministry of Health, 2018; World Health Organization, 2017). Recent experimental, genetic and epidemiological evidence has linked nitrate in drinking water to other conditions, including colorectal cancer (Temkin et al., 2019; Chambers et al., 2022), preterm births (Sherris et al., 2021) and congenital anomalies (Stayner et al., 2022). These adverse health outcomes were observed at levels as low as 3.8mg/L, well below the current World Health Organization guidelines (Schullehner et al., 2018). A cross-sectional analysis in Aotearoa estimated that 800,000 people are on supplies containing over 4mg/L of nitrate. Approximately 50% of those people are receiving water from registered water supplies controlled by district councils (Richards et al., 2022).

Nitrate is one of the most common drinking water contaminants in Aotearoa, largely driven by agricultural activity (nitrogen fertiliser application and livestock urine) ...

Current water testing and reporting rules for registered water suppliers

Water supplies in Aotearoa are broadly characterised as either a registered or an unregistered supply. The owner of a water supply serving more than 25 people (around 85% of the New Zealand population) is required to register with the Ministry of Health (Richards et al., 2022). District councils provide water to 98% of people on a registered supply. Unregistered supplies (around 15% of the population), including self-served water supplies sourced primarily from a groundwater bore or rainwater tank, are not subject to current Ministry of Health regulation (ibid.). However, the new Taumata Arowai proposal requires any person supplying water to more than one dwelling to register (Taumata Arowai, 2021b). The redefinition of a registered supply will increase our understanding of water quality for those people most at risk of water contamination.

The current drinking water testing and reporting requirements for many contaminants are largely based on a national testing programme that was conducted between 1996 and 2004 by the Institute of Environmental Science and Research (ESR) (ESR, 2019). Water supplies testing below 50% of the maximum acceptable value (MAV) for certain contaminants within this

Nitrate case study

In September 2021 we sent Local Government Official Information and Meetings Act requests to all district councils for all nitrate data for their drinking water supply components (source water, treatment plant and distribution system) and any spatial data (digital maps) on their water supply boundaries (the area served by any given water supply).

Data extraction

We received completed requests from all 67 district councils in the country, with these collectively providing reticulated water to 4,113,000 people (85% of the national population). Some councils were able to process the requests within days, while others took months (mean 54 days; range 2–130 days) (Table 1). The process involved over 500 email clarifications and phone and videoconference calls between researchers, council employees, commercial testing laboratories and infrastructure companies, and took over five months to complete, consuming substantial time and resources.

Data coverage

Table 1 shows the extent of nitrate testing conducted by district councils at the supply rather than council level (councils control multiple water supplies). Fifty-eight individual supplies (9%) serving 1,090,000 people (27%) continued to be tested for nitrate after the ESR testing programme ended in 2004. Continued testing occurred between 2005 and 2009 for an additional 24% of supplies serving 942,000 people, and between 2010 and 2014 for an additional 20% of supplies serving 1,307,000 people, while 10% of supplies have not tested their water for nitrate since the testing programme. 'Continued testing' in this context is loosely defined as either annual, bi-annual, five-yearly or spot tests after the ESR testing programme was completed.

In total, 42 councils (63%) provided spatial data, or confirmed spatial data held by the authors for their water supplies. While most data sets were spatially complete, many lacked descriptive elements in their data tables to facilitate linking to Ministry of Health compliance data (e.g., did not use ministry naming conventions). Further, data formats were not uniform across district councils. Substantial data cleaning was required to compile the data into a single spatial national data set. Twelve councils (18%) provided incomplete geographic information system (GIS) files, which meant one or more water supplies were missing. Four councils provided aerial snapshots from Google Maps or similar GIS to highlight the expected supply boundary, while nine councils (13%) were unable to provide any

spatial information on their water supply boundaries.

Data quality and standardisation

The nitrate testing information was received in various formats, including reports from the commercial testing laboratories, custom Microsoft Excel spreadsheets, highlighted in email correspondence, or redirection to environmental reporting data from regional councils. Again, each district council had their own data reporting systems, which meant collation of testing results required extensive data cleansing and data entry of all testing results to generate information in a uniform format. Additionally, district councils regularly used their own naming conventions (e.g., bore#231), which do not correspond to Ministry of Health compliance data.

Data loss

A number of district councils no longer possessed their water quality results, due to migrations to new data systems, the council's own data retention and disposal schedules, staff turnover, and reliance on commercial testing laboratories to archive testing results. A large portion of water quality results had to be retrieved by us from the major commercial testing laboratories upon appropriate permission from the relevant council. However, in some cases the laboratory no longer held the data because they had migrated to a new data system. In one case the laboratory no longer operated, preventing retrieval of all relevant testing results. The loss of testing data also poses serious questions about the ability of each council to independently monitor, store and analyse water quality data for the full range of contaminants.

Table 1: The extent of nitrate monitoring and spatial information for registered water supplies controlled by district councils throughout Aotearoa

Nitrate testing conducted	Number of water supplies		Population covered	
Testing since 1996–2004	58	(9%)	1,091,000	(27%)
Earliest testing 2005–09	154	(24%)	943,000	(23%)
Earliest testing 2010–14	131	(20%)	1,308,000	(32%)
Earliest testing 2015–19	199	(31%)	682,000	(17%)
Earliest testing 2020–22	40	(6%)	45,000	(1%)
No testing since 1996–2004	63	(10%)	45,000	(1%)
Total	645	(100%)	4,114,000	(100%)
Spatial data available	**Number of councils**		**Population covered**	
Complete GIS file	42	(63%)	3,600,000	(88%)
Incomplete GIS file	12	(18%)	266,000	(6%)
No files provided to researchers	9	(13%)	187,000	(5%)
Aerial images	4	(6%)	61,000	(1%)
Total	67	(100%)	4,114,000	(100%)

Taumata Arowai's proposed monitoring and reporting programme

A number of changes are proposed in Taumata Arowai's recent consultation document that may, in part, address some of these data issues. However, problems remain. First, all registered supplies, regardless of size, will be required to routinely test for nitrate in source water. Supplies serving more than 500 people are proposed to be tested annually, and smaller supplies three-yearly (Taumata Arowai, 2021b). However, the temporal variation in nitrate levels in source water (Morgenstern and Daughney, 2012) means that the proposed testing regime is unlikely to provide a reliable estimate for nitrate in source water (e.g., testing each season may be more appropriate).

Second, testing for some contaminants is not required in complex treatment or distribution systems that combine water from multiple sources, on the basis that they are tested in the source water. However, relying on source water data for such systems prevents the accurate measurement of contaminants in the water, since the volume of water derived from each source varies. For example, if three different sources contributing to a distribution system have nitrate levels of 0.5, 5 and 7mg/L, it is difficult to accurately determine the exact nitrate concentration in the drinking water in the network at any given time. This is a major problem for exposure assessment in epidemiological research which relies on valid quantitative results on an exposure (e.g., nitrate levels) to calibrate risks to health. It also raises issues in terms of the accuracy and transparency of information ratepayers are receiving about the quality of the water they are paying for and receiving.

Changing the rules to correct for these shortfalls would not be difficult or costly. All suppliers are required to test annually for other contaminants in some water supply components (e.g., for lead in the distribution system), at which point they could also test for nitrate. Private correspondence with commercial labs suggests that the marginal cost of adding a nitrate test is around $6 per sample, while an estimated cost to test for the identified contaminants listed in Taumata Arowai's recent consultation document using a simple distribution system would cost approximately $50.[1]

A third issue is that although the proposed rules require water suppliers to collate, report and maintain data to demonstrate compliance with the rules, there is limited detail in the consultation document on the prescribed format of these requirements. Suppliers may report and maintain their data differently, preventing the collation of a national database without substantial public and analyst resources. Further, it is not clear if Taumata Arowai will require actual testing results (e.g., the more informative, precise value of any given test in mg/L) or merely document achievement of a regulatory threshold (e.g., does the contaminant comply with the drinking water standards, yes/no). The latter is the current system, which is preventing any meaningful surveillance of contaminants below the MAV. Without a national database of contaminant values there is no ability to centrally monitor these trends and progressively optimise risk reduction to the public with water quality interventions.

The current rules also do not specify what spatial information will be required from registered water suppliers. Section 53 of the Water Services Act 2021 specifies that registered water suppliers must provide information on the location of the drinking water supply and the drinking water supply boundary. Further, section 55 specifies that Taumata Arowai must maintain a separate publicly available version of this information. However, both sections are vague enough that any form of spatial information provided in response to our information requests could comply. Without specific instructions to standardise spatial information on water

supply components (sources, treatment plants and distribution systems), it will remain a time-consuming and error-prone process to compile spatial information at regional and national levels.

How Taumata Arowai could improve public health surveillance and research on drinking water supply

Establish a national database for drinking water quality

A national database for drinking water quality would facilitate ongoing surveillance, trend analyses and public health research, all of which would support improvements in drinking water quality in Aotearoa. Currently the Ministry of Health's central database for drinking water quality compliance, Drinking Water Online, contains nitrate testing results for only 7% of all registered supplies, with its earliest measurements starting in 2017. The majority of data contained within this central database is only for compliance purposes – e.g., does the supply comply with the drinking water standards? This compliance-based approach has severe limitations for public health surveillance and research targeted at assessing risk to the public. For public health surveillance, it is important to assess trends in water quality to identify areas of degrading and improving water quality and potentially pre-empt future problems. From an epidemiological perspective, without actual testing results it is impossible to assess the potential health impact of key contaminants at levels below the MAV. Our understanding of the human health impacts of some chemical contaminants is still limited; thus, research into exposure below the MAV is central to informing future drinking water standards and protecting public health.

Taumata Arowai could facilitate the integration of water quality data into the Integrated Data Infrastructure (IDI) in collaboration with Statistics New Zealand. The IDI is a series of large linked data sets of individual-level personal data from most of the country's ministries, linked by a single identifier (Milne et al., 2019). The integration of a centralised water quality database would facilitate high-quality research to assess health risks at very low cost. Very few countries have access to a centralised database of routinely collected health and social data at an individual level and a national database for water quality. In Aotearoa, both are possible, a scenario that would facilitate world-leading research and ensure that public health researchers could assess ongoing and emerging health threats from drinking water to protect public health.

Specify quantifiable test results in the reporting requirements for all water suppliers

Taumata Arowai should specify precise data reporting requirements and formats to water suppliers. First, water suppliers should be required to maintain records on quantifiable testing results from each test, rather than compliance-based reporting. Second, Taumata Arowai should provide a standardised template for water suppliers' record-keeping. Third, for publicly owned supplies (e.g., all district council supplies), testing results should be publicly accessible online. These changes would improve the efficiency in collating a national database of water quality and ensure transparency. Furthermore, such processes would probably reduce the burden on district councils, which are routinely required to respond to information requests from the public and media on water quality data.

Increase the frequency and range of drinking water monitoring

The current testing regime lacks the frequency of testing and range of contaminants covered to ensure effective public health surveillance. This gap is problematic in a time of rapidly changing land use patterns and climate change impacts. Therefore, testing frequencies should be increased for all supply types. Most suppliers are required to test at weekly or at least yearly rates for some basic contaminants (e.g., *E. coli*). The marginal cost of adding contaminants to this testing is negligible compared to the total operating costs and asset values. For example, Wellington Water has an operating budget of $225 million per year and controls water assets worth $6.1 billion for all three water assets (Wellington Water, 2021, 2022). The burden of any additional testing will be felt most by smaller suppliers. However, a yearly cost of around $50–100 to cover testing of a wider range of contaminants to ensure water is relatively safe is justified given the human and economic impact of failures (Government Inquiry into Havelock North Drinking Water, 2017). Increasing the frequency and range of drinking water monitoring will also improve our understanding of the health impacts of chemical contaminants. This is particularly important for contaminants at levels below the current MAVs, to support the adoption of a precautionary approach to water quality testing and monitoring.

Create a national spatial data set of water supply components

Taumata Arowai should maintain a national spatial data set of registered water supply components. In particular, it should specify a standardised format for spatial information for registered supplies. Ideally, this would be a spatial file format that is compatible with common geographic information systems, such as a shapefile or KML file. The information should include standardised naming conventions that align with testing and compliance information so they can be easily linked. Registered water suppliers should be required to review these files at each registration event to ensure they are representative of their current water supply boundaries. Taumata Arowai should maintain this database each year with any changes submitted by suppliers incorporated, so that trends in the size and location of water supplies can be assessed. Many councils have specialised GIS teams that maintain spatial records on many public assets. It is unlikely that these requirements would require substantial ongoing investment from large water suppliers. But, as an interim measure, GIS support could be offered to smaller suppliers to enable them to develop and maintain spatial information on their water supplies. Without specification in the Taumata Arowai rules document, the currently wasteful, ad hoc and fragmented development and storage of spatial information will continue. Correcting this information gap could help with identifying areas of declining water quality, informing people in areas with MAV exceedances, and public health research.

Conclusions

The marked fragmentation of district council water quality testing, reporting and data management structures in Aotearoa has created major inefficiencies and data losses that potentially increase public health risk. The new rules proposed by Taumata Arowai are unlikely to substantively address many of the major design flaws that have adversely affected public health surveillance and research to improve water quality and minimise risks to public health. To maximise efficiency and improve information to protect public health, we recommend that the new rules are revised to: 1) establish a

national database for drinking water quality; 2) mandate the standardisation of reporting requirements across water suppliers; 3) increase the frequency and range of water quality testing; and 4) create a national database of spatial information on water supply components.

1 The current simple distribution system testing proposed by Taumata Arowai includes antimony, cadmium, chromium, copper, lead, mercury, nickel and zinc.

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Shelley Fischer

A Review of Current Regional-Level Environmental Monitoring

Reporting and Enforcement in Aotearoa New Zealand

Abstract

Environmental monitoring helps us take stock of our natural environment. Clear, coordinated and consistent regional-level monitoring and reporting are required to assess the state of our environment and protect important sociocultural and economic assets. This article reviews and summarises the key issues affecting regional-level environmental monitoring, reporting and enforcement in Aotearoa New Zealand. These include weak legislation, lack of independent monitoring, patchy data coverage, misuse and distortion of data, insecure funding and inappropriate political interference. Solutions include legislative reform, consolidation of funding and centralisation of some roles, and establishing a centralised research council.

Keywords enforcement, environment, monitoring, regional, reporting

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Our natural environment provides us with important goods and services, such as freshwater and food. It is also the place where we stand – our tūrangawaewae. The loss of our natural capital poses a threat not only to Aotearoa New Zealand's economic stability, but also to important sociocultural assets (Petrie, 2018; van Zyl and Au, 2018). Moreover, environmental degradation can lead to negative health outcomes, such as an increased cancer risk and respiratory illness (Gwangndi, Muhammad and Tagi, 2016; Richards, 2020). Environmental monitoring and reporting are ways to take stock of important sociocultural and economic assets. Clear, coordinated, consistent monitoring and reporting enables the public, local and central government, and scientists to track environmental progress (improvement or decline). It also facilitates peer learning and dialogue, and increases accountability among the regions and to the public.

This article builds upon previous national-level reports (e.g., Parliamentary Commissioner for the Environment, 2019; Brown, 2017; Ministry for the Environment, 2011; 2015; 2019; 2022) by focusing on

environmental monitoring, reporting and enforcement at the regional rather than the national level. In this review I provide an overview of regional-level monitoring, reporting and enforcement in Aotearoa New Zealand, and identify key issues. Specifically, the article outlines the legal requirements for regional-level environmental monitoring and reporting in Aotearoa New Zealand; reviews current regional-level environmental reporting in Aotearoa New Zealand; outlines issues with compliance, monitoring and enforcement; discusses regional-level data coverage; and summarises the limitations and problems with regional-level environmental monitoring and reporting in Aotearoa New Zealand, with recommendations for improvement.

Legal requirements

Regional councils and local authorities operate under several pieces of environmental legislation: the Resource Management Act 1991 (RMA), the Environmental Reporting Act 2015, the Hazardous Substances and New Organisms Act 1996 and the Soil Conservation and Rivers Control Act 1941. In this section I examine the two main pieces of legislation relevant to regional-level monitoring and reporting: the RMA and the Environmental Reporting Act.

Resource Management Act

The primary piece of legislation relevant to the management of Aotearoa New Zealand's natural resources is the RMA. It has been criticised for its complexity, lack of national direction, weak implementation, poor monitoring and enforcement, and failure to manage cumulative effects and long-term issues (Brown, Peart and Wright, 2016). The RMA is set to be replaced with three new pieces of legislation: a Climate Change Adaptation Act, a Strategic Planning Act and a Natural and Built Environments Act (Ministry for the Environment, 2021c).

Currently, local authorities are required to monitor '[t]he state of the whole or any part of the environment of its region or district to the extent that is appropriate to enable the local authority to effectively carry out its functions under this Act' (RMA, s35(2)(a)). This wording is problematic because there are no clearly outlined requirements for what aspect of the environment should be monitored or how often. Without clearly outlined monitoring requirements it is difficult to know if regional authorities are breaching their obligations to maintain pollutants below the levels outlined in the national environmental standards. Moreover, applying the RMA is complicated because decision makers (courts and councils) must weigh competing environmental, economic and sociocultural concerns when interpreting the Act (Hammond, 2018). Because there is no clear definition of economic wellbeing in the RMA, decision makers are permitted to consider financial benefit to an individual. To illustrate, consents have been granted for a meat processing plant (*Martin v Far North District Council*, 1999) and a hotel (*Armstrong v Central Otago*, 2008) based on the economic wellbeing of the applicants (Lowe, 2010).

Without clearly outlined monitoring requirements it is difficult to know if regional authorities are breaching their obligations to maintain pollutants below the levels outlined in the national environmental standards.

Furthermore, issues arise when local councils make decisions based on vested interests represented by their electorate. Councillors for city, district and regional councils are democratically elected by communities every three years. In regions where the economy is reliant on environmental exploitation, elected councillors may be strongly influenced by the interests of resource users in their electorate. Consequently, economic considerations and farming interests are often at the forefront of environmental consent assessments under the RMA (Brown, Peart and Wright, 2016; Hammond, 2018; Hanning, 2010).

National environmental standards

Between 2004 and 2021 the central government has brought into force nine national environmental standards, which are regulations under the RMA (Ministry for the Environment, n.d.). The first standards covered air quality and landfill gas emissions, while further standards stipulate requirements for the technical standards and methods for monitoring rivers and lakes, coastal marine areas, water take and use, land use and subdivision, discharge and noise. National environmental standards place a legal requirement on councils to test and to maintain concentrations of certain pollutants below given levels. While there are minimum standards set, councils can impose stricter standards in their own plans. For example, Horizons Regional Council and Hawke's Bay Regional Council have both set stricter standards for nitrate than the minimum standard set out in the regulations (Hawke's Bay Regional Council, 2021; Roygard and McArthur, 2008). However, there are limitations to councils imposing stricter standards. Under the RMA, if the 'rule is more stringent than the provision in that it prohibits or restricts an activity … and the standard does not expressly specify a rule may be more lenient … the local authority must amend the plan or proposed plan to remove the publication or conflict' (RMA s44A).

There are currently nine national environmental standards in force: for air quality, freshwater management, marine aquaculture, soil, plantation forestry, sources of drinking water, telecommunications facilities, electrical transmission activities and storing tyres outdoors. Expert scientists have criticised many of the pollutant levels set under the standards as being meaningless because they have been set at levels far higher than the point at which ecological impacts are observed. For example, the Freshwater Science and Technical Advisory Group recommended a limit of 1mg/L for dissolved inorganic nitrogen in rivers (Freshwater Science and Technical Advisory Group, 2020) and the Australia New Zealand guidelines for fresh and marine water quality have a limit of 0.44mg/L (Australian and New Zealand Governments, 2000, 2018). At levels above 0.44 and 1mg/L the health of a waterway declines, eutrophication (algal bloom) sets in and fish die from lack of oxygen. Despite this, the National Policy Statement for Freshwater Management bottom line for nitrate toxicity is set at 2.4mg/L. This is the level at which nitrate would directly kill fish – if they had not already died from lack of oxygen.

The national environmental standards for freshwater and air pollutants are the most

pertinent to environmental quality; the remaining national environmental standards largely concentrate on impacts to human health and infrastructure. Thus, in the following sections, I concentrate on the standards for freshwater and air pollutants.

National environmental standards for freshwater

In 2011 the National Policy Statement for Freshwater Management was enacted, with supporting guidelines (the National Objectives Framework) implemented in 2013–14. The National Objectives Framework sets national bottom lines for freshwater quality to achieve the national policy statement goals. Subsequently, in 2018 the Labour-led government set up three expert advisory groups: the Freshwater Science and Technical Advisory Group, Kahui Wai Māori/the Māori Freshwater Forum, and the Freshwater Leaders Group. The Freshwater Science and Technical Advisory Group was charged with overseeing the scientific evidence for freshwater policy development and provided reports to the minister for the environment in June 2019 and April 2020. New policies were announced for freshwater in August 2020; however, crucial advice from the expert panels was not accepted (Joy and Canning, 2020; Science Media Centre, 2013). For instance, the implementation of nutrient limits, such as for inorganic nitrogen nutrients, was either weakened or postponed (Joy and Canning, 2020; Parker and O'Connor, 2020).

The National Policy Statement for Freshwater Management has been strongly criticised by freshwater scientists, including members of the technical advisory group. These critiques include that many of the numerical limits stipulated in the statement allow for greater environmental deterioration rather than maintenance or improvement, that measures for ecosystem health (e.g., invertebrate health measures) and contaminants (e.g., heavy metals and organic contaminants) are absent, and that no limits are set for wetlands or estuaries (Joy, 2015; Joy and Canning, 2020; Science Media Centre, 2013). For example, Joy (2018) has criticised the periphyton limits for rivers as being meaningless, because 17% of samples can exceed these limits. Periphyton is a natural feature of rivers; however, periphyton blooms can smother riverbeds, changing invertebrate communities, reducing the availability of food for fish, and changing natural conditions such as pH and oxygen levels (Kilroy and Stoffels, 2019). With a 17% allowance to exceed set limits, any given river could be considered compliant (and 'healthy') even when periphyton growth is negatively affecting ecosystem health. The policy statement also allows for some discretion to be applied: infrastructure, for example, may be allowed on wetlands if it has economic benefits (Science Media Centre, 2013). However, the statement lacks detail on how this economic benefit is measured and how it stacks up against the environmental, sociocultural or recreational benefits of a wetland.

... we no longer have valuable long-term data to track the long-term impacts of intensive dairy farming.

Another issue is that the monitoring of freshwater management has been delegated to local authorities. This means that local authorities are effectively monitoring themselves. From 1989 to 2012 freshwater quality monitoring was largely conducted by the National Institute of Water and Atmospheric Research (NIWA), a Crown research institute which operates as a stand-alone company. Physical, chemical and biological variables have been publicly reported through the National River Water Quality Network from its inception in 1989. Originally the network covered 77 sites, which included both baseline (upstream) and indicator (downstream) sites. But from 2012 onwards, 18 of the 77 original sites were transferred to local authorities, due to a reallocation of resources within NIWA and the requirement for local authorities to conduct water quality monitoring under the RMA (Parliamentary Commissioner for the Environment, 2019). At present only five of the 18 sites NIWA transferred to regional authorities are still being monitored (LAWA, 2021b, 2021c, 2021d; NIWA, 2022). Thus, we no longer have valuable long-term data to track the long-term impacts of intensive dairy farming. Government reporting commonly combines (NIWA and regional council) data for baseline and impact sites, which misrepresents the actual state of freshwater environments (i.e., the most polluted impact sites are 'masked' by the best baseline sites). Objective A2 of the National Policy Statement for Freshwater Management is that 'the overall quality of fresh water within a region is maintained or improved' (Ministry for the Environment, 2015, p.30). Currently, freshwater quality for regions of Aotearoa New Zealand cannot be properly assessed; therefore, objective A2 cannot be achieved.

National environmental standards for air pollutants

The national environmental standards for air pollutants were introduced in 2004, with amendments in 2011. Regulations include: five standards for outdoor air quality; seven standards banning activities that discharge significant quantities of dioxins and other toxins into the air; a requirement for landfills of a certain size to collect greenhouse gas emissions; and a design standard for new wood burners. Regional councils and unitary authorities are responsible for managing air quality and are required to monitor areas where there are likely (or known) problems with air pollution. If it is likely that air quality standards will be breached in a particular airshed (region or area), the regional council must monitor 'in that part of the airshed where – (A) there are one or more people; and (B) the standard is breached by the greatest margin or the standard is breached most frequently' (Resource Management (National Environmental Standards for Air Quality) Regulations 2004, s15). This wording is problematic. While there is a requirement to monitor areas with likely or known air quality issues, there are no clear requirements outlining the minimum number of sites that should be monitored in a region, or how often monitoring should take place.

Air quality experts have raised issues with the national environmental standards for air pollution (G. Coulson (NIWA), personal communication). First, there is limited temporal and spatial coverage. To illustrate, in some regions (e.g., Gisborne, Taranaki and the West Coast) air quality has only been monitored in a single location. Second, few regional councils measure air quality indicators other than particulate matter, because there is no legal compulsion for them to do so. Third, the limit values which have been set can help drive the concentrations of

air pollutants down in non-compliant areas. However, reductions often stop once limits are complied with. For compliant regions, the limits are seen as a 'target' to pollute up to because there is no further pressure to reduce emissions of air pollutants (G. Coulson (NIWA), personal communication). For instance, there is no incentive for the Auckland region to reduce emissions of pollutants because the region is largely compliant; thus, people in areas such as the central city are exposed to legal concentrations of air pollutants that are still high enough to have a negative impact on human and ecosystem health (Talbot and Crimmins, 2020). It is important to note that the national environmental standards for air quality have yet to be updated in line with the World Health Organization (WHO) guidelines. The WHO guidelines now recommend that concentrations of particulate matter (PM10) should not exceed an annual mean of 15µg/m3 (World Health Organization, 2021); PM10 concentrations across Auckland are consistently at, and above, 15µg/m3 (Talbot and Crimmins, 2020). Finally, as previously discussed, there is an exemption in the RMA where local authorities are required to monitor 'to the extent that is appropriate' (s35(2)(a)(i)).

Environmental Reporting Act

Environmental reporting in Aotearoa New Zealand can be separated into two periods. Before 2015 there were periodic reports based on 22 indicators, and five key state of the environment reports: (Ministry for the Environment, 1997, 2007, 2015, 2019, 2022). Some indicator updates were reported annually, while others were intermittent, according to data availability. In 2007 the Ministry for the Environment defined a core set of national-level indicators, with indicators updated and added over time as data became available.

The Environmental Reporting Act came into force in 2015, with the purpose 'to require regular reports on New Zealand's environment'. Statistics New Zealand and the Ministry for the Environment are required to report on the state of different aspects of the environment (freshwater, marine, air, atmosphere and climate, and land) at a national level every six months. A synthesis report for the environment as a whole is required every three years. However, at present there is no legislative requirement for regional-level monitoring and reporting beyond drinking water supplies and certain air pollutants (Parliamentary Commissioner for the Environment, 2019).

At a regional level, the responsibility for data collection lies mostly with regional council, which are also tasked with achieving economic growth.

Agencies responsible for monitoring and reporting

Agencies that collect regional level-data (or data that can be disaggregated to a regional level) include NIWA, the Ministry for the Environment, Statistics New Zealand, regional councils and unitary authorities, Manaaki Whenua Landcare Research, Waka Kotahi NZ Transport Agency, the Ministry for Primary Industries, Water New Zealand, the Energy Efficiency and Conservation Authority and the Fertiliser Association of New Zealand. At a regional level, the responsibility for data collection lies mostly with regional council, which are also tasked with achieving economic growth. Because several agencies collect data for different reasons, there are inconsistencies in the methodology used and the resulting data sets. For example, the Environmental Monitoring and Reporting Initiative (EMaR) was established in 2014 as a partnership between the Ministry for the Environment and regional councils. The goal of the EMaR was to set up integrated regional- and national-level data collection networks, with reports to be publicly available on accessible platforms, such as the Land Air Water Aotearoa (LAWA) website. While the LAWA website is a useful means of communicating environmental information to the public, there are several issues with it. For example, LAWA requires nationally consistent data sets, which means that topics on the LAWA website are those with the most consistent data sets. There are many topics of public interest, such as waste generation and recovery, that are not available on LAWA.

An issue raised by environmental scientists is the use of misleading data (Joy, 2015; Miller, 2011; Science Media Centre, 2013). In particular, freshwater reports by Statistics New Zealand, the Ministry for the Environment and regional councils have been criticised by freshwater experts for several reasons: data for baseline and impact sites are commonly combined instead of being reported separately, and this obscures impacts from polluting industries; the time periods used for analysis are often too short; and erroneous calculation and interpretation of data (Joy, 2015; Miller, 2011). As an example of issues with calculation and interpretation of data, in 2013 the Ministry for the Environment stated that water quality had been stable or had improved at most monitored sites, in contradiction to data published by NIWA (Ballantine and Davies-Colley, 2009; Ministry for the Environment, 2013). After some probing by freshwater scientist Mike Joy, it was revealed that there was no statistically significant change in water quality. The statistical power of the analysis had been compromised because the data set did not include enough sites and ten years was not a long enough time period to gather meaningful data. When data was analysed for 20 years instead of ten, most of the trends disappeared and it was clear that water quality at most sites had worsened, not improved. More than a year later the ministry finally removed the errors from its website, but refused to make a public correction (Joy, 2015).

Enforcement

Under the RMA, regional authorities and the Ministry for the Environment are jointly responsible for compliance, monitoring and enforcement. While regional authorities are the primary agency responsible for enforcement of the RMA, the Act provides no specific detail on how councils should carry out compliance, monitoring and enforcement. Instead, councils are permitted to use their discretion. The Ministry for the Environment published its first (and only) report on compliance, monitoring and enforcement 25 years after the enactment of the RMA (Ministry for the Environment, 2022) and provides minimal oversight and support for regional authorities (Brown, 2017). Many regional authorities face funding issues and have limited resources to conduct monitoring and enforcement activities (Brown, 2017; Local Government New Zealand, 2015). Furthermore, councils are excluded from the definition of 'public

prosecution' in the Criminal Procedure Act 2011. Therefore, the solicitor-general has weak oversight over the activities of regional authorities. Thus, there is little in the way of checks and balances for regional authorities.

Past research has revealed that there is variation in the approach of different regional authorities to compliance, monitoring and enforcement. Some regional authorities report that they take a 'prosecution as last resort' approach because they lack the monetary resources to pursue prosecutions; others take a 'business-friendly' approach, with policies of not issuing fines (Brown, 2017). A survey of compliance, monitoring and enforcement officers in 2016 found that 65% of council staff reported that council departments do not address compliance consistently, and 45% of the staff felt that their council did not have effective and comprehensive monitoring programmes (de Silva and Besier, 2016). The issue of vested interests for regional authorities is compounded when councils invest in enterprises in their region. For example, Nelson City Council owns and operates plantation forestry holdings in the region. Theoretically, the same compliance, monitoring and enforcement requirements apply to council-owned enterprises, but there is a clear conflict when the owners are also the regulators (Brown, 2017).

While the Crown Law Office's prosecution guidelines state that prosecutions should be free from political influence, such interference is an issue for many regional councils (Brown, 2017; de Silva and Besier, 2016). The auditor-general's report into regional management of freshwater found that 'councillors in all the regional councils we audited had some involvement in deciding whether the council should prosecute or investigate cases after the decision to prosecute had been made' (Office of the Auditor-General, 2011, p.60). Both the auditor-general's report and the Environmental Defence Society have called for a clear division between governance and executive representatives so that elected councillors do not interfere with compliance, monitoring and enforcement action (Brown, 2017; Office of the Auditor-General, 2011).

Regional-level data coverage

Data collection for environmental monitoring in Aotearoa New Zealand has largely been a passive harvest, using whatever data is available. This has led to a situation where indicators are chosen to fit the available data, rather than active decisions being made about what indicators should be used and then data collected accordingly (Parliamentary Commissioner for the Environment, 2019). Data coverage for regions is fragmented, with gaps for many of Aotearoa New Zealand's most pressing environmental issues (Baisden, 2020; Parliamentary Commissioner for the Environment, 2019). To illustrate, while the national environmental standards set out minimum requirements for five air pollutants (carbon dioxide, nitrogen dioxide, sulphur dioxide, particle matter, ozone), none of these five indicators has publicly available data for all of Aotearoa New Zealand's regions. Only one air, atmosphere and climate indicator (artificial night sky brightness) has data for all 17 regions (Ministry for the Environment, 2021a, 2021b). Furthermore, there are issues with coverage within regions. In many cases, there are not enough monitoring sites to reliably identify changes in environmental quality across the entire region. For example, PM10 is monitored at a single site in the Gisborne, Taranaki and West Coast regions (Statistics New Zealand, 2018); therefore, it is only possible to track changes in PM10 for a single location in one town or city in each region.

> Our natural environment is an important sociocultural and economic asset; to protect this asset, five key issues need to be addressed in terms of regional-level monitoring and reporting.

The marine domain has the worst coverage at a regional level: only two indicators (chlorophyll-a and *E. coli*) have nationwide coverage (LAWA, 2021a; Statistics New Zealand, 2021a). The land domain suffers from similar issues. While land cover changes and fertiliser use are well documented for each region of Aotearoa New Zealand, coverage for soil health is limited, with no publicly available data for five regions (Statistics New Zealand, 2021b). Agricultural intensification is a major environmental issue in this country, with direct impacts on soil (Foote, Joy and Death, 2015; Moller et al., 2010). It is therefore deeply concerning that there is no coordinated, nationwide soil health data.

One of the key challenges in gathering data for all regions of Aotearoa New Zealand is the lack of systematic investment in consistent long-term monitoring programmes (Baisden, 2020; Parliamentary Commissioner for the Environment, 2019). Nowhere is this more evident than in freshwater monitoring. Because monitoring is now conducted by several different agencies, there are inconsistencies in the methods used (Our Land and Water National Science Challenge, 2021). Furthermore, even though continuous monitoring technology is available, monthly monitoring is still the predominant method of data collection (Hudson and Baddock, 2019; M. Joy, personal communication). Continuous monitoring – where high-frequency measurement equipment is left to operate over extended periods of time – is more useful in identifying water quality drivers and contaminant 'hotspots' (Hudson and Baddock, 2019). Continuous monitoring incurs additional outlay and set-up costs, but is less expensive in the long term (Acevedo, 2015; Hudson and Baddock, 2019). Central government investment in continuous monitoring devices would facilitate independent reviews of the performance of local councils at the central government level. Data sets from continuous real-time monitoring could be made available to the public and researchers; this would facilitate public engagement and encourage accountability of regional authorities to their constituents. Air pollution and freshwater pollution can both have significant impacts on human health: for example, nitrate in drinking water is associated with colorectal cancer risk (Richards, 2020) and particulate matter is associated with respiratory illness (EHINZ, n.d.). Continuous monitoring for air and freshwater quality would be helpful to close the link between environmental pollution and human health.

For some regional authorities, resourcing issues mean that they lack the technical expertise or equipment to conduct robust environmental monitoring (Parliamentary Commissioner for the Environment, 2020). A solution to this issue is to consolidate funding and centralise some roles. This is particularly important for freshwater because

freshwater pollution is one of Aotearoa New Zealand's most serious environmental issues (Foote et al., 2015; Joy, 2018). Therefore, it is imperative that regional-level monitoring for key indicators such as nitrogen and phosphate is conducted for each region, with consistent methodology and public reporting.

Summary and recommendations for the future

In this article I have outlined the legal requirements for regional-level environmental reporting in Aotearoa New Zealand; reviewed that reporting; outlined issues with compliance, monitoring and enforcement; and discussed regional-level data coverage. Here, I summarise the key limitations and problems with regional-level environmental monitoring, reporting, compliance and enforcement in Aotearoa New Zealand, with recommendations for improvement.

Our natural environment is an important sociocultural and economic asset; to protect this asset, five key issues need to be addressed in terms of regional-level monitoring and reporting. First, Aotearoa New Zealand's current environmental legislation is weak, and the wording of the RMA and national environmental standards is problematic. For example, beyond a general 'requirement to monitor', the RMA does not provide specific requirements for what regional authorities should be monitoring, where they should be monitoring, or how often. Moreover, the National Policy Statement for Freshwater Management allows exemptions to build infrastructure when it has 'significant economic benefit' (without necessarily defining what constitutes 'significant' or describing how this benefit stacks up against the damage done to the environment). Furthermore, the limits set out for nutrients, such as nitrogen in freshwater systems, allow for greater deterioration rather than maintenance or improvement. It is essential that the legislation replacing the RMA clearly outlines the responsibilities of regional authorities and how 'significant economic benefit' is defined (and when it is deemed to be more important than environmental, sociocultural and recreational benefits). Expert advice must be followed when setting numerical limits. Currently, the Environmental Reporting Act has no legislative requirement for regional-level monitoring and reporting beyond drinking water supplies and certain air pollutants. The Environmental Reporting Act should be amended, with clearly outlined requirements for regional-level reporting for important indicators such as nitrogen in freshwater and marine environments.

> Without clearly outlined indicators for monitoring and legislative requirements for reporting at a regional level, it is difficult for policymakers, science providers, conservation executors and the general public to assess performance differences between the regions.

Second, the responsibility for environmental monitoring and reporting lies mostly with regional councils, which are also tasked with achieving economic growth, and largely monitor themselves. Environmental monitoring should be conducted by independent agencies so that the central government and the public can assess whether regional authorities are fulfilling their environmental obligations. The parliamentary commissioner for the environment, Simon Upton, made recommendations for the development of an environmental research strategy (to be led by the Ministry for the Environment) and the establishment of an Environmental Research Council (Parliamentary Commissioner for the Environment, 2020). A centralised research council with the necessary experts could develop a standardised methodology for environmental monitoring and reporting at the regional level.

Third, there are problems with enforcement and political interference. Compliance, monitoring and prosecution action vary widely between councils. Because the RMA lacks specific detail on how councils should carry out enforcement action, councils are permitted to use their discretion. This is concerning, because political interference is an issue for many regional councils, where councillors interfere in decisions to investigate or prosecute cases (Brown, 2017). Local councillors are elected by constituents, and this means that in regions where the economy is reliant on environmental exploitation, councillors are more likely to represent the objectives and values of resource users in their electorates. Thus, economic benefits may be prioritised ahead of environmental protection. There needs to be a clear division between governance and council executives so that elected councillors do not interfere with compliance, monitoring and enforcement action. The Criminal Procedure Act should be amended to include councils under the definition of 'public prosecution'.

Fourth, there are problems with the way data is analysed and reported, an issue that is particularly relevant for the freshwater domain. Despite repeated communication from freshwater experts about the misuse and distortion of data sets, data has consistently been analysed in a manner that misrepresents the actual state of our freshwater systems. Statistics New Zealand, the Ministry for the Environment and regional authorities should work more closely with experts in respective fields so that data is analysed appropriately, and rectify any issues raised by expert scientists in a timely fashion.

Finally, many agencies tasked with environmental monitoring, reporting and enforcement have issues with insecure funding (Parliamentary Commissioner for the Environment, 2019). In 2021 the government committed $25 million to establish a national-level monitoring and reporting network (Treasury, 2021). This initiative should be expanded to plug data and knowledge gaps at both a national and regional level so that long-term monitoring and reporting is consistent across Aotearoa New Zealand's regions, with mandatory reporting of public data. Data should be made publicly available to both researchers and the public so that it can be independently audited to identify any issues with the calculation and interpretation of data. For some regional authorities, issues with resourcing means that they lack technical expertise or equipment to conduct robust environmental monitoring (Parliamentary Commissioner for the Environment, 2020).

A solution to this issue is to consolidate funding and centralise some roles. At present, the Crown and regional authorities are not fulfilling their obligations under te Tiriti o Waitangi or the RMA. If adequate resources are not allocated to compliance, monitoring and enforcement, the significant resources put into reforming the RMA will be wasted.

Without clearly outlined indicators for monitoring and legislative requirements for reporting at a regional level, it is difficult for policymakers, science providers, conservation executors and the general public to assess performance differences between the regions. It is imperative that we develop a clear, coordinated and consistent environmental monitoring and reporting system for Aotearoa New Zealand's regions so that we can take stock of an important sociocultural and economic asset.

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Ralph Chapman

Mitigating Climate Change in Urban Aotearoa: towards transformative policies

Abstract

Carbon emissions, the dominant greenhouse gas emissions in urban Aotearoa New Zealand, must fall. This article considers how New Zealand can implement transformative urban mitigation policies. First, it is time to move beyond a fixation with the emissions trading system and vehicle electrification, and apply a comprehensive set of known, effective policy measures. Second, policies must consider effects on wellbeing. Third, systemic solutions are needed to redress systemic problems of urban sprawl and car dependence, and offer a credible prospect of transformative urban mitigation.

Keywords mitigation, cities, transport, building, co-benefits, wellbeing, transformation

As this article is being finalised, the Intergovernmental Panel on Climate Change has just reported again, with Working Group III reviewing action to reduce emissions (IPCC, 2022a). The Working Group III report notes that per capita greenhouse gas emissions from New Zealand, Australia and Japan have been among the highest in the world. More generally, it argues that by 2025 emissions must be falling globally if there is to be significant hope of staying 'inside' the global warming target of 1.5°C. It warns, chillingly, that 'Without a strengthening of policies …, GHG emissions are projected to rise beyond 2025, leading to a median global warming of [around] 3.2°C by 2100' (ibid., para C.1). Such an outcome would be hugely irresponsible to our descendants.

Currently, New Zealand is off track in its mitigation trajectory. It has not been able to implement more than modest mitigation policies, for reasons including largely locked-in car dependence and construction approaches, together with entrenched interests in sectors such as transport (Chapman et al., 2017; Mattioli et al., 2020; Thinkstep-anz, 2019). New Zealand is unlikely to achieve its 'fair share' target of at least halving emissions by 2030, as recommended by the IPCC (IPCC, 2018). For example, Auckland would need to reduce its transport carbon emissions by 64% by 2030 (against a 2016 baseline), according to the Auckland Climate Plan (Auckland Council, 2020). This would require emissions reductions of around 10% or so each year, a stretch made more challenging by disruption from Covid-19. Even tracking to net zero emissions by 2050 will be difficult if the country fails to engage in a comprehensive mitigation strategy.

Cities house a majority of people and produce a majority of CO_2 emissions globally, and New Zealand, despite high agricultural emissions, is no exception to this pattern. Climate mitigation policies focused on urban transport, infrastructure and buildings in New Zealand towns and cities are critical, and cannot remain a matter of incremental change. An ambitious overall mitigation strategy needs to include robust, durable urban policies that go well beyond conventional neoclassical economic remedies such as carbon pricing (Hall and McLachlan, 2022) and gradual motor vehicle electrification (Hasan and Chapman, 2019). Those remedies are helping, but are not sufficient, as suggested by the steady rise since 1990 in carbon emissions from transport – 96% by 2019, while overall gross emissions increased 26% (Ministry for the Environment, 2021). Taking the language of climate emergency seriously means applying *all* the reasonably cost-effective instruments available (Chapman, 2019). Being wise in

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policy choices also means recognising co-benefits and equity as well as costs, and how good policies will interact to redress systemic problems such as urban sprawl, car dependence and other social and environmental impacts.

In understanding the barriers to ambitious urban mitigation policy, the wider policy context matters. Like other countries operating a growth-focused model (including China), New Zealand faces a fundamental 'operating system' dilemma. A growth orientation has to date generated a systemic de-emphasis of the importance of the environment, including climate stability. Conventional policy reform has been too slow to prevent growing damage to the environment, as higher incomes and consumption have dominated policy agendas and populations have inexorably expanded. The evident effects of these forces strongly suggest that, at a global level, economic growth cannot be maintained into the future (Hickel and Kallis, 2020; see also Boston in this issue).

Instead of focusing on growing incomes, a shift is needed to the higher goal of wellbeing. This would certainly be more environmentally sustainable, and may also be transformative. Despite the initial efforts of the current New Zealand government (Robertson, 2019), the appetite for it is so far only slowly emerging. Nevertheless, focusing urban policies on wellbeing within environmental and social limits (Chapman and Howden-Chapman, 2021) is likely to be an important part of a sustainable way forward.

The next section of this article critiques New Zealand mitigation policy to date. The pressures to emit more created by what can be described loosely as the 'urban' sector – transport, urban form, infrastructure and building[1] – are considered. The focus here is largely on transport, as currently 47% of the country's domestic carbon dioxide emissions are from this sector (Ministry of Transport, 2021, p.10). The following section reviews forthcoming urban mitigation policies, covering key measures recommended by He Pou a Rangi, the Climate Change Commission, or foreshadowed by the government in its lead-up to the major emissions reduction plan due by mid-2022. The clear risk is that the urban policies so far signalled may not be enough; this article identifies the main areas where New Zealand is likely to need to do more. The conclusion of this article is that an assessment of urban mitigation policies should ask not only whether the policies are sufficiently ambitious, but whether they support the wider transformation of our society's goals and practices towards living much more sustainably, seriously practising kaitiakitanga.

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Mitigation achievements and failures to date

Despite a dismal overall record since 1990 in mitigating gross greenhouse gas emissions, and leaving aside successive governments' failure to tackle agricultural (methane and nitrous oxide) emissions, there have been some salient achievements in New Zealand's climate policy. Major steps include the development of the Emissions Trading Scheme and its recent strengthening, and urban policy reforms such as the National Policy Statement on Urban Development 2020.

However, there have been three major barriers to better policy. First, the emphasis on price instruments (especially emissions trading) has eclipsed more thoughtful approaches. The price instrument emphasis has moderated over time but still holds sway (Crampton, 2021). It centres on the conviction that price is the most cost-effective policy tool, a stance increasingly challenged by evidence about human decision making (Gowdy, 2008). Other instruments, such as investment and regulation, may be more effective in some contexts, as is evident from a wider analysis of policy merits and demerits (Rosenbloom et al., 2020).

Non-price policies often have significant co-benefits, side effects and behavioural features that need to be considered in policy appraisal, but typically are not. Cost–benefit analysis struggles to include nuances of co-benefit and other impacts, but if it is to be used, it should try. An example is the cost–benefit analysis of investing in active transport. This can generate health gains that considerably exceed investment costs. Where health gains are included in assessment, the benefit:cost ratio can easily reach around 10:1 (Chapman et al., 2018), but if those health benefits are ignored, the benefit:cost ratio looks insufficient.

The OECD has traditionally advocated carbon pricing, but now accepts that by itself it is an inadequate instrument, even if emissions trading prices were lifted substantially: 'efficient complementary measures, which address market failures not corrected by carbon pricing alone, still need to be taken' (OECD, 2022, p.14). Of direct relevance to the present analysis, an OECD study notes that the 'effectiveness [of carbon pricing] is limited in car-dependent [urban] systems where … choices are not convenient or available, and where carbon prices can generate negative distributional impacts and thus are publicly difficult to implement' (OECD, 2021, p.168).

Second, the choice to rely heavily on carbon sequestration by forest carbon sinks and a willingness to envisage buying carbon permits offshore have together encouraged a dangerous deferral of policies to reduce New Zealand's gross emissions domestically. Delaying mitigation, especially evident under the 2008–17 National government, limits options for future governments by locking in patterns of emissions, such as those generated by heavy fossil-fuelled vehicles. Twenty-five years after the Kyoto Protocol was signed, New Zealand's tentative approach to cutting gross emissions means New Zealanders face a large bill to buy international carbon credits in order to meet the country's 2030 COP26 NDC (nationally determined contribution), even if such credits are available. Direct costs of buying units offshore might have been around $5 billion under the pre-COP26 pledge (McLachlan, 2021), but with the 'enhanced' pledge, and the *indirect* costs of investing less domestically to cut carbon, total costs could be over $30 billion (Climate Change Commission, 2021, p.369).

Third, many New Zealanders have long thought about mitigation passively in terms of 'what new technology comes along' (Daalder, 2022a). But mitigation success will largely depend on what existing low-carbon technology New Zealand households and

businesses adopt and how widely it is used, what adopters are prepared to pay for it, and the changes in everyday practice they choose to make. Given the intense pressures we all now face to reduce emissions without delay, and to avoid deferring mitigation in anticipation of dubious technologies such as autonomous vehicles, New Zealanders can deploy their skills in innovatively adapting and improving established emission-reducing technologies and practices. One means by which this might be supported is by funding pathfinder projects, pilots or experimentation in specific regions or cities. This concept is being advanced in the UK to 'enable learning about what is actually required to make net zero a reality, including the roadblocks and other likely stumbles' (Hepburn et al., 2020, p.33).

Pressures in the 'urban sector'

By far the majority (86%) of New Zealanders live in cities and towns, so how urban lives are lived has a large influence on the country's total emissions. Understanding and changing how people live requires understanding the systemic nature of urban settlements. To date there has been insufficient joined-up or systemic consideration of how policies might interact in response to visible pressures and constraints within cities. For example, affordability of transport has not been a central consideration in regard to transport pricing or investment policy. Although it would reduce carbon emissions over time, electrification of light-duty cars may well increase car travel (since the price per kilometre would fall) and congestion, and would also be notably less affordable for most households than other strategic policies, such as widespread adoption of e-bikes (Callister and O'Callahan, 2021, p.6).

Some of the affordability pressures on households can be ascribed to urban form, where misguided funding policies have worsened sprawl, raising infrastructure costs which flow on to section and housing prices. Policy coherence has been sacrificed to ongoing, substantial road building, sending problematic signals to the motoring public about future vehicle acceptability, and to developers about future urban land use. Although electric vehicles clearly do use roads, a more intensified urban form and rail transit infrastructure investment could minimise new road construction and carbon emissions (Erdogan, 2020). As one commentator writes, 'new roads may not be compatible with climate targets' (McLachlan, 2021). Ongoing urban road building certainly puts at risk housing affordability and local council rate affordability.

Car-dependent transport has largely locked in emissions by encouraging a dispersed urban form, reducing households' transport choices, and raising costs of infrastructure investment, such as extended three waters networks

Pressure on New Zealand motorists to shift to lower-carbon cars, or financial help to switch to e-bikes, has been minimal. The Emissions Trading Scheme has since its introduction in 2010 had little impact on vehicle purchase and use patterns, and hence emissions, although it might in future if the price of carbon reached levels reflecting its environmental damage (Hasan et al., 2020).[2] While the policy emphasis recently has been on the emissions reductions achievable with car electrification, accelerated by introducing stricter vehicle emissions standards (Wood and Shaw, 2021) and clean car 'feebates', the car dependence fostered by e-car assistance has been downplayed. Purchases of fossil-fuelled utes and SUVs continue in large numbers (Woodward, Wisniewski and Wild, 2021). Cleaner car policies (Cox et al., 2020; Karlsson, Alfredsson and Westling, 2020) can be worthwhile in shifting consumer preferences, but have typically disregarded hidden emissions and other disadvantages of car proliferation. Vehicle *operating* emissions are only part of the wider picture of urban-related emissions arising from vehicle manufacturing, shipping and disposal (Hasan and Chapman, 2019), emissions from road and related infrastructure construction and maintenance, emissions from electricity generation in a sector that is now largely decarbonised, emissions from cement production, and so on.

In short, narrow project-by-project assessments of urban policy actions need to give way to a more far-reaching and systemic approach to managing transport, infrastructure and building projects to ensure that reducing emissions in one domain reinforces emission reduction (and preferably social or environmental goals) in other parts of the urban system. As well as creating synergies, connected policies increase New Zealanders' confidence as citizens that the city is changing in a more sustainable direction while improving wellbeing.

Probably the toughest pressures have arisen around land use in New Zealand cities. Car-dependent transport has largely locked in emissions by encouraging a dispersed urban form, reducing households' transport choices, and raising costs of infrastructure investment, such as extended three waters networks (Chapman et al., 2021). Sprawling development has supported a dominance of the car throughout the urban area, as well as making it difficult to transform the urban core into an active travel-oriented place with a culture that is human-centred, car free, slow and interactive (Filion, 2015). Such patterns have exposed the need for change in planning rules and critical investments (such as Auckland's City Rail Link).

New planning rules, driven by the National Policy Statement on Urban Development, and new investments offer a path away from car dependence and dispersed form towards new and more intensive neighbourhoods, with more innovative housing designs, varied streetscapes, micro greenspaces, and an abundance of bikes, scooters and walkers, where motor vehicles are sparse, and a different and more vibrant culture and way of living emerges.

The Climate Change Commission recently acknowledged, in its advice to the government in July 2021, that it now recognises 'the importance urban form has at a system wide level' and that a key element of policy direction is to 'improve understanding of how urban form and function can reduce emissions' (Climate Change Commission, 2021, pp.30, 7). This is welcome, although it downplays considerable international research. For example, a major recent European study

argued that active transport is a key ingredient for net zero, healthy cities (Brand, 2021; Brand et al., 2021). Cycling has about one-thirtieth the carbon footprint of a fossil car (and in Europe about one-tenth that of an electric car). Also, car-oriented urban development has relied on carbon-intensive infrastructure – including wider roads, highways, roundabouts, carparking buildings and airports – and has fostered and embedded car-dependent, high-carbon lifestyles (International Transport Forum, 2021), a long way from what Edwards and Tsouros (2008) characterise as the healthier lifestyles that more intensified, active cities can encourage. Most recently, the IPCC (2022a, pp.10–15) notes that urban infrastructure can make a decisive difference in energy use and induced greenhouse gas emissions, citing Erdogan (2020).

State of play: current and expected urban mitigation policy

New Zealand is taking useful, but so far modest, policy steps (e.g., investing in cycling infrastructure, electrifying buses and lowering public transport fares) towards active travel and quality public transport, allowing for more human interaction than does car travel.[3] In addition, there has been encouraging innovation in biofuels, e-bikes, shared e-cars and road reallocation for bus lanes; urban infill and densification; and, in the buildings area, deep energy retrofits, heat pumps, pellet burners, and the beginnings of solar PV linked to micro-grids, to name a few examples (Grant, Viggers and Howden-Chapman, 2021). But it is evident that better practices and innovation in these areas will not be enough to reduce emissions at the pace needed. Each element helps, but has limited effect in rapidly and radically changing the overall picture of urban emissions and the urban culture which drives that.

Transformative change

A more comprehensive approach to increasing both accessibility (Rode and da Cruz, 2018) and sustainability in a systemic way is needed. A recent OECD review points to two conceptual shifts:

> For the transport sector the mind-set shifts … translate into moving: i) from a focus on mobility towards accessibility; and ii) from improving vehicles' performance in car-dependent systems towards transforming the systems' functioning (i.e. a systemic mind-set) so that people can access places with ease without the need to travel long distances for every daily need. This shift in thinking expands the scope of climate action, as policies can now focus on reversing car dependency, rather than just improving vehicles' performance. (OECD, 2021, p.167)

New Zealand is taking useful, but so far modest, policy steps … towards active travel and quality public transport, allowing for more human interaction than does car travel.

Policies with the potential (if enacted together and at scale) to reverse car dependency include measures to support shared mobility (e.g., shared scooters, e-bikes, e-cars) and, critically, 'street redesign and improved management of public space, [and] spatial planning focused on creating proximity' (ibid.).

A proximity-creating strategy is the 15-minute city, which can 'allow urban areas and their hinterlands to become networks of 15-minute cities in which people can move across the territory, but no longer need to travel long distances to meet their everyday needs' (ibid., p.9). In New Zealand, Hamilton is planning to realise such thinking, but it is also being considered more widely (Hamilton City Council, 2020; Walch and Bartle, 2021). The 15-minute city is likely to have wide benefits, especially for disadvantaged populations for whom accessibility is often challenging (Wild et al., 2021). The systemic point is that transforming mobility and transforming land use are heavily interconnected. In the words of one urbanist, with only a little exaggeration, 'Land use and transportation are the same thing described in different languages' (Alter, 2021, citing Jarrett Walker).

A growing awareness of the need for integrated car dependency-reversing policies, extending to all aspects of urban planning, housing and transport investment, is now seen in some of the government's documents. A seminal policy green paper of mid-2021, *Hīkina te Kohupara* (Ministry of Transport, 2021), for example, places top priority on actions ('Theme 1') to shape New Zealand's towns and cities to make it easier, safer and more attractive for people to access work, schools, shops and other opportunities by public transport, walking and cycling.

The Ministry of Transport does not overlook more conventional actions of vehicle electrification, improving the efficiency of supply chains and shifting freight to low-emission modes, together with existing policies such as the Clean Car Standard, decarbonisation of the public transport fleet and the biofuels mandate. Minister Michael Wood has described this set of policies as 'a solid start' (ibid., foreword). But the ministry recognises that, to effectively and rapidly reduce emissions across the entire transport system, more is needed. It acknowledges that conventional policy measures centred on electrification and efficiency would not be transformative.

The green paper is a breath of fresh air in its use of the 'Avoid, Shift, Improve' framework (for a recent elaboration see IPCC, 2022a, Table 5.1) and its embrace of the case for reshaping towns and cities to support transport mode shift, especially in its pathway 4. This pathway involves saving nearly 40% of the light vehicle kilometres travelled by 2035 through reducing trip distances and encouraging mode shift to public transport, walking and cycling (Ministry of Transport, 2021, p.107). However, a significant risk is that the solutions favoured by political decision makers (to be revealed in May 2022) may downscale the more innovative pathways (especially pathway 4) explored in the green paper.

Infrastructure

A key arena where systemic thinking is becoming more evident is infrastructure development, but such thinking is starting from a low base. Infrastructure investment patterns over recent years, including big ticket items such as Transmission Gully, demonstrate that climate and other environmental considerations have played second fiddle to considerations such as travel time savings (critiqued by some as largely spurious – see Cervero, 2011) and profitable land development. Waka Kotahi has avoided a comprehensive treatment of carbon emissions, including the critical matter

of how highway building can encourage urban sprawl.[4] A strong case can also be made that its investment modelling has also been flawed (Callister and O'Callahan, 2021, p.7). Its modelling appears to be subject to the same problem that besets many travel demand models: they 'do not typically include all of the feedback loops necessary to accurately predict the induced travel effect' (Volker, Lee and Handy, 2020). In short, it is slow in adequately addressing systemic effects, including the interaction between infrastructure and behaviour.

Encouragingly, the Climate Change Commission is now actively pointing out to agencies such as the Infrastructure Commission that better-directed investment in infrastructure is vital for mitigation: 'designing compact communities with infrastructure that enables easy access to rapid/frequent transit, and supports walking and cycling, can lead to significant emissions reductions over time by reducing reliance on private vehicles' (Carr, 2021, p.1). The Climate Change Commission also notes that: 'It is important that policy decisions and investments made now do not lock Aotearoa into a high emissions development path' (ibid., p.3).

A mixed picture of the reorientation to more sustainable infrastructure is seen in the allocation of the Covid-19 Response and Recovery Fund. An analysis of the energy projects financed by this fund is not inspiring: researchers working with the Energy Policy Tracker research network found that of New Zealand's early $50 billion spending allocation, about 45% went to fossil fuel-related spending and 55% to clean energy spending (Hall and Ives, 2021).[5] 'Conditionality' helps where it supports alternative modes – e.g., road upgrades that incorporate cycling and pedestrian infrastructure – but is not sufficient to materially offset the pattern of fossil fuel vehicle dependency. In short, only substantial reallocation (including during crises) will be enough to attain New Zealand's climate targets.

Building sector

A related but different process is going on in the building sector (including housing). Buildings and infrastructure are responsible for about 20% of New Zealand's CO_2 emissions, if consumption-based accounting is used, embodied carbon is considered and international trade is included (ThinkStep Australasia, 2018). Most buildings and infrastructure are in urban areas. Indeed, if we look at buildings and transport together, the majority of New Zealand's energy-related emissions can likely be attributed to making the materials for our buildings and cars, and operating our buildings and cars (Alter, 2021).

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While improving housing quality is essential, including upgrading the building code, the main current challenge for the housing sub-sector recently has been to increase production while containing costs (Grant, Viggers and Howden-Chapman, 2021). As part of a solution, the government is making regulation of the design and form of Aotearoa's major cities more permissive, recently with the support of the National Party. This has encountered some resistance focused on New Zealanders' views of the desirable form of cities and what constitutes ideals of housing. The intentions of both the 2020 National Policy Statement on Urban Development and the intensification-enabling RMA amendment of 2021[6] stem from the pressing need for Aotearoa's five largest cities to intensify. In practice, both regulatory initiatives are also likely to reduce car dependence. The national policy statement usefully removes council minimum parking requirements, but could have done more to actively discourage car use (e.g., by penalising car parks in buildings).

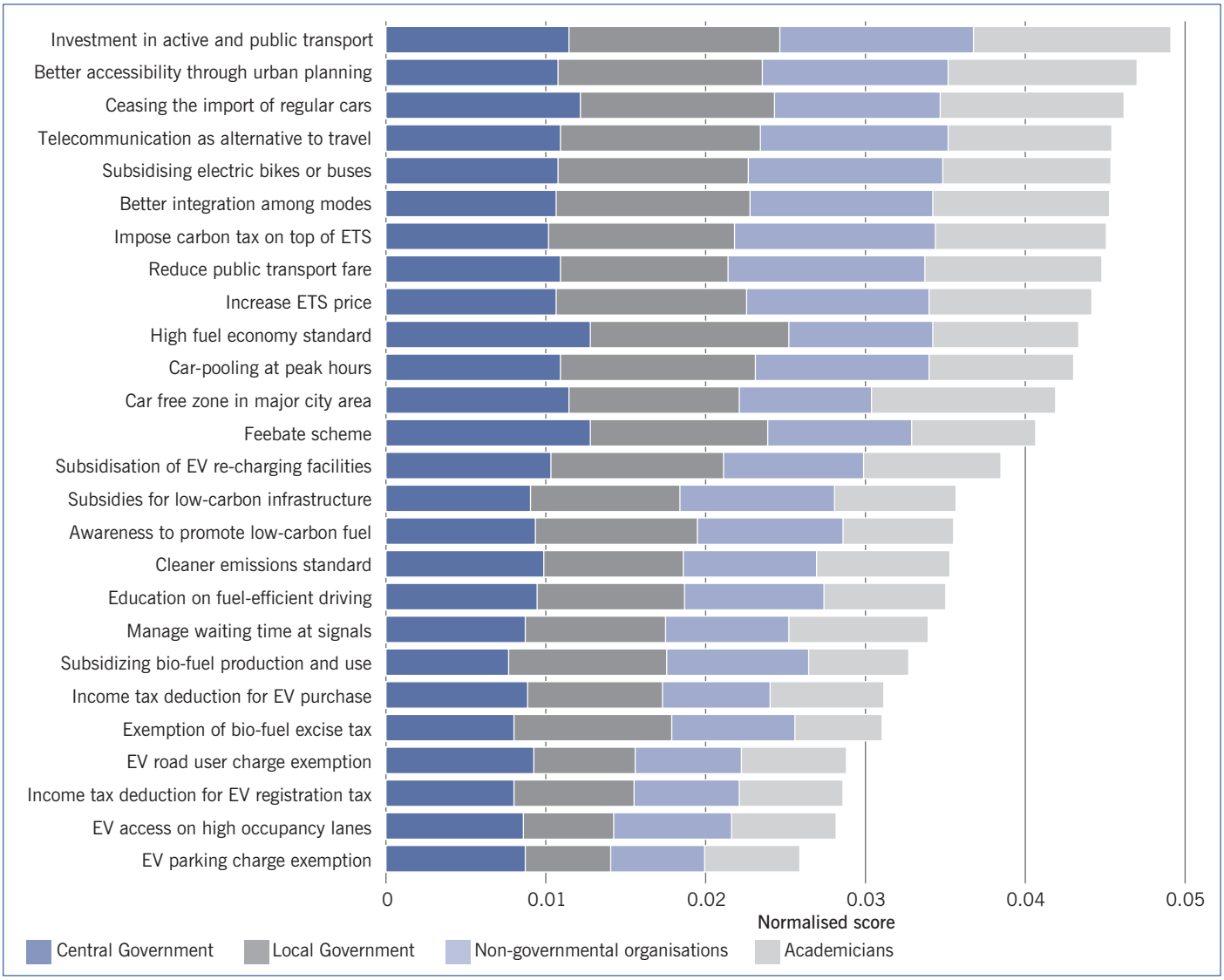
Opposition to intensification has focused on fears of loss of urban character, and exactly how the RMA regulation is implemented from August 2022 will be a delicate business. Some concern has arisen over loss of sunlight and housing character in non-central areas where district plans will enable medium-density development of three storeys as of right (Mehlhopt and Dickson, 2021; Parker, 2021b), with the national policy statement enabling more than six storeys in metropolitan centre zones. Some of this concern may be based on a desire to protect traditional suburban property values. But from a social equity and climate viewpoint, a change in priorities is sorely needed: expansion of the housing stock, an important part of improving housing affordability, and ensuring low-carbon urban form. Possible solutions to the urban form challenge lie in ensuring that district plans enable and encourage intensification close to main arteries and urban centres, and allow new solutions, such as perimeter block housing (Nunns, 2017), while protecting the best of our heritage housing and other buildings. Given the ongoing consequences for our wellbeing of how we build our houses and other buildings, and shape urban form, a strategic future orientation is vital in this part of the urban system.

Why expected urban policies may not be enough

Especially with the high cost of light rail per kilometre in New Zealand (Worrall, 2022), investing in public transport options and active travel is only likely to induce a certain amount of change, and work for a limited proportion of the population. In the right conditions, active travel infrastructure investment can reap rapid results (e.g. in Seville, Spain, a six-year network buildout increased working day cycle trips by 450%, from 13,000 to 72,000) (Marqués et al., 2015). To date in New Zealand, active transport investment has had to compete with private car-favouring investment that does not pay its way: consumers do not pay the full cost of car use at the point of consumption.

Unless distorted transportation 'markets' can be significantly reformed, and given that 'a third to a half of current motor vehicle use may result from market distortions' (Litman, 2021, p.47), some transport experts and urban planners have concluded that it is necessary to work on the 'push' side of the picture, not just the 'pull' side (Adam, Jones and Brömmelstroet, 2020). This includes working to improve the extent to which travelling by car better reflects the costs it imposes on others. This means pushing up its price and reducing its convenience – e.g., by including much higher carbon and

Figure 1: Multi-criteria analysis of transport policy options, from interviews with experts, showing support for policy options (normalised scores)



Source: Hasan, Chapman and Frame, 2020

congestion prices and parking tariffs (Harms, Bertolini and Brömmelstroet, 2016). A less appealing means is letting congestion increase, without validating increases in traffic by increased road building, with the result that car speeds drop and active travel becomes safer and relatively more attractive. In addition, one (infrastructural) mechanism in central areas is reducing road space available to cars (space usually not paid for by car users in any case) and creating more space for alternative modes (Marqués et al., 2015). Examples are putting city centre roads on 'diets' (Cycling Action Network, n.d.; Daalder, 2022b), limiting car movement, and managing car parking supply (Adam, Jones and Brömmelstroet, 2020). Such largely regulatory measures can reinforce infrastructural investments in supporting active and public transport.

Transport experts tend to support this way of thinking about preferred non-EV policy measures for Aotearoa, a multi-criteria analysis study suggests (Hasan, Chapman and Frame, 2020) – see Figure 1. In this study of 25 policy experts' views, options that aim to promote electric vehicle uptake are not seen as ineffective as such, but they are seen as less suitable alternatives to reduce Aotearoa's transport sector emissions. Of the 26 policy options examined, investments in active and public transport are seen as the most sustainable policy option to reduce emissions from the transport sector. They were supported by other 'top' policy options including: ensuring better accessibility through urban land use planning; ceasing the import of fossil-fuelled cars into New Zealand by 2030; using telecommunication services as alternatives to travel; and subsidising electric bikes or buses.

Additional to the multi-criteria analysis policies above are others to restructure funding incentives: these would be a valuable element in the New Zealand government's forthcoming emissions reduction plan. To support more sustainable transport investment, the financial assistance rates for public and active transport projects would be lifted to favour such transport, not roading. Similarly, central government and councils would make funding for any roading projects, including maintenance and renewals, contingent on a requirement to roll out counterpart cycling and walking improvements across the network and constrain motor vehicle use (Callister and O'Callahan, 2021).

The Climate Change Commission has taken an increasingly broad view of the mix of urban mitigation policies needed, in light of the pressing need to achieve significant emissions reductions in transport and other urban domains. The international literature has been addressing these issues for some time. It notes powerful long-run linkages between more sustainable urban form and emissions

reduction when key urban form drivers of emission reduction, such as density, land use mix, connectivity and accessibility, are considered, and, in most cases, concludes that changes to favour these goals will contribute to important co-benefits in health and wellbeing.

For example, the IPCC's fifth assessment report found that 'co-locating higher residential densities with higher employment densities, coupled with significant public transit improvements, higher land use mixes, and other supportive demand management measures can lead to greater emissions savings in the long run … (robust evidence, high agreement)' (Seto et al., 2014), p.928). The 2022 IPCC Working Group III report notes that '[m]any mitigation strategies in the transport sector would have various co-benefits, including air quality improvements, health benefits, equitable access to transportation services, reduced congestion, and reduced material demand (*high confidence*)' (IPCC, 2022b, para C.8).

The 2014–15 Global Commission on the Economy and Climate reached similar conclusions. It concluded that well-managed urban development is critical for aligning wellbeing and prosperity with climate stability. Cities, in their view, should be able to expand but should be as compact as possible, with higher densities and mixed neighbourhoods, be walkable and of human scale, redeveloping brownfield sites and ensuring green space. Connected infrastructure, including smarter public transport, cycling, car sharing, electric cars and energy-efficient buildings, have a strong complementary role. Too often, in their view, cities expand in a way that locks in inefficient infrastructure and future emissions. As an example, the commission contrasted costs of transport in compact Copenhagen (about 4% of its gross domestic product) with that of sprawling Houston, where transport costs about 14% of its GDP and generates much higher emissions. They underlined the large health gains and carbon savings possible from a global scenario based on compact cities with connected infrastructure: for example, global transport emissions could be cut about 1.5 billion tonnes per year (Floater et al., 2015).

Such international evidence makes clear that the way cities are built or upgraded, including where and how roads are built, and where different sorts of building are permitted, deeply influences not only how much carbon is emitted in the longer term, but also the wellbeing of citizens.

A 'local' example of integrated thinking about cities, transport and emissions is provided by an OECD report on Auckland's emissions (OECD, 2020). This study modelled regional and local transport and land use (urban form) policies. It found that road transport CO_2 emissions could be cut by 70% per capita (p.23) and overall by around 30% (p.12) by 2050 (slower than a target of 50% by 2030, but a major contribution). The following policies are envisaged:

- policies to promote public transport, biking and walking and discourage private vehicles by 'drastically increasing the cost of private vehicle ownership' (p.12);
- substantial subsidies and tax exemptions for electric cars, and faster innovation in the EV sector;
- land use policies to reduce kilometres travelled, by altering the spatial structure of Auckland over time, and enabling widespread densification.

The report notes that, 'Policies that promote a more compact urban form are fundamental in the long-run success of urban transport decarbonisation strategies' (p.18).

While some motorists might disagree with the specific prescriptions of this study, it illustrates that substantial emission savings can be made from a mix of urban form (land use) policies along with transport policies that include favouring electric vehicles, in general accord with the direction in which policy is heading in New Zealand, but so far much too slowly.

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Conclusion: a broader prescription for cities

While the most mutually reinforcing transport policy options for New Zealand cities are likely similar to the Ministry of Transport's 'pathway 4' identified above, some institutional changes may help to ensure that these policies really do extend into urban planning, infrastructure management, and the building sector (including housing). One recent suggestion is to establish a Ministry of Green Works, not just in relation to climate resilience but in relation to the housing shortage, infrastructure deficit and other areas of stress in the public sector (Harris and Paul, 2021). The authors of this paper question whether 'the existing range of public institutions have the right expertise to be far-sighted in anticipating future problems, and agile in response to short-term emergencies' (p.33), and ask how we can ensure all new infrastructure will be 'green'. The first of these questions is a good one, and echoes the questions posed by Boston (2016) in relation to ensuring a greater future orientation of public agencies. But the proposal of a Ministry of Green Works is a centralist structural solution, and may fail to address problems of wider coordination and incentives. Such a ministry might founder under problems of internal coordination and structural overreach.

One alternative may be Environment Minister David Parker's wider 'strategic planning' and resource management legislative structure, which would better coordinate central and local government resource management planning and apply to all private sector activity involving resource use (water, air, climate, soils, and so on) and impacts on the environment. This centres on a new Strategic Planning Act and national planning framework under a Natural and Built Environments Act (Parker, 2021a). This framework will incorporate the various national policy statements and national environmental standards that have been developed under the RMA, and will consolidate the different rules the government currently has for planning, including rules around urban form. The framework will include mandatory environmental limits, and ensure the government sets out strategic views on how it wants the country to develop (desired 'outcomes') – for example, through

regional spatial strategies – rather than leaving those questions to councils and private agents. The framework would include the National Policy Statement on Urban Development referred to earlier as an important step towards more compact, lower-carbon cities.

Associated with these policies and reforms affecting urban planning, form and design, attention is needed to matters of sociocultural and behavioural change to wean, as far as feasible, car-oriented urban residents away from energy- and carbon-intensive lifestyles towards 'slower' and more community-oriented ways of living and travelling. Some writers point to educational strategies and social tipping points, underpinned by a perspective that the use of fossil fuels is, increasingly, unethical (Otto et al., 2020). Others, including some OECD advisers, emphasise a multi-pronged and deeper strategy, including reframing – e.g., moving away from technological optimism, and from analytical to systems perspectives – and rethinking goals – e.g., moving from a preoccupation with mobility towards optimising access (OECD, 2021). The 2022 IPCC report argues that such approaches, characterised as demand-side mitigation, can offer significant reductions in transport and buildings by 2050 (IPCC, 2022b, Figure SPM.6), although uncertainties remain about some practices and rebound effects.

Beyond these questions there remains a further need to reconsider the broader questions of what sort of society New Zealand wishes to be. Confronting these questions is necessary if New Zealand is to take a strategic and ethically defensible view on climate and responsibilities to future generations.

A basic ethical question is whether New Zealanders are prepared to pay a price, even if modest, in terms of forgone income, in order to rapidly mitigate climate change. The 2022 IPCC report asserts that, globally, mitigation actions (whether urban or non-urban) costing less than US$100 per tonne could reduce emissions by at least 50% (vis-à-vis 2019 levels) by 2030, and that incomes would continue growing.[7] Moreover, the economic benefit of limiting warming to 2ºC would exceed the cost of doing so (ibid., C.12). There is no reason to think these findings do not apply to New Zealand. Because the real price of major mitigation is likely negative, failing to so mitigate is not only unethical but obdurately self-interested.

It is also unethical to abrogate decisions about the contributions which our cities, our transport systems and the ways we in New Zealand live and work can make to reducing carbon emissions. In the last few decades we have pretended that we can muddle through, deferring such big questions. We cannot. The major questions we have to face up to as citizens start from how we plan our cities, our buildings and our transport systems. They widen out to matters of how much we consume, why, and whether ultimately we are more concerned about our cars, our houses and our consumption patterns in the short term, or are prepared to take a deeper, broader and longer-term view of what makes for real wellbeing and sustainability in Aotearoa New Zealand.

1 Aviation and maritime transport are not urban-related, so are excluded here, as is inter-city transport. Domestic aviation emissions grew little since 1990, but international aviation emissions grew rapidly and now exceed domestic car transport emissions (Callister and O'Callahan, 2021, p.3).

2 The Climate Change Commission notes that 'marginal abatement costs of around $140 per tonne of CO_2e abated in 2030, and $250 in 2050 in real prices, are likely to be needed to reduce emissions associated with energy use' (Climate Change Commission, 2021, p.245).

3 Studies suggest pedestrians and cyclists spend more than car drivers on shopping in urban spaces, often simply because the former linger and window shop. Along with more shopping, they are also more likely to contribute to the sense of liveliness of an area, engaging with others in local parks or cafés, unlike most transient car drivers. This is where transport intersects with urban design and urban form, which are now clearly identified in the literature as vital factors in urban sociocultural change and carbon mitigation.

4 However, it is now rethinking its analysis of transport infrastructure: e.g., Waka Kotahi, 2019.

5 For a February 2022 update, see https://www.energypolicytracker.org/country/new-zealand/.

6 https://www.parliament.nz/en/get-involved/topics/all-current-topics/enabling-a-greater-supply-of-housing/.

7 US$100 is about NZ$143 in April 2022. A 2018 estimate implies that this would raise retail petrol prices by about 40c/litre (see Productivity Commission, 2018, p.293).

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Sasha Maher and Adam Forbes

Responsible Forest-centred Climate Policy

Abstract

The 2021 Glasgow Climate Pact and latest IPCC reports unequivocally recognise that urgent, concerted action is needed to address the interconnected crises of climate change and biodiversity. These twin emergencies are now viewed as one and forests are at the centre of this emergent but dominant discourse. Aotearoa New Zealand faces the challenge of addressing this call to action and is well resourced to responsibly answer. There are multiple forestry models available to the government to select from, but often the difficulty lies in discerning the differences between models. Here we tackle this issue by assessing the spectrum of forestry models and evaluating the biodiversity and carbon sequestration outcomes of each. We then suggest that models which incorporate native species are best placed to solve the twin crises and, as such, government should prioritise native forests in its climate policy framework.

Keywords climate change, biodiversity, forest models, carbon sequestration, native species

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Climate–biodiversity–society

The nexus of biodiversity, society and climate is now firmly embedded in the climate agenda. The recent United Nations Intergovernmental Panel on Climate Change (IPCC) reports (the sixth assessment report) and United Nations Framework Convention on Climate Change (UNFCCC) Glasgow Climate Pact (2021) explicitly recognise that the protection, conservation and restoration of nature is key to limiting temperature increases to 1.5°C above the pre-industrial level and to adapting to climate change. The inclusion of biodiversity in the Glasgow Climate Pact's preamble and mitigation section acknowledges that climate change and biodiversity loss are not only interconnected through system links and feedbacks, but are the most pressing issues of the Anthropocene (IPBES, 2021). Therefore, the response should be to address these two challenges simultaneously.

At the centre of efforts to address the twin crises are forests. Forests tightly connect the two: carbon is absorbed by and stored in forests. Forests lessen the deleterious effects of climate change and regulate the climate. The

climate change crisis, in turn, poses a serious threat to forest biodiversity and ecosystems. Risks range from wildfires and floods through to plant and animal pests, weeds and pathogens that exacerbate extinction and can lead to ecological tipping points.

The global recognition that both biodiversity and climate change are part of the same complex problem has resulted in public and private solutions that are close to win–wins, but others that solve one crisis at the expense of the other. In the quest to rapidly sequester atmospheric carbon, opportunities for restoration of biodiversity are often overlooked. Large-scale afforestation of monocultures is an example of solving one aspect of the climate biodiversity problem to the potential detriment of the other. Such policy trade-offs need to be carefully considered to ensure that adaptation, mitigation, equity and justice are all taken into account. The caution against planting large-scale monocultures in the race to reduce emissions has been echoed in recent reports from the IPCC on adaptation and mitigation, the Royal Society and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES).

In Aotearoa New Zealand we are acutely confronted with both the biodiversity and climate change crises. More than 4,000 native species are threatened or are at risk of extinction (Department of Conservation, 2020) and seven of the past nine years have been the warmest on record (National Institute of Water and Atmospheric Research, 2021). The two crises are not mutually exclusive. The effects of climate change are pervasive and threaten the health and functional capacity of ecosystems, and the goods and services they afford, across terrestrial, freshwater and marine environments.

Climate change pressures in the marine environment are widespread and difficult to control. The oceans are warming and changing in chemistry at broad geographic scales. Changes in phytoplankton abundance and distribution have been observed in coastal waters, with implications for the wider marine food web. Frequent pulses of unusually warm water ('marine heatwaves') are affecting the reproductive capacity of fish species and contributing to the loss of habitat-forming kelp forests. Many of our taonga marine species, including pāua, tuangi (cockles), kuku (mussels) and kina, are particularly sensitive to ocean acidification and will face growing pressures as the effects of climate change continue to be realised into the future.

After rapid destruction of native forests, government authorities decided on radiata pine as the solution for providing a supply of wood, with natives dismissed as growing at the wrong pace and in the wrong place ...

The government needs to respond responsibly to the international call to action. Forest-focused climate policy has the potential to address the two crises simultaneously, as well as meeting the short- and long-term needs of Māori, rural communities and forest-centric regions. Decisions made about forests have broader implications, such as the impacts of the release of sediment from clear-cut felling on coastal environments and communities.

A siloed approach

Since the 1990s, forests have been used as climate policy tools. At the inception of the Emissions Trading Scheme (ETS) in 2008, forests were included as tradeable units for offsetting emissions (Carver, Dawson and Kerr, 2017; Leining and Kerr, 2018). Forests earn units as they grow and forest owners face liabilities if carbon stocks are reduced through deforestation or harvesting. Because Pinus radiata (radiata pine) is known to sequester high volumes of carbon over a short time frame, investors and forest owners are favouring this species over other forestry techniques and compositions. Under the ETS, exotics comprise 90% of the 343,877 hectares registered as post-1989 forest, with the remainder being native species (Ministry for Primary Industries, 2021).

In 2019 the government updated its 2002 climate legislation. The Climate Change Response (Zero Carbon) Amendment Act 2019 established a new framework for reducing emissions and put in place a 2050 target to reach net zero. Against this target, government must set five-year emissions budgets. The first round of emissions reduction plans is due by 31 May 2022. The first emissions reduction plan is based on a four-year duration, from 2022 to 2025. This plan will outline the policies and strategies to meet the 2050 target. In 2020 the ETS accounting and operational settings were also reformed to better align with the targets under the Climate Change Response (Emissions Trading Reform) Amendment Act 2020.

In the consultation document for the emissions reduction plan, *Te Hau Mārohi ki Anamata: transitioning to a low-emissions and climate-resilient future* (Ministry for the Environment, 2021), forests are categorised into two classes: exotics and natives. The consultation document infers that the exotic class is *Pinus radiata*, whereas the term natives is used as a catch-all for the full diversity of species and forest types, from native conifers to broadleaved trees and beech. This classification follows a functionalist logic which can be traced back to early 20th-century colonial concerns about an impending timber famine and soil erosion due to agricultural practices (Brown, 1991; Brooking and Pawson, 2011; Roche, 2013; Starr, 2002). After rapid destruction of native forests, government authorities decided on radiata pine as the solution for providing a supply of wood, with natives dismissed as growing at the wrong pace and in the wrong place (Starr, 2002, p.281). Over the following decades radiata pine was planted extensively, and the genetics improved through government funding and research.

The classification of forests into radiata pine and natives has been remarked on by others as a siloed approach to land use (Hall, 2018). It ignores the biodiversity, sociocultural and adaptation features of a more integrated approach that would include natives. In recent climate policy discourse, most notably in the draft emissions reduction plan, this siloed approach still predominates. This is despite the expressed intention to treat offsetting and the ETS as only one part of a package (Ministry for the Environment, 2021, p.21) for tackling climate change. In the draft emissions reduction plan, sequestration is the deciding factor in how the species are treated separately and classified

into exotics and natives. The predilection is clearly for radiata pine, which yields a higher rate compared to natives (Ministry for Primary Industries, 2017; Aimers, Bergin and Horgan, 2021). This bias sidelines other features of a more integrated approach and fails to recognise that biodiversity loss is part of the same complex problem as climate change.

Integrated forestry models

Multiple forest models are available to address the twin existential crises, but these are in general difficult to distinguish, and, first, effort must be made to decentre the focus on ETS in the government's forest-centred climate policy response. To assist in this, here we outline the main forestry models and describe the dual carbon and biodiversity outcomes for each.

Model 1: Rotational exotic carbon forestry

This model piggybacks on the predominant production forestry model in Aotearoa New Zealand, which is rotational timber plantations comprising even-aged stands of radiata pine harvested by clear-fell over rotations of 20–30 years. The model offers rapid carbon sequestration in the short term, but carbon credits can only be claimed from the first forest rotation, meaning the benefits of carbon trading from this forestry model are very short-term. Due to the simple composition and structure of the forest, and short time frame of rotation, this model offers little in terms of biodiversity benefits. In addition to failing to yield meaningful biodiversity benefits, there are often externalities arising from this form of carbon forestry, such as wilding invasions, soil erosion and sedimentation, and adverse visual amenity effects.

Model 2: Permanent exotic carbon forestry

This model normally comprises radiata pine planted in a regime to optimise carbon sequestration (high stem densities at large scales) in the first few decades, on the premise that native tree species will take up canopy dominance in the long term, making the forest permanent (Casey, McKinlay and Kerr, 2021). This model has been referred to colloquially as 'plant-and-leave' carbon forestry. However, experience to date suggests that these forests are not managed once they are established or have no provision for long-term forest permanence (i.e., tending regimes to promote regeneration are lacking, the ecological context and macroclimate are often unsuitable, there are inadequate levels of ongoing pest control) or management (no security afforded by long-term funding or permanent forest management plans). Biodiversity outcomes from the plant-and-leave forestry model are unknown and uncertain. Outcomes will depend on the macroclimate and ecological context and the extent to which the forests are managed in the long term. Adequate levels of intervention are unlikely to occur at the scales and in the contexts at which this forestry model is being implemented. The long-term outcomes for both carbon sequestration and biodiversity from plant-and-leave carbon forestry are unknown as we have not had sufficient time to see sufficient empirical results (Forbes and Norton, 2021).

> The biodiversity benefits of planted native tree stands can be excellent as the trees will provide resources (e.g., fruit crops, seasonal nectar sources, insect communities) that native species have adapted to but are often missing in many of today's landscapes.

Model 3: Continuous-cover mixed exotic species carbon forestry

Continuous cover implies that forestry management will ensure that a forest cover is retained, particularly where there is tree extraction (Barton, 2008). This forestry model strongly contrasts with the clear-fell harvest approach (i.e., model 1) in that unlimited time is available for development of mixed tree ages, species and forest structure. This makes continuous-cover forestry a closer analogue to natural forest compared to either forest models 1 or 2. The model focuses on a complementary mix of exotic species, observing species' traits (e.g., incorporating species of increasing shade tolerance with stand age), to achieve canopy replacement and forest permanence. The biodiversity outcomes will depend on the quality of habitat and ecological resources provided, although they will likely be less than from forestry models comprising high proportions of native tree species. Few examples of this forestry model currently exist, and further trialling and research is required before this model can be implemented at scale.

Model 4: Native forest regeneration

This is the most natural carbon forestry model and normally occurs following cessation of agriculture in areas of Aotearoa New Zealand's higher rainfall and air temperatures (Climate Change Commission, 2021; Mason et al., 2013). The model relies on natural regeneration and recruitment of later successional species through time. Regeneration might occur initially within an exotic weed cover such as *Ulex europaeus* (gorse; Wilson, 1994). Management is normally required to address plant pests, browsing mammals and enrichment planting (Forbes et al., 2020) to help ensure successional development to support rapid forest development. Early carbon sequestration rates are less than in the early decades of models 1–3; however, with adequate management, forest permanence is assured, and the native forest ecosystem presents an excellent opportunity for biodiversity restoration and carbon sequestration in the medium to long term (Carswell et al., 2012). Further, a wide range of values can be provided in addition to carbon sequestration and biodiversity restoration (Aimers, Bergin and

Horgan, 2021) and there are fewer adverse environmental externalities.

Model 5: Native tree plantations

This model can comprise either diverse restoration plantings (aiming to mimic the processes of model 4) or lower-diversity stands of native tree species appropriately spaced and tended using silvicultural treatments (e.g., thinning and pruning) to maximise tree growth rates. This model lends itself well to selective timber harvest through continuous-cover forestry techniques, and with adequate management (e.g., enrichment planting), forest permanence is assured. Recent analyses indicate that beyond 30 years of age, planted native tree stands can sequester increasing rates of atmospheric carbon over many decades, making this form of carbon forestry an excellent mid- and long-term form of carbon forestry (Kimberley, Bergin and Silvester, 2021). Incorporating faster-growing early successional native species is a means of yielding early carbon and biodiversity benefits. The biodiversity benefits of planted native tree stands can be excellent as the trees will provide resources (e.g., fruit crops, seasonal nectar sources, insect communities) that native species have adapted to but are often missing in many of today's landscapes.

Conclusion

For any forest to be truly permanent, there needs to be tree recruitment from the forest understorey to the forest canopy, which in today's landscapes cannot be assumed. Irrespective of the forestry model adopted, management will be needed to address issues such as plant and animal pests, competition in densely planted or formed stands, and dispersal failure due to the absence of seed sources or dysfunctional pollinator or dispersal vectors. The incorporation of native species in carbon forestry is a critical method for boosting biodiversity benefits. Due to the relative growth rates of radiata pine versus native tree species, a mid- to long-term view which accounts for both carbon and biodiversity gains needs to be taken if we are to use forestry to help address our climate and biodiversity crises in tandem.

Loss of native forest cover is a root cause of many aspects of our biodiversity crisis, whether it be lost species, habitats and riparian and coastal buffers, or soil stabilisation and resulting sedimentation. We need to adopt a balanced and efficient approach to the urgent need to sequester atmospheric carbon and select carbon forestry models which benefit both the climate and biodiversity and which are truly permanent.

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Adapting to Avoidable and Unavoidable Climate Change

what must Aotearoa New Zealand do?

Abstract

The Intergovernmental Panel on Climate Change report *Climate Change 2022: impacts, adaptation and vulnerability* gives a stark warning of the urgency to adapt to avoidable and unavoidable climate change impacts and to transition to a more climate-resilient future. Aotearoa New Zealand has made some progress in setting up the institutional and planning frameworks for adaptation, but implementation is slow. Delay will increase the adverse consequences for humans and ecosystems, widen the adaptation gap, and increase the cost and damage burden to current and future generations, and those least able to adjust. Taking proactive actions today to avoid further exposure will enable a fairer and more robust and effective path for adaptation. Here we develop a report card for Aotearoa New Zealand's adaptation effort and recommend what we must do next.

Keywords climate change impacts, adaptation, vulnerability, climate-resilient development, institutional change, decision making, implementation

The Intergovernmental Panel on Climate Change (IPCC) Working Group II report *Climate Change 2022: impacts, adaptation and vulnerability* (IPCC, 2022a), released on 28 February, delivered a stark warning. In the words of IPCC chair Hoesung Lee, 'Our actions today will shape how people adapt and nature responds to increasing climate risks' (IPCC, 2022b). Any further delay in concerted global action will miss a brief and rapidly closing window to secure a liveable future. The report concludes that for every region of the world, at current rates of adaptation planning and implementation, the gap between what is needed for adaptation and what is delivered will continue to grow. As adaptation options often have long implementation times, long-term planning and accelerated implementation, particularly in the next decade, are critical to close adaptation gaps.

This report, and the Working Group I report on the physical science basis (IPCC, 2021), demonstrate that we have a good understanding of the likely impacts of climate change and recognise the interdependence of climate, biodiversity and people. While the magnitude and timing of impacts depend in part on the success of emissions reductions,

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the Australasia chapter of the report (Lawrence, Mackey et al., 2022a) summarises the observed and projected impacts for New Zealand. Cascading and compounding impacts[1] are increasingly a feature of changing climate and these underline the pressing need to build capacity and capability to move beyond incremental adaptation.

What can Aotearoa New Zealand learn from this body of evidence and the key messages for policymakers, and what must we do now? Governance is the critical lever for addressing these challenges, accelerating adaptation and helping to close the adaptation gap. Effective adaptation is inclusive and supported by accountable leadership to mobilise capabilities and resources and resolve disputes. It is enabled by legislation and procedures to provide clarity of purpose and to address fairness, equity and social vulnerability. Flexible governance is essential to change strategies, investment perspectives and policies leading to action, and that enhances the ability to organise and act collectively, and to learn to recognise and respond prudently to change before adaptation thresholds are reached. Such features of effective governance can help to address the low awareness amongst decision makers, communities and individuals of the scope and scale of the impacts of changing climate and their consequences. Furthermore, such governance must address the mismatch of scales and temporal decision making, and socio-economic inequalities and vulnerabilities, that can produce non-action or delayed action that counter effective adaptation.

A new feature of this sixth assessment is that the IPCC has now firmly linked mitigation with adaptation. The report calls attention to the rapidly closing adaptation gap caused by the delay in emissions reductions over many decades and the already built-in commitment to impacts yet to be felt (in the case of sea level rise for many centuries). Delay in reducing emissions means adaptation limits are reached sooner and adaptation options are reduced.

The report also places strong emphasis on the role of indigenous peoples, and their traditional environmental knowledge and understanding. In Aotearoa New Zealand the indigenous concept of kaitiakitanga has been embedded in environmental management since 1991, along with recognition of the principles of the Treaty of Waitangi. These components can be expected to become far more influential in future decision making in addressing ongoing climate change issues and risks.

In this article we examine adaptation policy and implementation in Aotearoa New Zealand in light of the report.

Large investments by central government and local government in stopbanks and sea walls were made across Aotearoa New Zealand earlier last century, which enabled cities and settlements and associated economic activities to develop largely unabated.

What are the observed and projected impacts?

Climate change is no longer something that will occur in the future. Observed changes and impacts are summarised in the report and shown in Table 1. Together with future projected impacts, this information can inform a strategy for accelerating the adaptation required.

Cascading, compounding and aggregate impacts of climate change are new risks for Aotearoa New Zealand cities, settlements, infrastructure, productivity, supply chains and services. Floods, droughts, wildfires, heatwaves, storms and sea level rise have been recognised as discrete implications of a warming world. However, their interactions are now being observed. For example, extreme snow, heavy rainfall and wind events have already combined to affect road networks, power and water supply, interdependent waste water and storm water services and business activities. Sea level rise has created similar cascading impacts across sectors and communities. Climate risks, exacerbated by underlying vulnerabilities and exposures, are projected to increase for a wide range of systems and sectors and for Māori and other communities.

How have we adapted to climate hazards in Aotearoa New Zealand to date?

Historically, adaptation in Aotearoa New Zealand has been embedded in natural hazard management and water and soil conservation that seek to protect people from nature's variability and 'surprises', usually following 'events' (Lawrence, Sullivan et al., 2015; White and Lawrence, 2020). Large investments by central government and local government in stopbanks and sea walls were made across Aotearoa New Zealand earlier last century, which enabled cities and settlements and associated economic activities to develop largely unabated. Such structures have saved lives, but have also created a false sense of security, leading to intensification of development and activities reliant on their protection (Lawrence, Sullivan et al., 2015). Residual risks are inevitably increasing, but largely ignored by the public and decision makers alike. These kinds of 'hard' engineering adaptations in a changing climate risk context have a defined lifetime, even though they bring near-term benefits until adaptation thresholds are reached. They can create new problems along the coast, such as 'end effects', and interfere with sediment supply, leading to loss of beach amenity, and increase erosion. Where protection measures encourage more development the risk increases, accelerating the need to move from incremental to transformational change (e.g., in low-lying coastal areas, where hazards compound or where droughts become increasingly severe). Such 'maladaptation'[2] can include sea walls or irrigation schemes that prolong a false sense of security and lock in further urban and rural development as climate impacts worsen.

Adaptation is typically reactive after major events, supported by emergency management funding through the Earthquake Commission (EQC),[3] the Ministry for Primary Industry's adverse events policy for the rural sector,[4] and the Local Authority Protection Programme for water infrastructure damage from natural disaster.[5] Such funding has acted as social insurance to enable a return to life as usual in the same exposed locations as

Table 1. Changes since the last IPCC assessment in New Zealand

Observed changes and impacts	Examples
Ongoing climate trends have exacerbated many extreme events.	Further warming and SLR, more hot days and heatwaves, less snow, more rainfall in the south, less rainfall in the north and more extreme fire weather in the east.
Climate trends and extreme events have combined with exposure and vulnerabilities to cause major impacts for many natural systems, with some experiencing or at risk of irreversible change.	In the Southern Alps, from 1978 to 2016, the area of 14 glaciers declined 21%, and extreme glacier mass loss was at least 6 times more likely in 2011 and 10 times more likely in 2018 due to climate change.
Climate trends and extreme events have combined with exposure and vulnerabilities to cause major impacts for some human systems.	Socioeconomic costs from climate variability and change have increased. Extreme heat has led to excess deaths and heavy rainfall has increased rates of serious illnesses. Nuisance and extreme coastal flooding have increased due to SLR superimposed upon high tides and storm surges in low-lying coastal and estuarine locations, including impacts on cultural sites, traditions, and lifestyles of Tangata Whenua Māori. Droughts have caused financial and emotional stress in farm households and rural communities. Tourism has been negatively affected by poor ski seasons and receding glaciers. Governments, business, and communities have experienced major costs associated with extreme weather, droughts and SLR.
Climate impacts are cascading and compounding across sectors and socioeconomic and natural systems.	New types of risks have been generated, exacerbating existing stressors and constraining adaptation options e.g., cascading effects of disruption of interdependent systems and infrastructure in cities and settlements due to heavy rainfall events, SLR, groundwater rise, and heat.
Projected impacts and key risks	
Increasing climate risks are projected to exacerbate existing vulnerabilities and social inequalities and inequities.	These include inequalities between Māori and non-Māori and between generations, rural and urban areas, income, and health status, increasing the climate risks and adaptation challenges faced by some groups and places.
Further climate change is inevitable, with the rate and magnitude largely dependent on the emission pathway.	Projections include ongoing warming with more hot days and fewer cold days, further SLR, ocean warming and ocean acidification; more winter and spring rainfall is projected in the west and less in the east and north, with more summer rainfall in the east and less in the west and central North Island; ongoing glacier retreat and increased drought frequency is projected for southern and northern Aotearoa New Zealand respectively.
Ongoing climate trends have exacerbated many extreme events.	The Aotearoa New Zealand trends include further warming and SLR, more hot days and heatwaves, less snow, more rainfall in the south, less rainfall in the north and more extreme fire weather in the east.
Climate risks are projected to increase for a wide range of systems, sectors, and communities, which are exacerbated by underlying vulnerabilities and exposures.	*Key risks for Aotearoa New Zealand* *Ecosystems at critical thresholds, where recent climate change has caused significant damage and further climate change may cause irreversible damage, with limited scope for adaptation* • Insufficient evidence for Aotearoa New Zealand (see knowledge gaps below) *Key risks that have potential to be severe but can be reduced substantially by rapid, large-scale and effective mitigation and adaptation* • Loss of kelp forests in southeast Aotearoa New Zealand due to ocean warming, marine heatwaves and overgrazing by climate-driven range extensions of herbivore fish and urchins • Loss of natural and human systems in low-lying coastal areas due to SLR, for example for 0.5 m SLR, the value of buildings in Aotearoa New Zealand exposed to 1-in-100-year coastal inundation could increase by NZ$12.75 billion *Key cross-sectoral and system-wide risk* • Cascading, compounding and aggregate impacts on cities, settlements, infrastructure, supply chains and services due to wildfires, floods, droughts, heatwaves, storms and SLR, for example in Aotearoa New Zealand, extreme snow, heavy rainfall, and wind events have combined to impact road networks, power and water supply, interdependent wastewater and stormwater services and business activities *Key implementation risk* • Inability of institutions and governance systems to manage climate risks, for example the scale and scope of projected climate impacts overwhelm the capacity of institutions, organisations, and systems to provide necessary policies, services, resources, and coordination to address socioeconomic impacts

Observed changes and impacts	Examples
There are important interactions between mitigation and adaptation policies and their implementation.	• Integrated policies in interdependent systems across biodiversity, water quality, water availability, energy, transport, land use and forestry for mitigation can support synergies between adaptation and mitigation. There are co-benefits for the management of land use, water, and associated conflicts and for the functioning of cities and settlements. The projected increases in fire, drought, pest incursions, storms and wind place forests at risk and affect their ongoing role in meeting New Zealand's emissions reduction goals.

quickly as possible, rather than building adaptive capacity and the potential for transformation as the risks intensify with changing climate. Governments, banks and insurers have underwritten the risks and spread the costs across the public and local government, thus muting the deterrent effect for change (Lawrence and Saunders, 2017). More recently, signals from insurers and reinsurers are emerging that they are considering either larger excesses or withdrawal of cover for certain classes of 'foreseeable' risk, as damage from climate-related events becomes more frequent, sea level rise impacts escalate, and costs increase due to the escalating exposure of people and their assets to climate-related risks.

Additionally, attention to adaptation has until recently been crowded out by an almost singular focus on reducing emissions through market instruments (e.g., the Emissions Trading Scheme) and carbon offsets, without a comprehensive suite of complementary adaptation policies and regulations to support New Zealand's response to the adaptation remit in the Paris Agreement and the Climate Change Response (Zero Carbon) Amendment Act. Despite the focus on emissions, Aotearoa New Zealand's emissions have been trending up for decades, contributing to an even greater adaptation burden. The IPCC warns: 'Any further delay in concerted anticipatory global action on adaptation and mitigation will miss a brief and rapidly closing window of opportunity to secure a liveable and sustainable future for all' (IPCC, 2022c).

The consequences of delaying action

The consequences of delay in reducing emissions are stark. For example, even transiently exceeding 1.5°C in the coming decades or later means that many human and natural systems will face additional severe risks compared to remaining below 1.5°C, and have irreversible consequences even if global warming is eventually reduced (ibid.).

Delaying adaptation action will result in higher future costs when adaptation becomes more urgent and the impacts more extreme. The costs of climate change impacts could become significant: evidence from Aotearoa New Zealand is very limited, but we know that floods have already cost the economy at least NZ$140 million for privately insured damages between 2007 and 2017, and two droughts alone that were attributable to climate change cost NZ$800 million (Frame et al., 2020). Damage costs from the projected increased frequency and intensity of floods and droughts will rise: the value of buildings exposed to coastal inundation could increase by NZ$2.55 billion for every 0.1m increment of sea level rise (Paulik et al., 2020).

While historically the government is seen as the insurer of last resort (Boston and Lawrence, 2018), the increasing frequency and intensity of impacts and associated damage may reduce the ability of the government to perform this role. The *National Climate Change Risk Assessment* (Ministry for the Environment, 2020) identifies 'Risks to governments from economic costs associated with lost productivity, disaster relief expenditure and unfunded contingent liabilities due to extreme events and ongoing, gradual changes' as a priority risk. Analysis in the IPCC report indicates that in the absence of investment in adaptation to reduce exposure and vulnerability, the risks will be passed over time from the public sector to the private sector and individuals (New et al., 2022). Combined with potential insurance retreat, this will render many populations increasingly vulnerable, exacerbating existing inequalities and potentially creating poverty 'traps' (Mechler et al., 2022).

Early action also provides an opportunity to address many of the existing challenges, including social inequality, enhancing the natural environment and biodiversity, improving urban spaces and increasing social cohesion. Identifying areas for synergies with emissions reductions and other goals can reduce costs and the administrative burden. The IPCC report emphasises that adaptation is most effective if climate change responses are integrated across all policy areas, rather than comprising a single-issue policy focus.

How can Aotearoa New Zealand adapt effectively and equitably?

The report sets out a range of adaptation options that are available and their limits within a fast-closing window of opportunity. Adaptation to climate change is much more than a single set of actions at a single point in time. Rather, it must be an ongoing cycle of assessment, action, reassessment, learning and response (New et al., 2022). Without this broader consideration and re-evaluation, many of the current adaptation actions in Aotearoa New Zealand will reach adaptation limits as the climate risks increase (e.g., sea walls, beach renourishment, dune plantings for protection; raising floor levels and land to accommodate the risks) (Lawrence, Allan and Clarke, 2021). Transformational adaptations such as changes in land use and planned and managed retreat are inevitable for some risks – coastal and riverine flooding and rising groundwater, extreme rainfall and drought – and require land use planning now based on strategies for reducing the impacts of climate disruption.

A stocktake of climate change adaptation resulting in 21 recommendations to guide adaptation action was completed in 2018 (Climate Change Adaptation Technical Working Group, 2017, 2018) in anticipation of the adaptation remit emerging. This contributed to the adaptation architecture that is now in place via the Climate Change Response (Zero Carbon) Amendment Act. The first Aotearoa New Zealand national climate change risk assessment has been completed (Ministry for the Environment, 2019, 2020). The Climate Change Act provides for national adaptation plans and the first is due in 2022. An independent Climate Change Commission was set up at the end of 2019 which is empowered to monitor the effectiveness and progress of adaptation in New Zealand. These provide the foundations for addressing the remaining recommendations of the Climate Change

Adaptation Technical Working Group for adapting to climate change in Aotearoa New Zealand; the information to support decision making, the building of capability and capacity and the funding to do the job are still to be addressed and leadership is yet to emerge for a planned and coordinated approach to adaptation action across central and local government agencies.

Ironically, planning to avoid and reduce risk from the effects of climate change has been possible for some years under the Resource Management Act 1991 (RMA) via natural hazards and climate change provisions, including the New Zealand Coastal Policy Statement, which must be given effect in policies and plans. The national coastal hazard and climate change guidance (last revised in 2017) gives specific guidance on addressing sea level rise, storm surge, erosion, associated coastal flooding and rising groundwater, for example. The Civil Defence Emergency Management Act expressly provides for risk reduction from natural hazards, and like the New Zealand Coastal Policy Statement adopts the precautionary principle even where there is uncertainty about the risks.

However, the potential of the RMA and the Civil Defence Emergency Management Act to help avoid increasing climate risks has not been realised, despite several councils attempting to address the rising risks (see examples below). With this context of inaction and delay around climate change adaptation, a review of the RMA (Resource Management Review Panel, 2020) highlighted the gaps in the current system. It recommended three new Acts: a Strategic Planning Act, a Natural and Built Environments Act and a Climate Change Adaptation Act (the latter mainly to address managed retreat property and funding gaps). The first two Acts are currently being drafted, while the Climate Change Adaptation Act is on a slower path. Any attempts to separate adaptation from strategic and spatial planning would make integration of climate change adaptation throughout policy areas more difficult. As emphasised by the IPCC report, integration is essential for effective adaptation.

Significantly, the RMA review acknowledged that the current static planning framework and practices are not well suited to addressing changing climate risks and that a more dynamic, adaptive approach is needed that can leverage more transformational change in land uses. This is where there are ongoing and increasing physical risks for ecosystems and habitation around our coasts and estuaries from sea level rise and compound coastal flooding (including rising groundwater and drainage challenges). The review elaborated on the types of legal instruments needed to bring about such changes. At the heart of these are powers relating to land use change and property ownership to address legacies from past decisions, stranded assets, and the need to avoid increasing ongoing exposures and vulnerabilities: for example, powers to acquire and modify existing land uses and consents and to acquire land; the power to use taxes, subsidies and other economic instruments to incentivise climate-resilient land and resource use; cost sharing and compensation governed via equity principles; and decision processes and measures that can enable legitimate engagement with communities and Māori. All are controversial issues yet to be navigated into law (Iorns, 2022).

Some progress has been made by some regional and district councils, and by a few government agencies, as they revise their plans and consider climate risks (Lawrence, Mackey et al., 2022a, 2022b; Lawrence, Allan and Clarke, 2021). However, to date progress has mainly been in planning, rather than implementation. Where implementation has occurred, it is largely incremental and retrospective, after extreme events.

The Civil Defence Emergency Management framework and funding through EQC have been largely short-term response focused, rather than looking to the long term for risk reduction and adaptive opportunities. Across other statutes the gaze is 30 years out – for example, infrastructure planning – with 50 years for building consents. Only very recently have climate change impacts featured: for example, in the National Policy Statement on Urban Development, and here it is relatively weak and poorly connected to other decision-making instruments.

However, default priorities continue in the crowded national policy statement space. Because of a lack of integration and policy coherence, the current short-term housing imperative is likely to override climate change considerations, despite clear principles for investment being available (e.g., the Climate Change Commission's principles for Covid-19 recovery).[6] The climate change imperatives appear distant in comparison with the immediate need to provide housing affordably or respond to a pandemic. This emphasises the criticality of integrating climate change throughout all policy areas, so that the longer-term implications for emissions reductions and adaptation are factored into decisions.

The Civil Defence Emergency Management framework and funding through EQC have been largely short-term response focused, rather than looking to the long term for risk reduction and adaptive opportunities.

Effective policy would set out responses to identified risk thresholds in advance, using triggers and/or threshold limits and stated actions that will be taken when those limits are reached (as in a dynamic adaptive policy pathways (DAPP) process). Every decision matters. On a sunny day nuisance tidal flooding looks ephemeral and inconsequential. Accommodating it may seem a satisfactory approach. More considered implications, such as long-term access to sites and buildings, the implications of extreme localised events ('weather bombs'), and the effectiveness of infrastructure such as gravity drainage and sewerage systems and underground coastal septic tanks, are often overlooked but become major problems as sea levels or flood exposures rise (Kool et al., 2020). Given the limited funds, it is essential that adaptation investment is prioritised to be efficient, effective and equitable (Boston and Lawrence, 2018).

The challenge for decision makers is that policy interventions and investments to avoid ongoing legacy effects from climate risks (damage, disruption and loss) to the things humans value and to nature will be required long before severe damages are experienced – although damage, disruption and loss are already being observed. Sea level rise poses a

distinctive and severe adaptation challenge as it implies dealing with gradual onset changes and increased frequency and magnitude of extreme coastal events which will escalate in the next few decades in low-lying areas (Stephens, Bell and Lawrence, 2018). Protection, accommodation, and advance and planned relocation responses are more effective if combined and/or sequenced, planned well ahead, aligned with sociocultural values and development priorities, and underpinned by inclusive community engagement processes (IPCC, 2022c; Haasnoot, Lawrence and Magnan, 2021).

Conventional decision-making processes and tools are seldom suitable as they do not account for the long time frames, the range of potential futures or the cascading and compounding impacts identified in the IPCC report (Dittrich, Wreford and Moran, 2016; Lawrence, Bell and Stroombergen, 2019; Lawrence, Haasnoot et al., 2019). Increased intensity and frequency of the climate risks make a strategic long-term approach to adaptation implementation essential. New institutions and laws cannot on their own effect the change needed to respond to the IPCC assessment without a public conversation that is built on an understanding of the rising risks and who bears them. Such a conversation is long overdue in a pluvial and maritime country with the majority of its citizens living close to the coast or on floodplains and where the inequalities that make us vulnerable are obvious to see.

Effective adaptation was defined in the 2017 Climate Change Adaptation Technical Working Group stocktake as adaptation that reduces risks substantially, avoids losses and maximises opportunities.

What might effective adaptation look like

It is one thing to identify climate risks and vulnerabilities. It is quite another to bridge to an effective adaptation strategy and to ensure that the strategy provides for ongoing responses to changing circumstances and increasing risks.

Effective adaptation was defined in the 2017 Climate Change Adaptation Technical Working Group stocktake as adaptation that reduces risks substantially, avoids losses and maximises opportunities. Three enablers for these outcomes were set out. It is instructive to reflect on what has been achieved in the five years since that report.

- Adaptation has to be well informed about how climate is changing and what that means for Aotearoa New Zealand: *we can gauge this now, albeit with some significant gaps, but we have no coordinated means by which to disseminate information and regularly update it.*
- There must be an organised and consistent approach to adaptation: *the foundations are in place or being built, but capacity, capability and coordinated practice are not.*
- Taking dynamic action is essential to proactively manage the environmental, economic and social risks: *in Aotearoa New Zealand there are a few examples of applied adaptive planning, a New Zealand Coastal Policy Statement and national coastal hazards and climate change guidance, and decision tools are available, but uptake is too slow compared with the climate changes that must be anticipated before adaptation limits are reached.*

The IPCC report frames the characteristics of adaptation as justice, feasibility and effectiveness – *just* to the extent that the adaptations respect the principles of distributive, procedural and recognitional justice; *feasible* to the extent it is considered possible and desirable, taking into consideration barriers, enablers, synergies and trade-offs; and *effective* to the extent it reduces risk.

The Australasia chapter of the report (Lawrence, Mackey et al., 2022a) encapsulates the learning over the intervening years since the previous assessment. The report card is that:

- while the ambition, scope and progress of adaptation has increased, progress is uneven due to gaps, barriers and limits to adaptation, and adaptive capacity deficits;
- a step change in adaptation from incremental to more transformative adaptation is needed to match the rising risks and to support climate-resilient development;
- delay in implementing adaptation and emissions reductions will impede climate-resilient development, resulting in more costly climate impacts and greater scale of adjustments;
- climate-resilient development integrates adaptation measures and their enabling conditions with mitigation to advance sustainable development for all.

Effective adaptation is dependent on enablers and gaining social legitimacy as far as is possible. The report concluded that shifting from reactive to anticipatory planning, integrating across decision domains, and coordination across levels of government and sectors are necessary enablers for effective adaptation. However, it also concluded that inclusive and collaborative institutional arrangements, government leadership, policy alignment, nationally consistent and accessible information, and decision support tools are part of a suite of enablers that also include adaptation funding and finance and robust, consistent and strategic policy commitments (Table 2).

Attitudes to climate change are changing in New Zealand, with the majority now agreeing that it is real and caused by humans (Milfont et al., 2021) – a good basis from which to build climate change literacy further through the use of more systemic, collaborative and future-oriented engagement approaches in local contexts (Rouse et al., 2017; Ministry for the Environment, 2017). These go hand in hand with dedicated expert organisational support (Climate Change Adaptation Technical Working Group, 2018; Salmon, 2019) (see Box 1). But such enablers depend on adequate resourcing and being able to measure progress and effectiveness of adaptation (Table 2).

How can the RMA reforms accelerate adaptation action?

The new structures for regional spatial planning, which involve larger regions and more streamlined decision making, provide the prospect of effective and consistent identification of areas likely to be subject to hazards and risks from climate change. This will assist in identifying areas which must be excluded from further development and prioritising other most vulnerable areas for urgent adaptive planning action, thus addressing avoidable and unavoidable climate

change impacts. The regional spatial plans can also identify and integrate long-term framework planning for infrastructure across all levels of government and the private sector. They establish a platform for more detailed regional and district land use planning, including environmental protection measures such as restoring natural coastal protection and retreat of development in response to rising seas.

We are yet to see how the new legislation will provide for long-term planning using DAPP assessment and decision processes in vulnerable areas. The existing New Zealand Coastal Policy Statement, which already provides an excellent national policy framework for adaptation in coastal areas, must be carried through under the new legislation. Further national guidance (through national policy statements and model policy and rules) is essential so that addressing climate change effects is prioritised, including identifying areas where unavoidable climate change effects require that any further development or land use intensification are prohibited. Enablers missing in action currently include legislative alignment for the Building Act, and new property constructs to address existing uses and where risks progress spatially across marine and terrestrial areas as boundaries change. The proposed Strategic Planning Act needs to override other statutes that may otherwise provide for use and development in areas of climate risk.

However, planning decisions continue to be made in the meantime and the new legislation may take years to be given effect. To avoid further legacy effects from current decision making, transitional provisions need to be in place. This should include urgent clarification in the National Policy Statement on Urban Development that land likely to be subject to climate change effects within the next 100 years should be excluded from urban intensification as a qualifying matter under that policy. Immediate changes to the RMA should put on hold changes in land use and unimplemented consents in areas of climate

BOX 1 Approaches to building climate literacy and capability

- Local 'adaptation champions' and experimental and tailored engagement processes can enhance learning.
- Dynamic adaptive pathways planning (DAPP) and inclusive community governance can help progress difficult decisions, such as the relocation of cultural assets and managed retreat, and contestation about which public goods or values to prioritise, and show how adaptation can be implemented.
- Participatory climate change scenario planning can test assumptions about the present and the future and help envision people-centred, place-based adaptation.
- Social network analysis can inform engagement and communication of adaptation.
- Knowledge brokers, information portals and alliances can help communities, governments and sector groups to better access and use climate change information.

Source: Lawrence et al ., 2022a

Table 2. Enablers for measuring progress and effectiveness of adaptation

Enabler	Example	Report card
Governance frameworks	• Clear climate change adaptation mandate • Measures that inform a shift from reactive to anticipatory decision-making (e.g., decision tools that have long time frames) • Institutional frameworks integrated across all levels of government for better coordination • Revised design standards for buildings, infrastructure, landscape such as common land use planning guidance and codes of practice that integrate consideration of climate risks to address existing and future exposures and vulnerability of people and physical and cultural assets	• Institutional foundations in place or being developed • Continuation of ad hoc single-issue planning • Coordinated governance frameworks emerging for some risks (3 waters; freshwater management; health institutions; local government reform) • Some design standards emerging but single issue focused and uncoordinated across sectors • Some councils have updated regional policy statements and regional and district plans aligned with the NZCPS. For example: – Marlborough Unitary Council has embedded adaptive policy in its proposed Marlborough Environment Plan. – Northland Regional Council has set out detailed policy and adaptive approaches for more detailed planning in collaboration with district councils and affected communities.
Building capacity for adaptation	• Provision of nationally consistent risk information through agreed methodologies for risk assessment that address dynamic change and uncertainty • Targeted research including understanding the projected scope and scale of cascading and compounding risks • Education, training, and professional development for adaptation under changing risk conditions • Accessible adaptation tools and information	• No coordinated training and professional development programmes in place to build climate change literacy nationally • No one stop shop portal/s where updated climate change information and expert advice can be accessed • Risk methodologies developed and being used by councils to develop regional risk assessments • Decision tools for dynamic and uncertain impacts available but uptake is slow • Methodologies available for assessing cascading and compounding impacts but uptake slow • Further development needed of cascading and compounding impacts methodologies that are simple to use and digitised and open source

Enabler	Example	Report card
Community partnership and collaborative engagement	• Community engagement based on principles that consider social and cultural and Indigenous Peoples' contexts and an understanding of what people value and wish to protect (e.g., International Association of Public Participation methodologies) • Use of collaborative and learning-oriented engagement approaches tailored for the social context and informed by the cultural context • Community awareness and network building • Building on Tangata Whenua Māori communities' social-cultural networks and conventions that promote collective action and mutual support	• Uptake of collaborative community engagement has been too slow given the rising risks • Declaration of climate emergencies has spurred the setting up of climate change action committees and groups to collaborate with councils • Membership of engagement groups typically include local Iwi and hapū to residents, non-governmental organisations, business interests and youth • Councils and DOC support of coastal care groups with the Coastal Restoration Trust of New Zealand is an example of coordinated community collaboration with cultural and science experts and practical resources through community networking • Enhancement of knowledge and understanding of the effects of climate change through community networking to enhance coastal buffering and improvements to local biodiversity
Dynamic adaptive decision making	• Increased understanding and use of decision-making tools to address uncertainties and changing risks, such as scenario planning and DAPP to enable effective adaptation as climate risk profiles worsen	• DAPP uptake too slow for timely and effective adaptation • A small number of councils and government agencies (e.g., DOC, Waka Kotahi, have started using DAPP for coastal planning, transport and asset planning which has raised awareness of the utility of DAPP for anticipatory planning. For example: • Marlborough Unitary Council has included provision in its proposed Marlborough Environment Plan to progress DAPP planning as a method for vulnerable communities. • Northland Regional Council used DAPP to scope out its climate change risks and options. • Hawkes Bay coastal councils used DAPP to chart options, pathways, in its development of the Tangoio-Clifton Coastal Hazards Strategy and signals and triggers for implementation of the Strategy. • DOC used DAPP to plan for impacts to huts from glacier melt and moraine erosion.
Funding mechanisms	• Adaptation funding framework to increase investment in adaptation actions • New private-sector financial instruments to support adaptation	• Adaptation Act with funding and property instruments on a slower track so barriers remain further delaying effective adaptation • Private sector initiatives for funding emissions reductions but slow to develop similar for adaptation investment • Major barrier remains around who pays and how • Funding models exist for ad hoc responses e.g., leaky buildings, Matata but none address the scale of climate change impacts evidenced in IPCC, 2022
Reducing systemic vulnerabilities	• Economic and social policies that reduce income and wealth inequalities • Strengthening social capital and cohesion • Identifying and redressing rigid or fragmented administrative and service delivery systems • Reviewing land use and spatial planning to reduce exposure to climate risks • Restoring degraded ecosystems and avoiding further environmental degradation and loss.	

Source: adapted from Lawrence, Mackey et al., 2022a

risk, address the fraught issue of existing use rights, and provide that new rules have immediate effect in such areas. Additional changes are needed to align statutory timelines for prioritising vulnerabilities and use of DAPP, and for establishing a monitoring regime using signals and triggers with the Climate Change Response (Zero Carbon) Amendment Act monitoring timelines of the national adaptation plan and next national climate change risk assessment (Lawrence, Allan and Clarke, 2021).

Knowledge gaps for effective adaptation

Successive IPCC and national assessments (Climate Change Adaptation Technical Working Group, 2018) have highlighted for Aotearoa New Zealand the paucity of information about climate change impacts

on natural system dynamics in terrestrial, freshwater and marine ecosystems. Addressing these gaps is now urgent to support effective resource management and conservation activity.

New information gaps have emerged from the report across two areas relevant to accelerating adaptation in Aotearoa New Zealand: understanding complexity and uncertainty in observed and projected impacts, and supporting adaptation decision making. These include:

- the exposure and vulnerability of different groups within society, including indigenous peoples;
- the relationships between emissions mitigation and adaptation, especially where land carbon mitigation is affected by climate change;
- the effectiveness, longevity and feasibility of different adaptation options;
- the social transitions needed for transformative adaptation;
- the enablers for new knowledge to better inform decision making (e.g., monitoring data and repositories, integrated risk and vulnerability assessments, robust planning approaches, sharing adaptation knowledge and practice for more rapid adaptation).

Mātauranga Māori

Aotearoa New Zealand is uniquely placed to enhance effective adaptation through mātauranga Māori about climate change planning that promotes collective action and mutual support across New Zealand. Tangata whenua Māori are grounded in mātauranga Māori, which is based on human–nature relationships and ecological integrity and incorporates practices used to detect and anticipate changes taking place in the environment, a major theme of the report.

Sociocultural networks and conventions that promote collective action and mutual support are central features of Māori communities, and these customary approaches are critical to responding to, and recovering from, adverse environmental conditions (Hikuroa, 2020). Intergenerational approaches to planning for the future are also intrinsic to Māori sociocultural organisation and are expected to become increasingly important, elevating political discussions about conceptions of rationality, diversity and the rights of non-human entities in climate change policy and adaptation.

The report concluded that supporting tangata whenua Māori institutions, knowledge and values enables self-determination and creates opportunities to develop adaptation responses to climate change to the benefit of all in New Zealand. Active upholding of the United Nations Declaration on the Rights of Indigenous Peoples and Māori interests under the Treaty of Waitangi at all levels of government enables intergenerational approaches for effective adaptation to be adopted.

Conclusion

Aotearoa New Zealand faces an extremely challenging future that will be highly disruptive for many human and natural systems (IPCC, 2018, 2021, 2022b; United Nations Environment Programme, 2020). The extent to which the limits to adaptation are reached depends on whether global warming peaks this century at 1.5°C, 2°C or 3°C+ above pre-industrial levels. Additional warming beyond 1.5°C this century will result in irreversible impacts on certain ecosystems with low resilience. For Aotearoa New Zealand this means alpine, ocean and coastal ecosystems impacted by warming and glacier melt or by accelerating and higher committed sea level rise. Risks to human systems will increase, including those to infrastructure, low-lying coastal settlements, some ecosystem-based adaptation measures, and associated livelihoods and cultural and spiritual values.

The IPCC report stresses the interdependence of adaptation and emissions mitigation, and that delaying either or both will impede climate-resilient development and result in more costly climate impacts and greater scale of adjustments. Avoiding increasing the risks requires robust, timely and effective adaptation as well as significant and rapid emissions reductions to keep global warming to 1.5°C–2°C. The projected warming under current global emissions reduction and adaptation policies would leave many of New Zealand's human and natural systems at high risk, and in some cases potentially beyond adaptation limits.

Integrated and inclusive adaptation decision-making and statutory processes can contribute to climate-resilient development by better mediating competing values, interests and priorities and helping to reconcile short- and long-term objectives, as well as public and private costs and benefits, in the face of rapidly and continuously changing risk profiles. The scale and scope of societal change needed to transition to more climate-resilient development pathways requires close attention to governance, ethical questions, the role of civil society and the place of tangata whenua Māori in the co-production of ongoing adaptation at multiple scales.

1 The summary report notes that 'multiple climate hazards will occur simultaneously, and multiple climatic and non-climatic risks will interact, resulting in compounding overall risk and risks cascading across sectors and regions' (IPCC, 2022c, B5).

2 Maladaptation refers to actions that may lead to increased risk of adverse climate-related outcomes, including via increased greenhouse gas emissions, increased or shifted vulnerability to climate change, more inequitable outcomes, or diminished welfare, now or in the future. Most often, maladaptation is an unintended consequence.

3 The Earthquake Commission Act 1993 provides insurance funding for residential property damage from natural disasters, administered by the Earthquake Commission, which is funded through a levy on private property insurance for underwriting damages up to NZ$150,000 per claim.

4 See https://www.mpi.govt.nz/funding-rural-support/adverse-events/planning-for-natural-disasters-and-other-adverse-events/.

5 See http://lapp.org.nz/. The Local Authority Protection Programme (LAPP) disaster fund is a cash accumulation mutual pool for fund members for post-event funding, with a central government/ local government 60:40 split for infrastructure repairs and clean-up costs after a threshold is reached.

6 https://www.climatecommission.govt.nz/our-work/advice-to-government-topic/six-principles-for-economic-recovery.

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Bruce D. Clarkson

Reversing Biodiversity Decline in Aotearoa New Zealand

Abstract

Reflections on the history of and prognosis for reversing biodiversity in Aotearoa New Zealand are provided from the perspective of a 40-year involvement in terrestrial ecology and its interface with central and local government policy development and implementation. The emerging favourable policy framework, continuing growth of iwi- and community-led conservation, and a shift to regional-scale restoration give cause for optimism. But reversal of biodiversity decline over still greater areas is required, alongside an in-perpetuity commitment to management that enhances indigenous biodiversity.

Keywords biodiversity, pests, weeds, conservation, restoration, policy, strategy

The wicked problem of biodiversity decline

Biodiversity – the diversity within species, between species and of ecosystems – is declining globally faster than at any time in human history, according to the most recent (2019) Intergovernmental Science-Policy Panel on Biodiversity and Ecosystem Services (IPBES) report on the state of biodiversity and ecosystem services. Further, the negative trends in biodiversity and ecosystem functions are projected to worsen in most future scenarios in response to rapid human population growth, unsustainable production and consumption, and associated technological development. The world is on track to miss the targets of the Paris Agreement, the Aichi biodiversity targets, and 80% of the United Nations Sustainable Development Goals (food, water and energy security) because of our poor stewardship of the natural world. Following a brief flurry of media attention, these shocking predictions have generally evaporated from public discussion, leaving only a Google trail and the unanswered question, how does this apply to Aotearoa New Zealand? This article reflects on the history of and prognosis for reversing biodiversity decline in Aotearoa New Zealand.

How does Aotearoa New Zealand fit within this global crisis scenario? How representative of our situation is this gloomy outlook of widespread biodiversity loss? Recent assessments show that New Zealand biodiversity is following and perhaps even exceeding global trends, partly reflecting the insular origin of many ecosystems and species. And what are the key causes of our biodiversity decline? Again, our unique global context is significant. New Zealand shares the main contributors of decline reported internationally. But our unique history sets us apart. Our flora and fauna have high levels of endemism and are poorly adapted to impacts of invasive alien species, but they can be preserved only in Aotearoa New Zealand.

Nationally our main ecological drivers of biodiversity loss are:

- *Habitat loss and fragmentation*
  The majority of habitat loss and fragmentation occurred prior to the 1920s, but it was still significant up to the 1970s, was government funded, and has transformed our landscapes later and

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more rapidly than elsewhere in the world. More than one-third of New Zealand forests were cleared for agriculture and 90% of wetlands have been drained. While the rate of loss is comparatively low this century, indigenous habitats, including wetlands, continue to be destroyed, and the cumulative impact on depleted or threatened ecosystems remains significant. Further, legacy effects continue in residual indigenous vegetation patches many years after fragmentation or drainage occurs.

- *Pest predation of fauna and browsing and grazing of vegetation*
  A wide range of environmental pests was introduced by successive settlers deliberately or inadvertently. Our flora and fauna are highly vulnerable to competition and displacement from these alien invaders. Recognition of the impacts on indigenous fauna, and in particular on avifauna, is comparatively recent. Herbivore impacts were recognised earlier, but their significance may have been overlooked in recent years due to a focus on mammalian predators.
- *Weed competition and altered ecosystem processes*
  More than 1,800 exotic vascular plants survive in the wild in New Zealand without human assistance and about 20 new species escape from gardens every year from a reservoir of more than 25,000 introduced plant species. Many naturalised plant species have traits which give them the ability to alter ecosystem processes, changing the rate and trajectory of vegetation succession in ways which, sometimes irreversibly, reduce the richness and diversity of native species.
- *Disease*
  Arrival of new diseases can also reduce population viability and change vegetation composition and structure. Kauri dieback caused by fungus-like *Phytophthora agathidicida* is currently causing significant damage to kauri forest and individual trees, while the recently arrived fungus *Austropuccinnia psidii* is affecting members of the myrtle family, including ramarama, rāta and pōhutukawa.
- *Land use change and intensification*
  For indigenous biodiversity, the initial transformation from a natural ecosystem, either for agriculture, cropping or plantation forestry, causes the most degradation and decline. Land use changes and intensification exacerbate the initial modifications, but can be part of sustainability goals to conserve and enhance biodiversity values.
- *Climate change*
  The potential impacts are still unclear, but most ecologists agree that our flora and fauna will be disadvantaged directly and indirectly by the impacts of climate change, resulting in at least local extinctions, strengthened competition from alien species, and biotic migrations tracking suitable climates.

> Forty years ago in Aotearoa New Zealand environmental management was a hotly contested topic and major changes were initiated.

But more important are the underlying causes of biodiversity decline, summarised by Brown et al. (2015), based on the results of the Root Causes project (Wood, Stedman-Edwards and Mang, 2000). They attribute biodiversity decline to the imbalance between human growth and consumption and sustainable development (including biodiversity protection). The loss of biodiversity and ecosystem services, in their framework, is fundamentally caused by market failure, exacerbated by the unequal power of private development interests and public conservation interests, and the lack of recognition of how many key commodities rely on biodiversity (Brown et al., 2015). Ecologists understand the ecological impacts and drivers of biodiversity decline and largely know how to fix degraded ecosystems and increase threatened species populations, but are sometimes naïve about these 'root causes' of decline. Unfortunately, continually repeating the ecological narrative has not led to a reversal of biodiversity decline. But working alongside iwi and communities, and councils and the Department of Conservation (DOC) can make a local and even regional difference.

Background history

Forty years ago in Aotearoa New Zealand environmental management was a hotly contested topic and major changes were initiated. In 1982 a nature conservancy for the management of natural lands of the Crown, and a Ministry for the Environment with its own Act, were called for by a consortium of environmental and recreation non-governmental organisations. The Environment Act 1986 created the Ministry for the Environment and the Office of the Parliamentary Commissioner for the Environment. One year later (in 1987), DOC was established by 'joining the green dots of conservation' between the New Zealand Forest Service, the Department of Lands and Survey and the Wildlife Service. The conservation estate was extensive, comprising national parks and scenic and allied reserves. Sizeable forest parks and their ecological areas were soon added to the Crown conservation estate, following the controversial decision to cease logging of native forests on Crown-owned land. This protected natural area network covered one-third of New Zealand's land area. But it was concentrated in the uplands and unrepresentative (in the words of the Reserves Act 1977) for

> ensuring, as far as possible, the survival of all indigenous species of flora and fauna, both rare and commonplace, in their natural communities and habitats, and the preservation of representative samples of all classes of natural ecosystems and landscape which in the aggregate originally gave New Zealand its own recognisable character. (s3(1)(b))

The early 1980s saw the advent of the Protected Natural Areas Programme (PNAP), an attempt to rapidly identify the 'best of the rest' areas (recommended areas for protection) for protection on private lands, especially in regions undergoing rapid development: for example, scrub clearance for establishment of pine plantations or expansion of dairying and cropping.

Coincidentally my own career as an ecologist began around this time, and indeed my role as a Department of Scientific and Industrial Research (DSIR) regional botanist appears to have resulted from the need to place staff close to where some of the controversial land use decisions were occurring at the time. Now, having been a keen observer of landscapes and native flora for even longer, it is timely to reflect on the

state, condition and trend of Aotearoa New Zealand's biodiversity under a changing policy framework and consider the prognosis for reversing biodiversity decline. My starting point is the 1980s and my emphasis is on specialist-interest native vascular plants and terrestrial vegetation.

The New Zealand Protected Natural Areas Programme

David Thom, chair of the National Parks and Reserves Authority, considered the PNAP survey the most important conservation initiative of the 1980s (Kelly and Park, 1986). Started in 1981, five years later the programme had achieved wide support, with 26 of New Zealand's 268 ecological districts having been surveyed. The four pilot studies, focusing on ten districts, identified some 200 areas for protection. I was privileged to be involved in one of these pilot studies (Motu ecological district) and a further ten PNAP surveys undertaken between 1984 and 2009 across a large portion of the western and eastern central North Island. They provided essential training for a new generation of ecologists and remain for some ecological districts the most comprehensive publication available on indigenous ecosystems. While the coverage was far from comprehensive, the PNAP surveys were the best available information to address the state of biodiversity on private land, and the adequacy of protection (Bellingham, 2001). The recommended establishment of a permanent PNAP survey unit (Kelly and Park, 1986), with a staff of at least 15 operating on an initial ten-year time frame (to match the rate of transformation evident in the New Zealand landscape), never eventuated.

Nevertheless, by 2001 at least 83 ecological districts had been surveyed and 43 reports had been published (Bellingham, 2001) by various consortia of DOC and its precursors, councils, universities, the Crown research institute Landcare Research and its DSIR precursors, and environmental consultancies. Wildland Consultants Ltd (2004) identified 51 published reports and 17 unpublished reports, and new surveys were still being undertaken. I am unaware of any more recent reviews of the PNAP and it is unlikely many additional surveys were undertaken; the most recently published PNAP survey appears to be the one covering the Kaipara ecological region (Smale et al., 2009). PNAP surveys suffered from lack of accessibility of both the published and unpublished documents and the underlying data layers (Bellingham, 2001; Wildland Consultants Ltd, 2004). However, they have been widely used by councils in delineating and scheduling significant natural areas under the Resource Management Act 1991 (RMA).

> In district plan reviews, definitions of significance were continually debated, there was an over-reliance on desktop surveys and incomplete schedules of significant natural areas appeared to result from pushback by politically motivated vested interests.

The advent of the RMA, a new statutory context, was partly responsible for the demise of the PNAP, but it was unfortunate that the programme was never completed. At this time a national approach was debated, with no consensus from ecologists (Walker et al., 2008) or across all territorial local authorities on criteria for assessing significance, and conflicts arose with private landowners about the use of PNAP data by authorities. One of the strongest legacies of the PNAP is evident in the Mt Taranaki (Egmont) ecological district (Clarkson, 2011), where most of the small ring plain patches identified as recommended areas for protection remain and are now QEII covenants, or in case of the 142-ha Mahood-Lowe Reserve, opened in 2020, a Native Forest Restoration Trust reserve purchased following a public fundraising appeal.

The Resource Management Act 1991

The RMA can be viewed as a legislative response aligned with the restructuring of environmental management in New Zealand and designed to move beyond the adversarial and politicised debates of the 1980s. In consolidating disparate environmental planning statutes, the RMA fostered a system of plans and policy statements at the territorial and regional level (Davies, 2008). Initially heralded as innovative and novel internationally (Memon and Gleeson 1995), reflection on its limitations soon emerged (Davies, 2008) and continue to this day.

Soon after the inception of the RMA, a critique by Murray and Swaffield (1994) noted that it was based on policy myths, including the focus on tradeable natural and physical resources and the assumption that these resources could be managed sustainably. The RMA also assumed that sustainable management should integrate conservation and development, achieved through rational planning of the environmental outcomes in resource use. From an ecologist's perspective, the first is most problematic, as the Act takes a reductionist approach to trading and managing resources, including biodiversity, across complex interdependent and interconnected systems (ecosystems). The main impact of the Act on biodiversity was through section 6 matters of national importance, in particular sections 6(a), 6(b) and 6(c) relating to:

(a) the preservation of the natural character of the coastal environment (including the coastal marine area), wetlands, and lakes and rivers and their margins, and the protection of them from inappropriate subdivision, use, and development:
(b) the protection of outstanding natural features and landscapes from inappropriate subdivision, use, and development:
(c) the protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna.

From my perspective, most debates over consent applications quickly descended into overly adversarial conflicts in which the emphasis was on specific patches of habitat, as if they were static entities in time and space. Key concepts such as cumulative loss or the need to maintain metapopulations at regional scale were overshadowed, despite often being inherent in the significance criteria being utilised. The risks associated with climate change were rarely, if ever, considered. On several occasions I witnessed

procedures appearing to favour those with greater resources to employ expert witnesses or those with the capacity to take the financial risk of challenging decisions, a finding supported by Chapple (1995) and Gunder and Mouat (2002).

In district plan reviews, definitions of significance were continually debated, there was an over-reliance on desktop surveys and incomplete schedules of significant natural areas appeared to result from pushback by politically motivated vested interests. This over-regionalisation of approach or lack of will to undertake the process of recognising and providing for biodiversity also seemed to result from inadequate resourcing in smaller councils and a lack of central government policy and leadership. Despite these limitations, the RMA slowed loss of biodiversity on private land, and in some areas of New Zealand notable successes have been achieved, often associated with national campaigns. From an ecological perspective, retention of indigenous habitat on landscapes is the first step, followed by statutory protection. But both are only holding patterns (for the lifespan, in the case of native forests, of the main trees) if the fundamental drivers of decline persist and there is little or no active management to reverse the decline.

Compliance and monitoring of resource consents is another area where the RMA has been problematic. Countless resource consents have been issued by regulatory agencies since the inception of the RMA: 34,000 by regional and district councils and the Environmental Protection Authority in 2012–13 alone (Brown et al., 2015). The decision-making process, requirements for mitigation actions, compliance and monitoring are all important dimensions for protecting biodiversity. As outlined by Brown et al. (2015), the requirements are typically stated in a side agreement or, more commonly, as a condition of consent. Consent conditions for these positive conservation actions are important to lessen the impacts of development on biodiversity. However, compliance must be enforced. Brown et al. (2013) documented that councils do not rigorously enforce either their plans or the conditions of consent. Monitoring of consents is typically under-resourced, penalties are modest and political interference seems common. A possible solution is the separation of consenting from compliance and monitoring (Brown et al., 2015). Finally, there is the issue of local authorities using extensive powers for non-notification and with developers apparently able to buy off objections in order to avoid conflict (Gunder and Mouat, 2002).

> Despite some gains from habitats reverting to native cover naturally or through restoration, the net loss of native forest, scrub, shrubland and grassland (2012–18) amounted to 12,900 ha.

All of the constraints outlined have the potential to contribute to biodiversity decline, and in my experience often do. While I am aware that a review of the RMA is currently in progress, my focus here is on the specific biodiversity-focused policies.

The first New Zealand Biodiversity Strategy

Under DOC leadership, and involving many government agencies, including the Ministry for the Environment, the first New Zealand Biodiversity Strategy (Department of Conservation and Ministry for the Environment, 2000) was developed and ratified. Public participation in the development of the strategy was strong and the draft subtitle 'Our chance to turn the tide', and primary goal of 'halting the decline' seemed to resonate widely. The sub-goals of goal three (halt the decline) of the strategy were:

> Maintain and restore a full range of remaining natural habitats and ecosystems to a healthy functioning state, enhance critically scarce habitats, and sustain the more modified ecosystems in production and urban environments; and to do what else is necessary to Maintain and restore viable populations of all indigenous species and sub species across their natural range and maintain their genetic diversity.

The strategy was, in large part, a response to commitments made under the United Nations Convention of Biological Diversity, signed in 1992 and ratified in 1993.

The New Zealand Biodiversity Strategy specified 147 actions in ten priority action areas, most falling to central government agencies and territorial authorities and regional councils. Territorial authorities and regional councils carried out their statutory functions under the RMA, and most regional councils and unitary authorities invested in operational programmes (mostly through pest management under the Biosecurity Act). In 2000 government had recognised that 'to turn the tide' on biodiversity losses would require more resources and initiatives on a wider number of fronts to achieve. A review of progress in the first five years (Green and Clarkson, 2005) showed that the funding ($184 million) provided through the Biodiversity Package made important contributions in a number of areas. In summary, one-third (35%) of the priority actions were scored as having made 'substantial' progress in the first five years of the strategy, while two-thirds (67%) scored as 'high priority' for contributing to the future outcome of the strategy. Green and Clarkson also noted that several objectives were achieved despite government agency priority shifts, while iwi- and community-led conservation and restoration initiatives continued to grow.

Without further systematic reviews it is difficult to assess progress over the remaining 15 years. However, Willis (2017) did highlight further important initiatives aimed at lifting performance in achieving reversal of decline, including: amendment to the RMA to provide local authorities with the express function of 'maintaining biodiversity'; and a major policy and consultation process looking at biodiversity and private land, and the value of a national policy statement on biodiversity to guide and direct decision making under the RMA. In my view, several government agencies listed as leads on specific actions progressively disengaged and the strategy was seen as a DOC strategy, rather than one embraced nationally. Despite a promising start, the fact remains that the strategy did not meet the primary goal of halting the decline and, in the words of Willis (2017), was an 'intervention failure'.

In an attempt to learn from the first strategy's shortcomings, a 2020 DOC review, 'Lessons learnt from the 2000 New Zealand Biodiversity Strategy' (Department of

Conservation, 2020b), drew on consultation discussions, comments received in response to the discussion document (*Te Koiroa o te Koiora*) published in August 2019, and on other published reviews, including the two already covered above. Apart from noting that the strategy was viewed as belonging to DOC, the most significant issue identified centred around implementation. Aspects of accountability and responsibilities, prioritisation, monitoring and review all contributed to a lack of progress of implementation.

The current state of biodiversity

Since the landmark 1997 *State of New Zealand's Environment report* (Ministry for the Environment, 1997), which identified biodiversity loss or decline as New Zealand's most pervasive environmental issue, a plethora of reports and updates (e.g., the Environment Aotearoa series, the OECD performance review series and reports by the parliamentary commissioner for the environment) have consistently reported on an ongoing decline. Perhaps the most robust analysis to date is found in Brown et al. (2015), because it not only analyses the drivers of biodiversity decline but provides a solutions framework and a range of strategic, tactical and practical solutions (Clarkson, 2015). However, as Willis has correctly identified, 'the reality is that whether things have got better or worse depends on what you are measuring where, and compared to what baseline' (Willis, 2017, p.17). All of the accounts have their limitations, but in recent years there has been greater availability of suitable data and indicators.

Most recently, the DOC report *Biodiversity in Aotearoa: an overview of state, trends and pressures* (Department of Conservation, 2020a), companion to the strategy, sought to objectively present the data and information that describes the extent of the biodiversity crisis in Aotearoa New Zealand. In doing so it set the scene and supported the strategy 'by providing the evidence base for the action needed to respond to this crisis'. As discussed below, these strong words are generally backed by a more quantitative approach than seen in earlier assessments.

In terms of terrestrial ecosystems and species, the focus of this account, decline, is clearly documented, but the question remains, is it of crisis proportions? For vascular plants, the best-known group of plants and with 84% endemism, some 62% of species have shown declines in conservation status between the last two New Zealand Threat Classification System (NZTCS) assessment years (2012–17). However, the NZTCS assessment uses a Delphi methodology and no rigorous quantitative population viability analyses appear to have been undertaken. Some 107 species are now listed as data deficient (de Lange et al., 2018) and many members of Myrtaceae have been reclassified to higher threat status because of the presumed impacts of myrtle rust. However, there can be little doubt that 213 plant species in the highest threat class (nationally critical) – for example, kōwhai ngutu-kākā (*Clianthus maximus* and *C. puniceus*) – are at serious risk of extinction in the wild.

> As to be expected, I have noted a wide range of vegetation condition changes, from serious decline to marked improvement, but a majority of sites appear to be in poor condition, most of these over the duration of my observations.

Continuing clearance of indigenous vegetation is quantified from the New Zealand Land Cover Database (2020). For indigenous forests, scrub and shrubland, the net loss from 1996 to 2018 was 40,800 ha, and for indigenous grasslands it was 44,800 ha. Despite some gains from habitats reverting to native cover naturally or through restoration, the net loss of native forest, scrub, shrubland and grassland (2012–18) amounted to 12,900 ha. The latest threatened environments analysis demonstrated that 32% of New Zealand's 500 land environments had less than 10% cover of native vegetation remaining, while a further 14% had 10–20% native vegetation cover (Cieraad et al., 2015). Collectively, these two categories represent around 33% of New Zealand's total land area, with the most depleted parts of Aotearoa in coastal and lowland areas of low relief, particularly high-fertility alluvial plains, terraces and flats. While the spatial extent of vegetation and its reduction is adequately assessed, there was insufficient information to document the state and trend of ecological integrity of indigenous ecosystems across the country.

Data collection of indicators of ecosystem integrity is limited, as is coordinated curation of existing information. However, researchers have developed a basis upon which to advance this area. This includes standard regional government biodiversity indicators (Lee, McGlone and Wright, 2005; Bellingham et al., 2016). DOC has used the outcome monitoring framework originally set out by Lee, McGlone and Wright (2005) and revised and updated by McGlone et al. (2020) to support the development of a quantitative, field-based monitoring programme for ecological integrity: data elements combine to form a measure, and multiple measures are combined to provide information about an indicator.

The most comprehensive and extensive systematic long-term monitoring programme presently operating in Aotearoa to report on state and trend in terrestrial biodiversity is Tier 1, undertaken by DOC across all public conservation land. The Tier 1 network measures condition and builds on and extends the Ministry for the Environment's land-use carbon analysis system (LUCAS), in place since 2002 for reporting on carbon stock and change in Aotearoa New Zealand's forests and shrubland.

Trends from Tier 1 monitoring on public conservation land indicate no change in the overall balance of indigenous and exotic plants in forests between the first (2002–07) and second (2009–13) measurements (Bellingham et al., 2014). However, many of these forests are in remote uplands, well buffered from infestation from the weeds that inhabit smaller forest remnants in lowland and coastal zones. Environmental weeds detected by Tier 1 monitoring were more frequent in non-forest plots, with the most common being mouse-eared hawkweed (Bellingham et al., 2013).

There are some positive trends in statutory protection on private land. The extent of private land protected through Queen Elizabeth II National Trust covenants rose from 10,000 ha

in 1990 to 184,210.8 ha in 2018 (qeiinationaltrust.org.nz). Most QEII covenants occur in the two most threatened environments and their contribution to biodiversity representativeness far exceeds their generally small patch size (median 5.6 ha). However, limited information is available on the condition and trend of covenants nationally.

While no national-scale direct assessments of the condition and trend of indigenous ecosystems appear to be available, recent research focused on the extent of conservation lands under intensive and extensive pest management via ecosanctuaries, offshore islands and mainland reserves can be used to indirectly gauge the extent of pest control, a major aspect of reversal of biodiversity decline. Green and Clarkson (2005) noted that it was clear that the funds or capacity will never be available to manage indigenous biodiversity at the level of DOC's current investment in its intensively managed areas. These represented just 2–3% of the total lands administered by the department. The auditor-general (2012) suggested that DOC was able to actively manage only a small proportion (about one-eighth) of New Zealand's conservation land and about 200 of the 2,800 threatened species. Russell et al. (2015) estimated that some 45% of mainland New Zealand was under some form of predator management (possum control, mustelid control and rodent control), that 10% of island area was predator free in 2014 and that 50% of island area could be predator free within a decade. Focusing on ecosanctuaries, Innes et al. (2019) showed that while comprising only 0.2% of New Zealand's land area, they have achieved significant biodiversity gains, in particular returning some very pest-sensitive species to the New Zealand mainland after decades of absence. Spill-over of biodiversity into the wider landscape is a further benefit of ecosanctuaries (Tanentzap and Lloyd, 2017). Ecosanctuaries are the strongest practical attempts on mainland New Zealand to meet legislative requirements to eradicate diverse, harmful introduced species and thereby reverse biodiversity decline (Innes et al., 2019). They also represent a shift in management leadership, with some 50% managed by DOC and the remainder by community trusts or similar.

My own recent observations on the current state of biodiversity

Not long after the Covid-19 pandemic began to constrain my work programme, I determined to spend more time in the outdoors (nature) to reacquaint myself with some of the field sites I worked on as the DSIR Botany Division regional botanist and to relearn the New Zealand vascular flora. The results of this effort are publicly available on the citizen science platform iNaturalistNZ (under the user name brucedc). As of 14 March 2022, some 9,711 plant observations (1,195 species) were posted over a period of almost two years. While my re-examination has been essentially qualitative, my baseline is long experience and many unpublished and published reports on the natural areas produced between 1980 and 2000. I have used my observations of the vegetation condition and the presence and abundance of palatable vascular plant species to assess whether natural areas or specific sites have declined or improved or remain in a similar condition to when visited mostly more than 30 years previously. As to be expected, I have noted a wide range of vegetation condition changes, from serious decline to marked improvement, but a majority of sites appear to be in poor condition, most of these over the duration of my observations.

> While a national policy statement is not a silver bullet, it could be expected to assist in providing a more coherent and strengthened approach to solving the biodiversity crisis, particularly in relation to ongoing loss of biodiversity on private land.

Unsurprisingly, the amount of active management of introduced herbivores and invasive weeds seems to explain the differences. Waikato's Maungatautari Ecological Island sanctuary has shown the greatest improvement, a result of intensive pest control implemented since the installation of the predator-proof fence and the extermination of mammalian herbivores, including goats and possums. In places, the once uncommon shrub epiphyte kohurangi (*Brachyglottis kirkii*) is becoming prominent as a ground dweller again and the vegetation on old slip faces or rocky ridges is thickening and impenetrable in places. Palatable ground species, such as toropapa (*Alseuosmia macrophylla*) and hen and chicken fern, are abundant and king fern (*Psitana salicina*) is regenerating. Te Papakura o Taranaki (Egmont National Park) is showing similar recovery since the implementation of Project Mounga, with goats most likely fully eradicated and possum numbers as low as they have ever been. The only damage noted came from intensive human impact on a confined area on the crest of Pouakai, and hare damage more widely on the Pouakai Range tops and fringe of Ahukawakawa mire. While birds were not a focus, the range of species seen and the bird song intensity in both natural areas is remarkable compared to my visits in the 1980s and 1990s. The same situation is evident at Rotokare Reserve in east Taranaki, where bird translocations and extermination of pests have been undertaken inside the predator-proof fence since 2009. A different style of recovery is evident in Paengaroa Reserve, where intensive weed control alongside pest control has helped protect a rich assemblage of divaricating plants. On mounts Tarawera and Tauhara wilding conifers have been greatly reduced, but the benefits of pest control were not as evident.

The worst examples of decline are mainly in scenic and allied reserves or former state forest lands: for example, Karamu Scenic Reserve, Paiaka Domain Recreation Reserve, Awakino Conservation Area and Pureora Mountain Ecological Area (Pureora Forest Park). In these places, introduced herbivores remain a problem. Goats have modified the Awakino reserve since my first visits and show no signs of abating. Over more than 50 years of observation, the scenically and ecologically important Awakino Gorge flora and native vegetation has continued to decline in extent and condition due to goat and possum browsing and weed invasion, particularly of the roadside fringes. In the Awakino Conservation Area extensive areas of the

understorey and ground cover exhibit major depletion and a cessation of normal forest regeneration, with toropapa all but locally extinct. At Karamu Scenic Reserve goats are progressively removing the palatable limestone flora and the ground cover is heavily depleted, as it is at Paiaka Domain Recreation Reserve. Goat control was recommended for Karamu Scenic Reserve as early as 1984, but it is uncertain if this has ever been undertaken. On Mount Pureora deer numbers are likely higher than they were in the 1980s, because the submontane flora remains obviously impacted. Within Tongariro National Park, deer are damaging an important mire with uncommon plant species on the flanks of Hauhungatahi. Many sites show a complex mix of improvement and decline, depending on the range of management undertaken. For example, in Tukainuka Scenic Reserve, where pest control is good, domestic stock have continuing access because of inadequate boundary fencing.

Overall, from the sites revisited, the picture emerges of ongoing decline at different rates depending on management. Notable exceptions are the highest-status conservation sites, such as national parks or ecosanctuaries. Sites intensively managed, such as Maungatautari, give us an insight into what the vegetation was like before the invasion of mammalian herbivores, although lacking pre-human large avifauna herbivory. With kohurangi growing in the ground layer at Maungatautari, reinforcing the descriptions of early European explorers, the emerging vegetation composition cautions each generation of ecologists about the shifting baselines for interpreting vegetation condition. These sites also represent a new approach, where the local iwi and/or community or private landowners have taken full responsibility for active management. Some small patches in the rural landscape – e.g., the Te Aroha Station, Pehiri, Miller Bush and Waingaro QEII covenants –have shown good recovery. The most important ingredients are kaitiaki who care and have the resources to actively manage the degradation caused by introduced pests and weeds.

Waiting for a national policy statement on indigenous biodiversity

It is now more than 20 years since I was invited to early discussions on development of a national policy statement on indigenous biodiversity. Previous iterations appear to have been halted because of disagreements among stakeholders and lack of political will. A useful interim document, a statement of national priorities for protecting rare and threatened native biodiversity on private land, emerged from the earlier discussions and was published by the Ministry for the Environment in 2007, after the failure to finalise a draft national policy statement. Those priorities were:

- national priority 1: to protect indigenous vegetation associated with land environments (defined by Land Environments of New Zealand (LENZ) at Level IV) that have 20% or less remaining in indigenous cover;
- national priority 2: to protect indigenous vegetation associated with sand dunes and wetlands, ecosystem types that have become uncommon due to human activity;
- national priority 3: to protect indigenous vegetation associated with 'originally rare' terrestrial ecosystem types not already covered by priorities 1 and 2;
- national priority 4: to protect habitats of acutely and chronically threatened indigenous species.

> The nature and style of council consultation, the lack of clarity around constraints on use and development, and the lack of clear economic incentives to retain and protect biodiversity on private and Māori lands all come into play.

While a national policy statement is not a silver bullet, it could be expected to assist in providing a more coherent and strengthened approach to solving the biodiversity crisis, particularly in relation to ongoing loss of biodiversity on private land. The latest attempt to formulate a national policy statement began in 2016, with the formation of a Biodiversity Collaborative Group consisting of industry representatives, environmental groups, and an iwi advisor to the Iwi Chairs' Forum. Perhaps the most significant report commissioned by the group (Walker et al., 2018) discusses the critical factors to maintain biodiversity, in particular what effects must be avoided, remediated or mitigated to halt biodiversity loss. This provides tables and a decision tree to assist policymakers and stakeholders to interpret and understand how to assess the effects of development applications. In essence, the group recommended that it is most sensible, efficient and cost-effective to maintain existing indigenous biodiversity resources. They also noted that there are inherent difficulties and risks in seeking to recreate or reconstruct indigenous habitat in order to mitigate for continuing removal of indigenous habitat for development projects, and that mitigation may not result in an ecosystem of equivalent richness or function. I agree. From my observations of many RMA decisions, biodiversity has been the loser, particularly in landscapes where biodiversity has already suffered serious depletion. The remedy or mitigation offered often has little chance to result in a medium- to long-term biodiversity gain, and in any case will often not be monitored to determine compliance with consent conditions.

My interest and contribution to these discussions focused on the urgent need to restore or reconstruct indigenous habitat in New Zealand's most depleted environments, including the urban and peri-urban zone (Clarkson, Kirby and Wallace, 2018). There the goal should be to build, expand and reconnect indigenous habitats to ensure that they persist near where the majority of New Zealanders live. The MfE's draft national policy statement released in November 2019 following a consultation process found 92% support among submitters.

The draft statement is well grounded in ecological science, and, most importantly, has implementation requirements which, if adhered to, could make a significant difference to protecting and restoring indigenous biodiversity on private land.

There is also recognition that existing significant natural areas may not capture all areas of significance, and provision needs to be made for new sites to be managed, reflecting their natural values. Highly mobile species, such as bats, and their habitats and iwi taonga species and ecosystems are also catered for. Modern restoration ecology principles feature strongly in the draft, with recognition that territorial local authorities need to promote restoration and enhancement (including through reconstruction) of wetlands, degraded significant natural areas and areas providing connectivity or buffering functions. Native vegetation cover of a minimum of 10% is expected in urban and rural zones. Local authorities are encouraged to adopt a precautionary approach to development where the effects on biodiversity are uncertain, and when changing or making policy statements or plans to promote the resilience of indigenous biodiversity to climate change. The requirement for regional councils to prepare a regional biodiversity strategy in collaboration with territorial authorities, tangata whenua, communities and other identified stakeholders could be the process that finally delivers a coordinated approach to reversing biodiversity decline at the regional scale.

The Aotearoa New Zealand Biodiversity Strategy

Led by DOC (2020c), a revised *Te Mana o te Taiao: Aotearoa New Zealand Biodiversity Strategy 2020* was completed and launched on 10 August 2020. The new strategy takes a broader approach to solving biodiversity decline than the previous attempts. Importantly, it encompasses a more progressive bicultural (Treaty of Waitangi-based) approach. It confirms the priority focus on indigenous flora, fauna and ecosystems. It seeks to address the systemic structural and funding issues that constrained the previous strategy and has ambitious goals, including restoration of ecosystems running from the mountains to the sea. It recognises the importance of influencing and meeting commitments to international agreements and conventions. Finally, it has an increased emphasis on urban and peri-urban nature and the centrality of people's relationships with nature. Unfortunately, some impetus appears to have been lost during the 2020 election process. Following the installation of the sixth Labour government in 2020, work on an implementation plan was revived and an interim oversight group established to advise the new minister of conservation on aspects of the strategy, including governance.

> While the IPES report and the United Nations Decade of Ecosystem Restoration, which began in 2021, provide us with added motivation for the transformational change needed, in the end it will be the people of Aotearoa New Zealand who will determine the fate of our unique biodiversity.

Progress on the draft national policy statement on indigenous biodiversity, inextricably linked to the strategy, appears to have slowed. Ironically and predictably, the same issue that prevented ratification of earlier iterations of the national policy statement has reappeared. In the late 1990s, attempts to identify significant natural areas on private land in the Far North District led to discord and withdrawal of plan provisions. Similar reactions have occurred in other districts and regions over the years, and most recently in the Far North again following a council communication to 8,000 landowners regarding significant natural areas. Māori land is disproportionally affected, as Māori landholdings are often remaining biodiversity strongholds, reflecting a history of confiscation or loss of their most productive land. The nature and style of council consultation, the lack of clarity around constraints on use and development, and the lack of clear economic incentives to retain and protect biodiversity on private and Māori lands all come into play. Efforts are currently underway to determine appropriate incentives to reduce this roadblock. As is often the case, previous research (Clough, 2000) probably identifies most of the potential solutions. However, new approaches in the form of bio-banking and payment for retention of ecosystem services are emerging internationally.

An optimistic future?

The IPBES report concluded optimistically, observing that it is not too late to turn this crisis around and that there are many practical actions available to get back on the right trajectory and improve the scale and pace of change: 'Nature can be conserved, restored and used sustainably while other global societal goals are simultaneously met through urgent and concerted efforts fostering transformative change' (IPBES, 2019, p.20). It identified five main interventions to generate transformative change by tackling the underlying indirect drivers of the deterioration of nature: (1) incentives and capacity building; (2) cross-sectoral cooperation; (3) pre-emptive action; (4) decision making in the context of resilience and uncertainty; and (5) environmental law and implementation. Many elements of these interventions can be identified in our attempts to reverse biodiversity over the last 40 years discussed above. Moreover, Brown et al. (2015) have canvassed them all in detail.

My November 2020 address to the Royal Society of New Zealand branch in Napier outlined many reasons for taking an optimistic view on progress towards reversing biodiversity decline. In brief, increased funding for DOC and the Ministry for Primary Industries and philanthropic funding of the style of Project Janzoon and Project Mounga, as well as recent initiatives such as Predator Free 2050, Jobs for Nature and the One Billion Trees programme, were providing the opportunity to restore at scale. The emerging favourable policy framework, continuing growth of iwi- and community-led conservation, and a shift to regional-scale restoration involving new collaborative and collective impact models were also improving performance. Finally, increasing recognition

of the seriousness of climate change and its coupling with biodiversity decline, alongside growing awareness of the human wellbeing and health benefits of high-quality greenspace and nature, were driving an appreciation of the need for a greater response. Countering these positive influences are the realities of the dominant economic model, inadequate funding to adequately mitigate past and present biodiversity loss, and continuing habitat losses and species range contractions. Then there is ongoing failure to recognise the full scale of the response needed to achieve a one-ecosystem approach (Daugherty and Towns, 2019), in which every transaction with nature leaves nature no worse off and preferably provides a net biodiversity gain. At the time of writing, the likelihood of a ratified national policy statement on indigenous biodiversity seems to be hanging in the balance. In addition, while the total funding package has improved, the security and term of funding and the over-reliance on voluntary support is a continuing concern. Many of the gains from Jobs for Nature, or any other conservation initiative for that matter, can be quickly lost as the nature of reversing the decline in Aotearoa New Zealand requires an in-perpetuity commitment and any cessation in management will result in rapid loss. The transformational shift required would see extermination of the pests targeted by Predator Free 2050 and some more besides, and similar success with control of the most problematic weeds, over even more extensive areas of Aotearoa than currently.

While the IPES report and the United Nations Decade of Ecosystem Restoration, which began in 2021, provide us with added motivation for the transformational change needed, in the end it will be the people of Aotearoa New Zealand who will determine the fate of our unique biodiversity. That is the main reason I remain optimistic, as I observe so many New Zealanders prepared to commit their time and energy to working for the highest practicable extent of improvement and a rebalancing of the results of 200 years of sometimes systematic removal of indigenous biodiversity over much of lowland and coastal Aotearoa. Our indigenous biota just needs to be given the chance to reassert itself on our landscapes. Tipping that balance at regional and national scale remains an elusive yet feasible goal.

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Hannah Blumhardt and Liam Prince

From Lines to Circles
reshaping waste policy

Abstract

The impacts of waste transcend landfills and litter; emissions and pollution occur at every stage of the linear 'take–make–waste' economy. Zero waste and circular economy theories offer systemic perspectives and practical solutions. The New Zealand government has committed to a circular economy vision for Aotearoa. Given New Zealand's 'rubbish record on waste', the social and economic transformation required will take extraordinary collaboration and a common direction of travel. This article diagnoses the extent of global waste problems, the circular pathways forward, and New Zealand's early steps along them. With the government re-oriented to act, we urge an ambitious, joined-up approach that avoids locking in inadequate responses to existential threats.

Keywords zero waste, circular economy, bioeconomy, waste, climate

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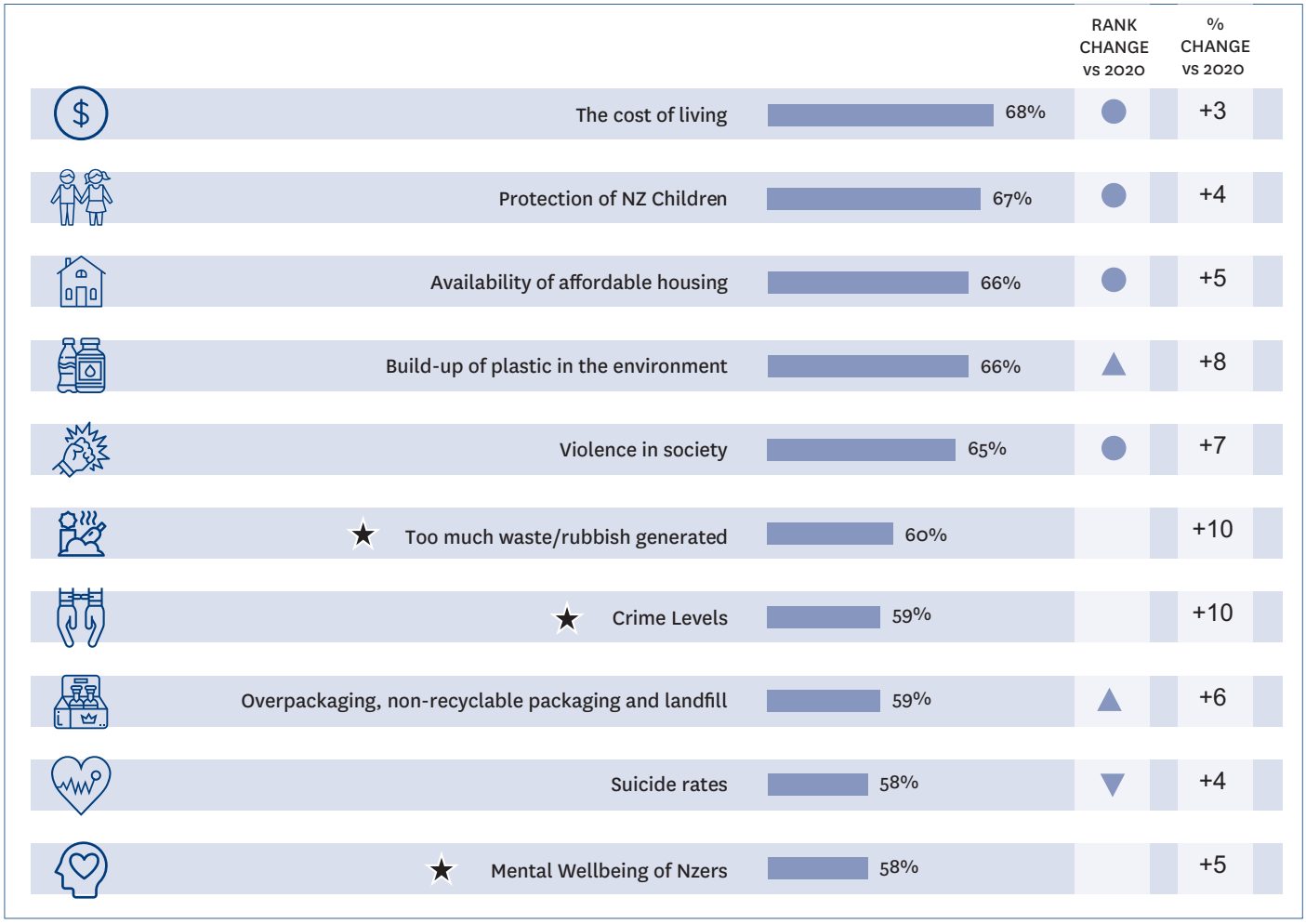
By global standards New Zealanders have big waste footprints; our hunger for resources outstrips our ability to return those resources to the economy. The result is overflowing landfills, plastic pollution, ecosystem degradation and greenhouse gas emissions. The government proposes to address these problems by moving to a low-waste, low-carbon, circular economy (Ministry for the Environment, 2021e, 2021f). The nature, scale and scope of the changes needed to achieve this vision are immense, given that production and consumption patterns drive waste and emissions and thus require transformation. All public sector agencies, industries and organisations must get with the programme and move beyond working at cross purposes in silos. Policies directed at waste, climate, business and innovation require harmonisation, underpinned by a shared understanding of the meaning and purpose of zero waste and circularity. While the government aims to replace extractive lines with regenerative circles, goodwill, coordination and clear-eyed ambition are needed to transcend inertia and the temptation to repackage business as usual in an eco-veneer.

Figure 1: New Zealanders' top 10 concerns according to the Kantar Better Futures Survey 2022



Source: Kantar and Sustainable Business Council, 2022, p.14

The waste problem is worse than you think

People care about waste. While many unfolding ecological catastrophes, from climate change to biodiversity loss, can be hard to grasp or easy to deny, waste and plastic pollution are tangible, visible problems confronting people daily. Successive Kantar Better Futures surveys demonstrate that waste issues deeply trouble New Zealanders. In 2021 and 2022, topics related to waste and plastic pollution were the only environmental issues that ranked in New Zealanders' top ten concerns, taking up three spots in the list (Kantar and Sustainable Business Council, 2022). Other serious topics were absent, including climate change, water quality, biodiversity, Covid-19, healthcare, racism and social cohesion (see Figure 1).

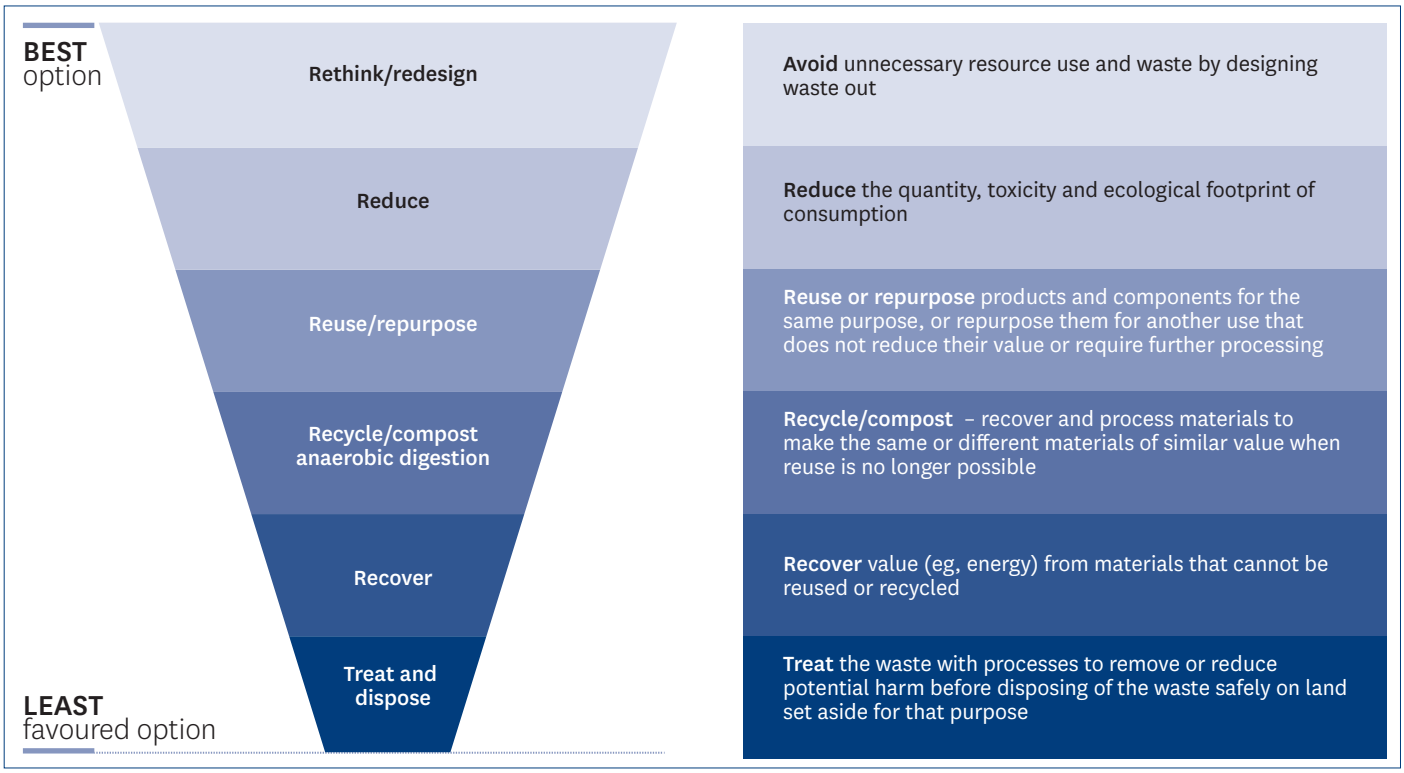
The immediate impacts of waste are justifiably concerning. Between 2009 and 2021 New Zealand's waste sent to landfills increased 39% (Ministry for the Environment, n.d.).[1] Many landfills are filling up, necessitating new or expanded sites, which pleases nobody (Cardwell, 2021; Waste Management, 2022). Even engineered landfills pollute surrounding environments: landfills emit methane from organic waste decomposing anaerobically, even with sophisticated gas capture technology;[2] liners designed to contain liquid leachate can fail and do not last forever (Pivato, 2011); and rubbish escapes, despite strategic fences. Old landfills are also vulnerable to rupture from extreme weather events and sea level rise, as the 2019 Fox River landfill disaster demonstrated (Ministry for the Environment, 2021f, p.19; RNZ, 2022).

The inadequacy of recycling solutions elevates anxiety among the segment of the public who are concerned about waste. Most consumables are not made to be recycled, or appropriate and consistent collection and processing systems do not exist. New Zealand exports much of our recyclate, including shipping tonnes of plastic packaging waste to Southeast Asia (Wilson, Eve and Grant, 2018). Reports of this plastic being dumped or burned in receiving countries, detrimentally affecting local communities, is rightly challenged as 'waste colonialism' (#BreakFreeFromPlastic, 2020).

Globally, over 5 billion tonnes of plastic waste were landfilled, informally dumped or mismanaged between 1950 and 2017 (United Nations Environment Programme, 2021). Much of this plastic waste has entered the environment, affecting marine, coastal and terrestrial environments, and human populations. Microplastics are in the air, drinking water, food, and the bodies of living organisms, including human blood (Farrelly, Taffel and Shaw, 2021, p.2; Leslie et al., 2022). Plastic also pollutes inequitably. For example, Pacific Island countries are disproportionately affected by plastic pollution, despite contributing less than 1.3% of the plastic waste in the world's oceans (Farrelly, Borelle and Fuller, 2020, p.6).

Unfortunately, these immediate impacts of waste represent just a fraction of the overall harm. Waste is a symptom of systemic problems; a quotidian manifestation of humanity's careless exploitation of natural resources that follows the extractive 'take–make–dispose' formula. This global plundering has reduced the planet to an assembly line that ends in waste, but drives climate change, biodiversity loss and irreversible pollution along the way (Burke, Zhang and Wang, 2021). The Ellen MacArthur

Figure 2: The waste hierarchy featured in the Ministry for the Environment's consultation document on a new waste strategy for Aotearoa



Source: Ministry for the Environment, 2021f

Foundation (2021) calculates that making, transporting and consuming goods creates nearly half of global greenhouse gas emissions; Circle Economy (2022) claims that 70% of global greenhouse gas emissions 'are ultimately generated through material handling and use' (p.27). Essentially, everything wasted represents embodied emissions lost to the economy and generates the need to repeat the harmful extraction, production and transportation process.

Plastic pollution transcends rubbish on beaches or roadsides. Extracting and refining oil for plastic production generates substantial greenhouse gas emissions (Centre for International Environmental Law, 2019). Plastic products can leach harmful additives and persistent organic pollutants before, during and after use, and plastics exposed to sunlight can release methane (Farrelly and Green, 2020; Royer et al., 2018). Furthermore, microplastics' environmental prevalence is not only caused by mismanaged plastic waste degrading, but from products like tyres, clothes, carpets and upholstery shedding while performing the functions they were designed to perform (Pew Charitable Trusts and SYSTEMIQ, 2020, p.17).

Understanding zero waste and the circular economy

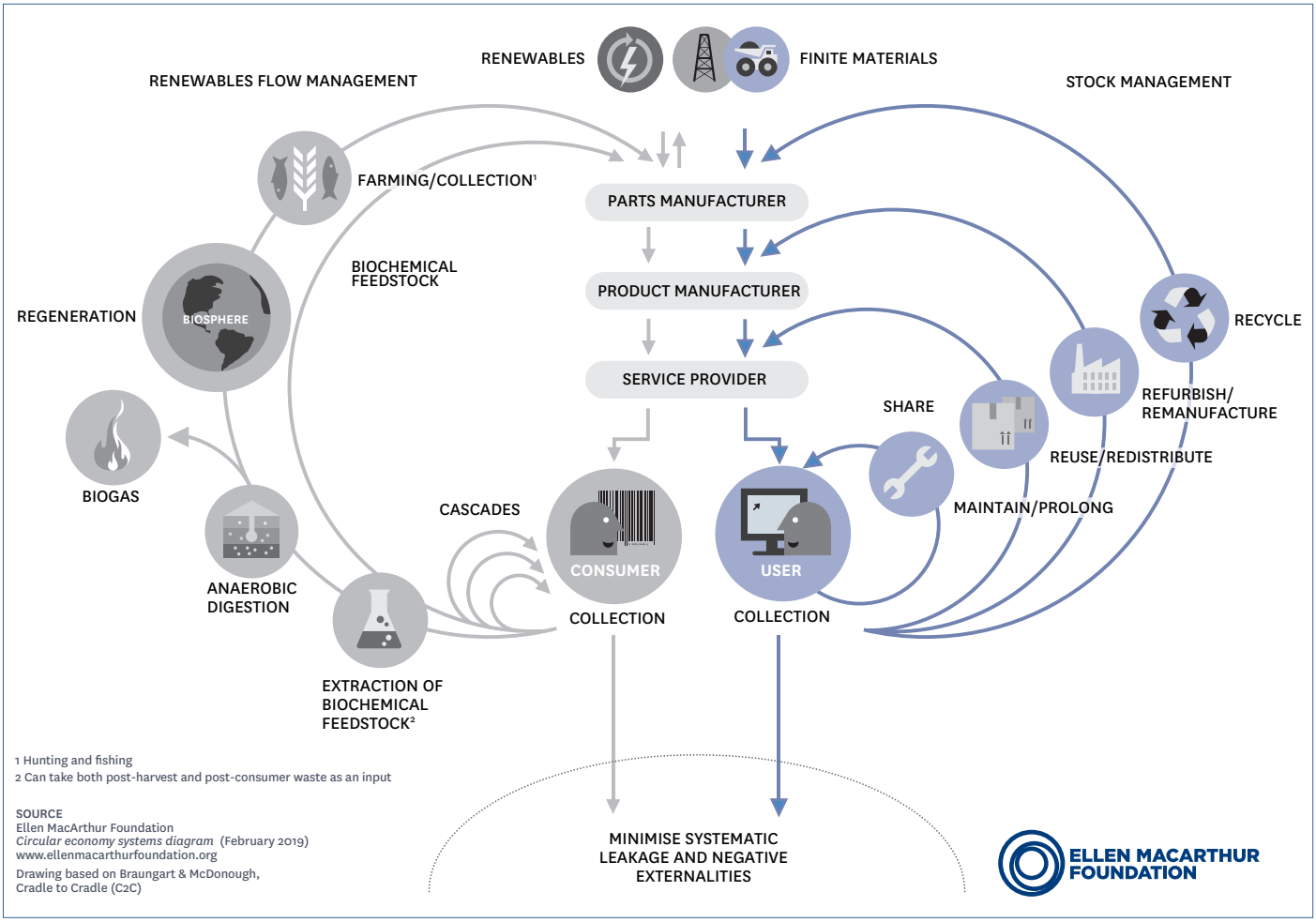
Zero waste and circular economy theory emerged to better understand and address both upstream and downstream impacts of waste. From the late 1990s, early zero waste advocates began calling for systemic solutions to supplement end-of-pipe waste management, including eliminating waste at source through product redesign, reducing the volume and pace of materials and products moving through the economy through reuse and recycling, and harnessing the wasted potential of organic materials through composting (Dickinson and Snow, 2003). Guided by values of fairness, redistribution and community resilience, the zero waste movement supports regulatory mechanisms to elicit producer responsibility and cost internalisation, and champions public investment and procurement being directed to localised resource recovery and zero waste business models (ibid.; Varshneya, Abbe and Danovitch, 2020; Simon, McQuibban and Condamine, 2020; Bianchi and Yates, 2021, p.2).

The zero waste approach is expressed in the waste hierarchy, now the mainstream cornerstone of effective waste policy (see Figure 2). The waste hierarchy prioritises preventing and reducing waste, and reusing products, over efforts to recycle, compost or dispose of materials because actions higher up the hierarchy are most effective at reducing both waste and emissions. The zero waste movement's systemic focus is combined with the practical, 'can-do' orientation characterised by grassroots movements, making zero waste both 'pragmatic and visionary' (Simon, McQuibban and Condamine, 2020, p.15). Today, zero waste is advanced by municipalities and NGOs globally, including local organisations like Para Kore and Zero Waste Network Aotearoa.

Overlapping with zero waste is the circular economy concept, emerging from William McDonough's 2002 cradle-to-cradle design framework, and popularised by the Ellen MacArthur Foundation (Burke, Zhang and Wang, 2021). The circular economy has garnered respect from governments, international agencies, NGOs and multinational corporations (Circle Economy, 2022, p.14), and is defined as 'a systems solution framework that tackles global challenges like climate change, biodiversity loss, waste, and pollution', underpinned by three key principles: 'eliminate waste and pollution; circulate products and materials (at their highest value); and regenerate nature' (Ellen MacArthur Foundation, n.d.b). Advocacy of the circular economy and zero waste dovetail, although the former has a more corporate and technological flavour and following. The circular economy's principle of regenerating nature also underscores new considerations, including the need to detoxify products and materials so they can circulate safely without causing pollution or toxicological harm (World Health Organization, 2018).

The circular economy butterfly diagram (see Figure 3) displays how resources should cycle in loops, prioritising the small closed

Figure 3: The circular economy butterfly diagram



Source: Ellen MacArthur Foundation (n.d.a)

loops closer to the centre of the butterfly as these reduce energy demand (mirroring the logic of the waste hierarchy, which also prioritises actions in accordance with resource efficiency and communicates this in a simple cascading visual). While relying on recycling can be circular, more energy-efficient closed-loop approaches include redesigning products and business models to reduce material footprints (e.g., sharing systems), or keeping products in use locally through reuse and repair. Practices like downcycling, incineration or landfill are discouraged as linear, 'open loop' practices. The butterfly diagram also shows that biological and technical materials should cycle in separate loops: these materials have different functions and mixing them makes their end-of-life recovery costly or impossible.

What do zero waste and the circular economy guide us to do in practice?

Today, the circular economy and zero waste are often marshalled in tandem, given that they are complementary and mutually reinforcing. Both highlight that waste and plastic pollution result from how we live, consume and do business, and interconnect with wider issues like climate change, social justice and public health. As waste and pollution are typically baked in at the product design phase, interventions must go up supply chains to decelerate resource extraction and simplify and reduce the products and materials cycling through the economy. The bigger picture that zero waste and the circular economy elucidate helps identify the necessary ambition and coordination to change the present trajectory and avoid false solutions that prolong root causes. Circle Economy's *Circularity Gap* reports, and the zero waste masterplans created by Zero Waste Europe (Simon, McQuibban and Condamine, 2020) and the Global Alliance for Incinerator Alternatives (Varshneya, Abbe and Danovitch, 2020) provide comprehensive and practical blueprints for implementing these visions in reality.

Currently the global economy is only 8.6% circular; it is estimated that this figure must double by 2032 for the planet to stay within 1.5°C of global warming (Circle Economy, 2022, p.30). Doubling circularity requires transforming production and consumption systems. Currently business models are built 'to stimulate repeat consumption and production and thus profits' (Burke, Zhang and Wang, 2021, p.1). Most products are inherently linear: short-lived and/or disposable, made from virgin materials, not designed for reuse, repair or recycling, and over-duplicated.[3] Too much economic activity is not regenerative. We carelessly use materials and additives that expose biological organisms to persistent organic pollutants and microplastics, and compromise efforts to circularise because recycling and composting activities can increase exposure and propagate these contaminants (World Health Organization, 2018). Furthermore, roughly one-third of food produced is not eaten (Scialabba, 2015). Food waste, consistently the largest portion of household waste globally, typically ends up decomposing anaerobically in landfills, producing methane.

A zero waste, circular economy would produce only what is needed, and most products would be built to last. Business models would favour sharing over individual ownership, reuse over single-use, and upgradeability over replacement to reduce

quantities of product in the economy, conserve resources and extend product lifespans. Examples of these models in practice include public transport, library/loan systems (beyond books – e.g., tool and toy libraries), laundrettes, clothing rental, app-based peer-to-peer sharing services, reusable packaging systems, whole-house deconstruction to salvage and reuse building materials, and easy and affordable repair of consumables, appliances and equipment (Blumhardt, 2021b; Bianchi and Yates, 2021, p.11).

Furthermore, organic materials would be kept separate at design and end-of-life. Biomass would be utilised regeneratively, with only the highest value uses extracted in low quantities and the majority composted locally to replenish soils via decentralised models that reduce transport, increase compost quality, create more jobs and build local food resilience (Prince, 2021a, 2021b). Products would also be safe to use; regulations would control use of hazardous additives, chemicals and materials, and of polymers in functions with elevated risk of microplastic degradation – e.g., textiles, or horticulture, agriculture, viticulture and aquaculture applications (CHEM Trust, 2015; BEUC, 2017; World Health Organization, 2018).

The techniques and solutions deployed for a zero waste, circular economy future must fit within prescribed carbon budgets. This likely means technological simplification based on 'what works', rather than over-reliance on complex, unproven and/or experimental technologies (that can be carbon intensive without evidence that they will deliver necessary upstream reductions in waste). Governments could better identify and support organisations already using existing technology to implement circular practice up the waste hierarchy. Innovation should focus on reconfiguring business models, practices and relationships across supply chains, and incentivising product redesign to reduce waste and toxicity (Burke, Zhang and Wang, 2021). Well-designed product stewardship can support these transitions and put responsibility on producers to achieve prevention, reduction and reuse outcomes (Blumhardt, 2021a),[4] alongside financial mechanisms to disincentivise linear business models and redistribute resources to those working to close the loop, including targeted levies, tax relief and subsidies (Burke, Zhang and Wang, 2021, p.14). Governments and industry must also invest in communications and standards around circularity, the necessary infrastructure and reverse logistics for circular practices, and the specific skill sets, mindsets and training for work in the circular economy (te Bokkel et al., 2021).

> The government has signalled a desire for more reusable/refillable packaging in various policy documents, but has advanced few regulations to support this; its latest signatory report to the Ellen MacArthur Foundation's New Plastics Economy Global Commitment did not cite a tangible, distinct policy action undertaken or in train to advance reuse ...

Moving New Zealand's economy from a line to a circle

Since 2017 the New Zealand government has done a lot to turn the page on previous decades of waste policy neglect (Blumhardt, 2018). The new policy direction has triggered a flurry of action: various measures to tackle plastics, including targeted bans; regulated product stewardship for six 'priority products'; increasing and expanding the waste disposal levy; and proposals to implement a beverage container return scheme, standardise kerbside recycling, mandate food scrap separation and collection, and update the New Zealand Waste Strategy, the Waste Minimisation Act and the Litter Act (Ministry for the Environment, 2021g).

The new-found momentum for waste policy is reflected by a rhetorical commitment to the circular economy both within and beyond the Ministry for the Environment (reflecting similar moves by the EU, the UK and several European countries).[5] In 2019 the prime minister's chief science advisor produced a seminal, 264-page report on rethinking plastics, with 51 recommendations addressing the full plastic life cycle, including the need for government-wide adoption of the circular economy. The circular economy was prominent in the emissions reduction plan discussion document (Ministry for the Environment, 2021e), and centre-stage in the proposed vision for the updated New Zealand Waste Strategy: 'A circular economy for Aotearoa New Zealand in 2050' (Ministry for the Environment, 2021f, p.25).

Climate policy has also driven significant waste policy developments. The Climate Change Commission, in response to the waste sector's 4% contribution to New Zealand's total greenhouse gas emissions inventory (81.2% of which arise from organic waste decomposing in landfills), recommended that the government set a target to 'reduce biogenic methane waste emissions to at least 40% below 2017 levels by 2035' (Climate Change Commission, 2021, p.302). This recommendation will influence efforts to remove organic waste from landfill, and the government has already proposed to require councils to collect household food scraps at kerbside and all businesses to separate their food scraps (Ministry for the Environment, 2022b). The Climate Change Commission advice also recommended that the government create strategies to move Aotearoa towards a circular economy and a bioeconomy, and appoint a minister and lead agency for these tasks. The commission understands the bioeconomy as essentially the biological cycle of the circular economy, viewing the latter as being 'about directly displacing fossil fuels with renewable biological resources' (Climate Change Commission, 2021, p.251).

Falling short, false solutions and fractured silos?

The government's intention to reduce our shameful waste footprint, using the

circular economy as a yardstick for progress, is undeniably positive. Furthermore, recognising waste and circularity as relevant to climate conversations, and the broadening interest in these topics across the public sector, is important. The task government agencies now face is to elevate and sustain ambition, while ensuring cross-sector coordination to avoid diluted goals or divergent policy approaches.

Falling short of ambition

Given the magnitude of the necessary transformation, even the most ambitious states fall short in activating circularity promises. The European Union has struggled to fulfil its ambitious Circular Economy Action Plan, and to consider policies that acknowledge biophysical limits to economic growth and intersecting social and ecological issues (Friant, Vermeulen and Salomone, 2021). Everywhere, the rhetoric–action gap is demonstrated by the lip service governments pay to the waste hierarchy, only for 'this golden principle [to be] pretty much thrown out the window' when policy, practice and investment concentrates towards the bottom of the hierarchy (Kunamaneni, Jassi and Hoang, 2019, p.257). Treating the hierarchy like a ladder to climb, rather than a funnel, should be avoided because of the real-world implications of path dependence and lock-in associated with investing at the bottom of the hierarchy.

The waste strategy consultation document released in 2021 acknowledged that New Zealand is 'behind the curve' on waste and must lift its ambition (Ministry for the Environment, 2021f, p.17). However, it proceeded to propose that the remainder of the 2020s be spent 'catching up' (p.31) by accelerating activities overwhelmingly focused on waste management and anti-littering (Blumhardt, 2021b). In response, Para Kore (2021) called the proposal 'catastrophically inadequate' given the scale and urgency of the ecological crises presented by waste and climate change. Similarly, the National Plastics Action Plan (Ministry for the Environment, 2021c) released earlier in 2021 was criticised by the Aotearoa Plastic Pollution Alliance and others because it 'lacks concrete and measurable targets, actions and investments at the top of the waste hierarchy, acknowledgement of Te Tiriti o Waitangi and mātauranga Māori, and does not address the human and ecological health impacts of chemical additives and microplastics' (Aotearoa Plastic Pollution Alliance, Para Kore and New Zealand Product Stewardship Council, 2021).

> The government could do more to clarify the meaning and purpose of the circular economy and zero waste, and share information about closed-loop processes and their importance.

A more ambitious aim would be to leapfrog rather than catch up – whereby New Zealand strides ahead with transforming business models, strengthening producer responsibility to achieve and finance upstream actions, and looking to mātauranga Māori to guide a place-appropriate, equitable pathway forward. More must also be done to ensure that products circulate in small, closed loops at the top of the waste hierarchy. Neither the emissions reduction plan discussion document, nor the waste strategy consultation document properly identified the role of new business models to increase circularity. While product stewardship has the potential to promote reduction and reuse, these activities are currently under-prioritised in scheme designs (Blumhardt, 2021a). The government has signalled a desire for more reusable/refillable packaging in various policy documents, but has advanced few regulations to support this; its latest signatory report to the Ellen MacArthur Foundation's New Plastics Economy Global Commitment did not cite a tangible, distinct policy action undertaken or in train to advance reuse (Ministry for the Environment, 2021a). Furthermore, the proposed updates to the Waste Minimisation Act 2008 included virtually no regulatory tools for outcomes up the waste hierarchy, except potential right to repair provisions, which are welcome , but not sufficient to transform the economy (Ministry for the Environment, 2021f).

Government investment and procurement should be allocated according to the waste hierarchy, and with greater transparency. Most local government waste minimisation expenditure is on recycling activities, such as kerbside recycling. Furthermore, without social procurement policies, most resource recovery service contracts are won by large corporations. The majority of the Covid-19 Response and Recovery Fund earmarked for waste went to infrastructure focused on downstream waste management, despite major infrastructure gaps for upstream prevention, reduction and reuse activity (Ministry for the Environment, 2021b). The contestable central government Waste Minimisation Fund has no mechanism to distribute funds according to the waste hierarchy. Furthermore, a lack of transparency hampers the ability to track funding allocations and the surrounding decision-making process. This includes the non-disclosure of the membership of the funding panel and the criteria against which applications are assessed, granted and rejected, and the fact that the ministry does not release complete information about all applicants and projects funded. Despite these limitations, PhD candidate Warren Fitzgerald analysed the publicly listed grants that have been awarded since the fund's inception and found that the overwhelming majority went to activity lower down the waste hierarchy (Zero Waste Network et al., 2021) (see Figure 4).[6]

Avoiding false solutions

Globally, endless false solutions have arisen that distort the meaning of zero waste and circularity: for example, technical efforts to 'get rid of waste', like waste-to-energy, downcycling or inventing compostable products. None of these challenge overconsumption or tackle upstream emissions; nor do they close the loop and slow down extraction by putting materials back to their original use. In fact, they risk creating market demand for waste generation, are usually expensive, and can generate a path dependence or lock-in effect. Furthermore, both bioplastics and compostable products put organic materials into technical contexts, while many downcycled products combine organic and technical materials. These approaches violate the circular economy's

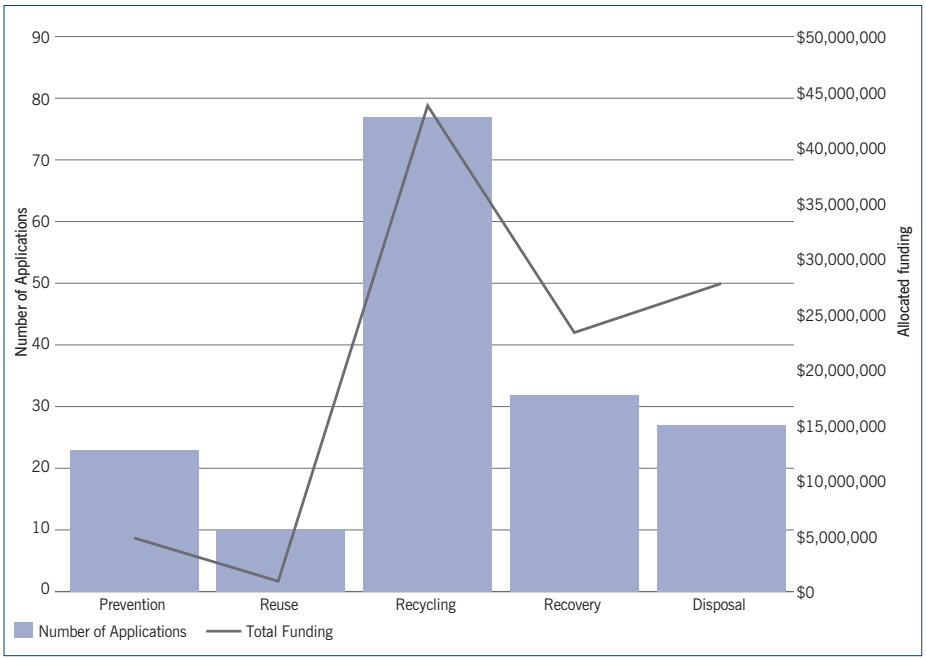
butterfly principle by mixing technical and biological loops, create 'monstrous hybrid' final products that are not themselves circular, or use soil as a waste disposal system for manufactured products. Many false solutions ignore or gloss over their toxicological impacts and cannot be described as regenerative.

In New Zealand, private and public entities are advancing many such projects, including research into bioplastics and waste-derived sustainable aviation fuel, using waste materials for construction supplies, agricultural products and roading, and numerous waste-to-energy proposals. The government could do more to clarify the meaning and purpose of the circular economy and zero waste, and share information about closed-loop processes and their importance. The Ministry for the Environment has released a position statement on compostable products, highlighting their potential toxicological impact for soil, waterways and human health and underscoring the preferability of reusable alternatives (Ministry for the Environment, 2022a). The ministry has also raised the possibility of expanding the waste disposal levy to capture downcycling and waste-to-energy (Ministry for the Environment, 2021f). The government could consider developing express funding restrictions or exclusions for activities that could constitute false solutions, and a clear position on waste-to-energy in a circular economy. There is also need for a lead agency to generate reputable, consistent and evidence-based information on the circular economy that can be referred to by all government agencies and the private sector to help avoid the concept's dilution via greenwashing. Improved economic and regulatory incentives for initiatives up the waste hierarchy would also shift attention away from false solutions.

Fractured silos

The ambition deficiency and dilution of zero waste and circularity risks exacerbation as the circular economy agenda is diffused across government agencies, and climate and waste portfolios. The increased focus on waste in climate policy could distort the long-term direction of waste policy and practice, unless the way emissions are understood better reflects the analyses produced by zero waste and circular economy theory. The strict adherence to production-based emissions accounting in New Zealand's greenhouse gas inventory (which counts emissions where they occur) effectively suggests that

Figure 4: Publicly Listed Waste Minimisation Fund grants according to the waste hierarchy



Source: Warren Fitzgerald (cited in Zero Waste Network et al., 2021)

waste's climate impact is limited to methane produced by organic waste in landfills. This overlooks the upstream embodied emissions of all waste products, from plastics, e-waste, textiles, furniture and packaging, to the upstream emissions associated with organic waste, such as avoidable food loss and waste. This oversight undervalues the climate impact of zero waste initiatives and has the unfortunate side-effect of continuing to marginalise resource use considerations in climate action debates, vis-à-vis transport, agriculture, renewable energy and tree planting. While these actions are critical, they only address part of the picture (Circle Economy, 2022, p.14).

Such neglect is not unique to New Zealand, but we do lack systematic methods to measure and manage consumption-based emissions and material footprints. While consumption-based emissions accounting may not be suited as the primary method for setting emissions targets and obligations, it is critical for waste and circular economy policy development (Afionis et al., 2017). The Climate Change Commission (2021) recognised that consumption-based emissions 'are a useful complement to the national inventory… [that] provide insights into the wider impact Aotearoa has on global emissions, carbon intensive supply chains and trade flows' (p.199). However, this was not mentioned in the government's emissions reduction plan discussion document, which largely overlooks embodied emissions (excepting some promising comments and initiatives in relation to buildings – e.g., the Building for Climate Change programme – but this approach is not translated to any other product, material or industrial sector).

Finally, the Climate Change Commission's circular economy and bioeconomy recommendations have catapulted circularity to the attention of agencies beyond the Ministry for the Environment.[7] This increases potential for cross-sector coordination, and more powerful upstream interventions to influence business models and supply chains. However, it also exposes the interpretation of circularity to ministries with different priorities, at a time when we still lack shared understandings of definitions, measurements and targets for circularity.

One area already exposing some shaky faultlines is the bioeconomy, which the Climate Change Commission has advanced as a stand-in for the biological cycle of the circular economy (an interpretation the emissions reduction plan discussion document adopts). However, the circular economy and bioeconomy come from different conceptual traditions, and emerging notions of a 'circular bioeconomy' are highly contradictory and immature in the literature (Giampetro, 2019; Prince, 2021b). In circular economy theory, the biological cycle limits overly exploitative and wasteful extraction of natural resources and biomass, and ensures that those resources and their nutrients return to nature to regenerate its life-sustaining and resource-providing capacity (Burke, Zhang and Wang, 2021, p.3). Reducing biomass wherever possible first, and harnessing the remainder to build soil

health or increase regenerative agriculture practices is prioritised (Prince, 2021a, 2021b; Zero Waste Network et al., 2021).

In contrast, the government's proposed bioeconomy is primarily concerned with feedstock replacement: i.e., displacing fossil carbon with renewable biomass for fuel, products, chemicals and food. Accounting for the impacts of natural resource extraction, or designing ecosystem regeneration into the system are not centre-stage. The government has tailored the bioeconomy to its goal of developing a bioenergy/biofuels sector to offset hard-to-abate emissions sources, rather than achieving circular economy outcomes. As such, it does not truly reflect the circular economy's biological cycle because it follows an extractive, not regenerative, model.

Establishing a new independent Crown agency for the circular economy could help avoid too many more divergent misinterpretations and siloes (Bianchi and Yates, 2021, p.6). Many jurisdictions currently leading in zero waste and circular economy policy have dedicated independent agencies or delivery bodies, such as Zero Waste Scotland, the Waste Reduction Action Programme in the UK and Sustainability Victoria in Australia. These agencies bring consistency, specific expertise and thought leadership to their respective jurisdictions, enabling effective delivery of government programmes, funding allocation and research, in alignment with best-practice understandings of circularity (Zero Waste Network et al., 2021). In New Zealand, an independent, te Tiriti-based agency, tasked with both delivery and research, and better able to connect into the existing expertise of local communities, might also soften the government's current top-down, sector-focused approach to wicked ecological problems, which undervalues mātauranga Māori and community knowledge and capability (Zero Waste Network et al., 2021; Para Kore, 2021; Stephenson, Kawharu and Burch, 2021; Bargh and Tapsell, 2021).

Coming full circle

The government is launching a multi-sector programme to move Aotearoa towards a low-waste, low-carbon circular economy by 2050. Policies on waste, climate and industry transformation are in development across public sector agencies. Locally and globally there is increased awareness that waste, climate, biodiversity and plastic pollution are interconnected. In Aotearoa, it is positive that environmental protection issues are no longer siloed to one ministry. More work is needed to ensure that all parties understand the purpose and depth of zero waste and circular economy theories, to sing from the same song sheet. Furthermore, despite all the talking, research and consultation documents, the jury is still out on whether the government can muster meaningful action to deliver the upstream transformation needed to move to an equitable zero waste, circular economy compatible with a world that stays within 1.5°C of global warming.

1 Between 2009 and 2019 waste to levied landfills increased by 47%. A decline in waste between 2019 and 2021 accounts for the smaller overall increase of 39% cited here. The Ministry for the Environment notes that this decline is likely due to Covid-19 and that longer-term trends suggest waste disposal is increasing.
2 The average lifetime efficiency of landfill gas capture in New Zealand is 68% (Ministry for the Environment, 2021d, p.377).
3 Over-duplication occurs when production of a particular item exceeds what is necessary to meet everybody's needs. It is typically connected with inefficient allocation of resources.
4 Product stewardship is about creating responsibility for products throughout their full life cycle, and implementing fair financing mechanisms to enable those responsibilities to be effectively discharged.
5 See European Commission, 2020; Department for Environment, Food and Rural Affairs et al., 2020.
6 Due to the limited information available, only 67% of total applications (representing 78% of total approved funding of roughly $277 million) could be classified.
7 The Ministry for Business, Innovation and Employment will likely be tasked with leading the circular economy and bioeconomy strategies.

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Jonathan Boston

Living Within Biophysical Limits
green growth versus degrowth

Abstract

Since the early 1970s there has been vigorous debate over whether global economic growth can continue more or less indefinitely on a finite planet. Central to the most recent version of this debate are the claims and counterclaims of those advocating 'green growth' and those advocating 'degrowth'. This article outlines and briefly assesses the main areas of agreement and disagreement between these contending schools of thought. It is argued that humanity must live within real, non-negotiable biophysical constraints. Failure to make the required transformation of the global economy soon will ultimately undermine social progress. But what level and form of global economic activity is ultimately compatible with ecological sustainability remains uncertain.

Keyword green growth, degrowth, decoupling, decarbonisation, environmental sustainability

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Vigorous debate continues over the feasibility and desirability of unending global economic growth, even at modest annual rates (e.g., 2–3%). At stake is whether economic growth, as measured by an increase in gross domestic product (GDP), is compatible with – and perhaps even necessary for – environmental sustainability and intergenerational wellbeing. In short, is global GDP growth (and higher per capita incomes) counterproductive and thus 'uneconomic', in the sense that the overall long-term costs will outweigh, and perhaps even dwarf, the overall long-term benefits? Further, even if global GDP growth is technically possible for much of the 21st century, is it feasible indefinitely, and what bearing should this have on current policymaking? Can there be an unlimited global economy on a finite Earth? Can humanity continue to increase the value of the goods and services it produces independent of resource throughput and damaging environmental impacts?

Central to the current debate are the contrasting assumptions, assertions and policy prescriptions of the advocates, respectively, of 'green growth' and 'degrowth'. Those championing 'green growth' (also referred to as 'sustainable economic growth' and 'ecomodernism') include major international organisations, such as the International Energy Agency (2009, 2021), the OECD (2011), the United Nations

Environment Programme (UNEP, 2011a, 2011b, 2017) and the World Bank (2012), along with numerous leading economists and policy experts.[1] Many green-oriented policy packages have been advanced over the past decade or so, such as the 'global green new deal', the 'European green new deal' and the US version. Significantly, however, not all proponents of the 'green economy' support continued, let alone indefinite, GDP growth.

For their part, the advocates of 'degrowth' (sometimes referred to as 'anti-growth' or 'post-growth') comprise researchers from multiple disciplines within the social and biophysical sciences, including many ecological economists.[2] While the global debate continues to evolve and new evidence is constantly emerging, the main fault lines are now well established.

This article identifies and briefly assesses the key claims and counterclaims at the heart of this debate. It proceeds as follows. First, it clarifies the meaning of several important terms and concepts. Second, it places the current debate in the context of earlier debates about the relationship between economic growth and environmental limits. Third, it summarises the main areas of agreement and disagreement between the contending schools of thought. Finally, it offers a brief assessment.

> '... decoupling 'is reducing the amount of resources such as water or fossil fuels used to produce economic growth and delinking economic development from environmental deterioration'

Several caveats

Several caveats deserve mention. First, doing justice to the scope and significance of the topic is impossible in a short article. The relevant academic literature on green growth and degrowth and their many variants is already vast and continues to expand rapidly. Moreover, it traverses an extraordinary range of issues – philosophical, ethical, political, technological, biophysical, behavioural, social, cultural and economic. Some of these issues are highly technical and inherently complex. There is also much disputed empirical evidence and numerous uncertainties. Accordingly, this brief analysis is limited to the main contours of the debate. It does not address, therefore, the wider societal and ethical issues raised by the green growth/degrowth debate, such as those relating to global governance, population limits, aid and development and intergenerational justice.

Second, several related schools of thought are ignored here. One of these is 'ungreen growth' or 'brown growth'; another is 'a-growth'. The former approach either rejects the need for the global economy to operate within biophysical limits or denies that such limits exist. Neither position is scientifically plausible. The latter approach involves being agnostic or neutral about GDP growth (see van den Bergh, 2009, 2011, 2017; van den Bergh and Kallis, 2012) and/or prioritising other policy goals (e.g., wellbeing, social welfare, etc.) (see, for instance, Jacob and Edenhofer, 2014). Such perspectives merit serious consideration. But while there are good reasons to deprioritise GDP as a performance measure, the suggestion that GDP growth is largely irrelevant or inconsequential from a policy perspective is less convincing. Politically, too, the proposition that governments should simply be indifferent to economic growth, and hence to changes in per capita incomes, is likely to be difficult to justify, not least in low-income countries.

Third, the relative merits of green growth and degrowth can be investigated at multiple scales (e.g., global, regional, national, sub-national) and over radically different time horizons (e.g., decades and centuries). Given the current serious ecological issues facing humanity at a planetary level – not least anthropogenic climate change, large-scale biodiversity loss, extensive pollution and rapid depletion of many non-renewable resources – the crucial analytical issues are global rather than local. In short, the fundamental question is whether continued (even modest) annual *global* GDP growth (both in aggregate and per capita) is a feasible and desirable policy objective over an extended time frame (e.g., the next 50–100 years) rather than, say, the next decade or two. Answering this question necessarily requires a global focus. Equally, the relevant timespan must be multi-decadal, not short term. What might be possible within individual countries (e.g., see Hatfield-Dodds et al., 2015) or over much shorter time horizons are separate issues and are not explored here.

Fourth, this analysis accepts the seriousness of the current global ecological challenges and hence the need for urgent and effective policy responses at the national and sub-national levels (e.g., see IPBES, 2019; IPCC, 2018, 2021; OECD, 2021). There is no suggestion, therefore, that the decisions of national policymakers, and especially those in the major economies (e.g., the US, China and the EU), are irrelevant to the green growth/degrowth debate. But it is beyond the scope of this analysis to consider national-level policy options, strategies and pathways, whether for major economies or much smaller ones such as Aotearoa New Zealand. That said, no country has fully embraced, let alone achieved, a genuinely sustainable pathway ecologically.

Defining key terms

Economic growth and gross domestic product (GDP)

Economic growth is typically measured by changes in GDP over a specified period (e.g., quarterly or annually). GDP is a monetary measure or indicator of economic value; it is not a measure of physical properties, such as natural resources or energy flows. It is generally defined as the market value of all the final goods and services produced in a country over a particular time frame. It can be expressed in various ways (e.g., as an aggregate or per capita measure), and changes can be measured in either real or nominal terms. Global GDP is simply the aggregate of the GDP of every nation (currently close to 200). In 2021 global GDP was approximately US$95 trillion. Significantly, the composition of GDP can, and does, change over time and it varies greatly between countries. For the purposes of this article, economic growth and GDP growth will be used interchangeably.

Green growth

The concept of green growth has various strands and definitions. In broad terms, it involves a commitment to continued GDP

growth, both globally and nationally, on the grounds that growth, at least of certain kinds, is beneficial in net terms – socially, politically and environmentally. The crucial caveat, however, is that future growth must be consistent with clearly identified biophysical limits at multiple scales (e.g., global, national and local). Accordingly, advocates of green growth support a raft of fiscal and regulatory policies to enhance the efficient use of resources (both renewable and non-renewable) and minimise waste (i.e., embrace a more circular economy), improve societal resilience, and minimise environmental pressures. To quote from a major OECD report, *Towards Green Growth*:

> A green growth strategy is centred on mutually reinforcing aspects of economic and environmental policy. It takes into account the full value of natural capital as a factor of production and its role in growth. It focuses on cost-effective ways of attenuating environmental pressures to effect a transition towards new patterns of growth that will avoid crossing critical local, regional and global environmental thresholds … It is about fostering economic growth and development while ensuring that natural assets continue to provide the resources and environmental services on which our well-being relies. (OECD, 2011, pp.10, 18)

Degrowth

As with 'green growth', the concept of 'degrowth' comprises multiple strands and definitions (see Hagens, 2020; Hickel and Kallis, 2020; Hickel and Hallegatte, 2021; IPCC, 2022; Ward et al., 2016). Indeed, those associated with the degrowth camp differ markedly in their philosophical, ideological and policy preferences. Hence, some degrowth proponents (for example, Jason Hickel and Juila Steinberger) have more affinity with green growth advocates, at least on certain matters, than with their more radical associates (e.g., see Seibert and Rees, 2021).

Be that as it may, degrowth advocates are united in rejecting economic growth as a legitimate policy goal and oppose using GDP as an indicator of societal progress or prosperity. Instead, much broader policy goals and progress indicators are favoured (Jackson, 2009 ; see also Stiglitz et al., 2009). Nonetheless, many advocates endorse (at least temporary) additional GDP growth per capita in low-income countries, if not also in emerging economies, to reduce poverty and enhance

> … there has been mounting evidence that humanity is harming vital biophysical systems, living beyond Earth's means … and exceeding 'safe' planetary boundaries …

human wellbeing. By contrast, continuing GDP growth in high-income (OECD) countries is rejected. There is no consensus, however, over whether average per capita incomes in high-income countries needs to fall, and, if so, by how much, over what specific time frame and by what means.

Second, degrowth advocates favour slowing and then reversing global resource consumption, commodity production and energy usage until they reach genuinely sustainable levels. This entails support for a raft of regenerative policies to reduce the aggregate use of natural resources (e.g., via comprehensive recycling, reusing, refurbishing, remaking, sharing, etc.), lower the physical throughput of the global economy, decrease overall energy consumption, and decarbonise global energy systems rapidly (i.e., within about three decades) to achieve net zero carbon dioxide (CO_2) emissions and large reductions in other greenhouse gas emissions.

Third, degrowth proponents generally favour stabilising the global population and ensuring a more egalitarian distribution of income and wealth, both globally (i.e., from North to South) and within individual nations. Some degrowth proponents believe a significant fall in the global population is essential.

Finally, degrowth proponents often emphasise that a failure to mitigate urgently the current global ecological challenges will inevitably slow, if not reverse, GDP growth, due to ever more disruptive and damaging impacts (e.g., more severe storms and droughts, sea level rise, massive crop failures, etc.) precipitating mass migration, increased conflict, economic shocks, financial instability and ineffective governance. In short, beyond a certain point, temperature increases will render further global growth impossible. This argument, while plausible, is not discussed here.

Decoupling

The concept of decoupling is pivotal to the debate between the advocates of green growth and degrowth (see Jackson, 2009; Hickel and Hallegatte, 2021; UNEP, 2011a; Ward et al., 2016). Put simply, decoupling 'is reducing the amount of resources such as water or fossil fuels used to produce economic growth and delinking economic development from environmental deterioration' (UNEP, 2011a, p.xi). Resources, in this context, embrace both renewable and non-renewable resources. The former include biotic resources, such as forests, animals and fish, along with renewable energy sources, such as solar, wind and geothermal.[3] Non-renewable resources include construction minerals, ores and industrial minerals, and fossil fuels.

Decoupling has various forms. First, there is a distinction between *resource* decoupling and *impact* decoupling. The former refers to delinking GDP from resource use, whether in aggregate or for specific material and energy resources (e.g., overall energy decoupling, fossil fuel decoupling, etc.); the latter refers to delinking GDP from environmental impacts (e.g., greenhouse gas emissions, ocean acidification, biodiversity loss, including the loss of insect pollinators, soil degradation and loss, air and water pollution, and ever-increasing waste), thereby reducing impacts per unit of output. Overall, the evidence points to a close correlation between aggregate resource use and environmental impacts, but actual impacts vary depending on the specific resource in question and the technologies employed (van der Voet, van Oers and Nikolic, 2004; Hickel and Kallis, 2020; Steinmann et al., 2017).

Second, there is a distinction between *relative* (or weak) and *absolute* (or strong). Relative decoupling implies that the growth in resource use and/or environmental impacts is slower than GDP growth (e.g., because of improved resource efficiency or substitution). For absolute decoupling, the rate of relative decoupling must exceed the rate of increase in GDP (i.e., resource use and/or environmental impacts must decline while GDP rises). As discussed later, while

some relative decoupling has occurred globally (and within many countries) over recent decades, absolute decoupling (whether resource or impact) has been limited. In other words, per capita GDP growth globally, coupled with ongoing population growth, has generally exceeded improvements in overall resource efficiency and efforts to reduce environmental impacts.

The context for the current debate

Debates about the potential for humanity to overshoot critical biophysical limits at a planetary scale are not new. In 1798 Thomas Malthus published *An Essay on the Principle of Population*, in which he argued that the size of the human population would ultimately be limited by scarce resources, not least food supplies. To quote: 'The power of population is indefinitely greater than the power in the earth to produce subsistence for man' (1798, p.13). To date, Malthus has been wrong.

Almost two centuries after Malthus, Meadows et al. (1972) argued in *The Limits to Growth*, and in various subsequent publications (Meadows, Meadows and Randers, 1992, 2004), that long-term exponential GDP growth is impossible, given Earth's limited natural resources and constrained absorptive capacity. Indeed, the MIT team claimed that even under the most optimistic assumptions concerning the nature and pace of technological innovation, continuing economic and population growth globally would eventually lead to overshoot and collapse. Such claims proved to be highly controversial and were the subject of many sustained and detailed rebuttals (e.g., Cole et al., 1973). Such critiques – which covered a range of methodological, empirical and normative issues – led many policymakers globally to dismiss the core arguments in *The Limits to Growth* (and related publications) as seriously flawed and misguided.

In recent decades, however, concerns about humanity's severe and widespread ecological impacts have intensified. In short, there has been mounting evidence that humanity is harming vital biophysical systems, living beyond Earth's means (i.e., consuming or damaging beyond what nature can regenerate), and exceeding 'safe' planetary boundaries (Rockström et al., 2009a, 2009b; Steffen et al., 2015, 2018). According to a recent OECD report, for instance:

> While global GDP per capita increased by more than 60% between 1992 and 2014, natural capital stocks per capita declined by nearly 40%, undermining future economic growth and well-being. One million plant and animal species now face extinction. (OECD, 2021, p.6; see also Managi and Kumar, 2018)

Green growth advocates believe that the fiscal and regulatory reforms needed for environmental sustainability will be unacceptable politically if citizens in high-income countries ... are confronted with a stark choice between ... environmental responsibility and ... continued improvements in living standards ...

Similar concerns have been raised by many other international organisations, along with scientific academies, governmental agencies and leading researchers.[4] There have also been various studies updating, and generally supporting, many of the assumptions and projections of Meadows et al. (e.g., Randers, 2008; Turner, 2008, 2019).

Broad areas of agreement

While the advocates of green growth and degrowth disagree about many things, there are also important areas of agreement (see, for instance, Hickel and Hallegatte, 2021; Hickel and Kallis, 2020; van den Bergh, 2017). These can be summarised as follows.

First, humanity faces many systemic complexities and multiple uncertainties – technological, ecological, social and political – with the potential for significant non-linear changes. Accordingly, the future cannot be fully known, the past may not provide a reliable guide to the future, and many surprises are likely, some positive, others negative. All this points to the need for a flexible and precautionary approach.

Second, there is a general acceptance that Earth, as a finite planet, exhibits various real, non-negotiable biophysical constraints. These include basic physical constraints. For instance, human settlements and related structures cannot get bigger indefinitely and non-renewable resources, if exploited continuously and not fully recycled or repurposed, will eventually be exhausted. Likewise, the (safe) absorptive capacities of Earth's biosphere are limited (e.g., the capacity to absorb greenhouse gas emissions and material waste), as are its regenerative capacities. These constraints must be respected if a modern industrial civilisation is to survive, let alone prosper. Against this, there is less agreement about where 'safe' boundaries should be drawn, what limits have already been exceeded, and the severity of the current biophysical risks. That said, few doubt the difficulties of forging a global path that is compatible with the full range of planetary and sub-planetary limits (Boston, 2011).

Third, there is broad agreement that the current global patterns of production and consumption are unsustainable ecologically. Moreover, supporting up to 10 billion people with an average per capita income of US citizens, and comparable per capita resource and energy use, is not feasible. Hence, significant changes are needed to investment flows, modes of production, transport and stationary energy systems, land management, and the use of material resources, both renewable and non-renewable. In particular, the global economy must be decarbonised (or 'defossilised') rapidly and a circular economy instigated, with minimal waste. These changes, it is generally accepted, will be impossible without globally coordinated, widely adopted and highly effective policy reforms and related behavioural changes. Current reform agendas fall far short.

Fourth, there is no dispute that significant and sustained absolute decoupling of resource

Table 1: Green growth versus degrowth: key issues, assumptions and claims

Issue	Green growth	Degrowth
Biophysical limits, including the absorptive and regenerative capacity of the biosphere	There are real, non-negotiable biophysical limits at multiple scales which is why global GDP growth must be 'green' if it is to continue indefinitely	There are real, non-negotiable biophysical limits at multiple scales which is why global GDP growth must discontinue, and sooner rather than later, in the interests of ecological sustainability and human wellbeing
Current ecological crises	There are multiple ecological crises; current global production and consumption patterns are not ecologically sustainable; significant policy changes are essential	There are multiple ecological crises; current global production and consumption patterns are not ecologically sustainable; radical policy changes are essential
Global population	The human population can be expected to stabilize at an ecologically sustainable level	Additional efforts are needed to stabilize the human population; some degrowth advocates favour a substantial fall in the human population by 2100
GDP per capita as a measure of economic progress	GDP per capita is a useful but inadequate measure; more comprehensive measures of progress and societal wellbeing are desirable	GDP per capita is neither a reliable measure of human wellbeing nor a proper focus for public policy; more comprehensive measures of progress and societal wellbeing are desirable
The desirability of further global GDP growth	Overall, GDP growth is welfare enhancing; prudent green growth strategies will accelerate the required technological transitions and generate higher long-term growth rates	Further GDP growth per capita is justified in low-income countries, but not in high-income countries. Continuing global GDP growth will make the required technological transitions harder by increasing aggregate demand for energy and natural resource, exacerbating harmful environmental impacts, and increasing the reliance on speculative negative emissions technologies
Constraints on global GDP growth	Assuming ecologically sound policies are adopted globally, the only long-term constraints on global GDP growth will be human creativity, technological innovation, and good governance; continued GDP growth can be expected in a fully circular, zero-carbon global economy	Fundamental biophysical constraints of various kinds will ultimately limit the capacity for further efficiency gains and resource substitution, thereby limiting further global GDP growth
Absolute decoupling	While the historical record provides no evidence of sustained absolute decoupling globally, the future can be different from the past. Rapid technological transitions are possible	The historical record provides no evidence to support the contention that long-term absolute decoupling is likely. Relative decoupling, however, has been occurring
Absolute resource decoupling	Absolute resource decoupling is technically feasible, but suitable policies will be needed to catalyse the required technological transitions	Absolute resource decoupling on the speed and scale required appears unlikely based on recent evidence. There are multiple behavioural, structural, institutional, and political barriers to rapid and sustained resource decoupling
Absolute impact decoupling	Absolute decoupling of global GDP growth and global GHG emissions is not only technically feasible, but with suitable policies can also be achieved at a rate sufficient to meet agreed global climate change targets and other important ecological goals	Absolute decoupling of global GDP growth and global GHG emissions appears unlikely based on recent evidence; rapid and sustained reductions in global GHG emissions to meet ambitious targets (e.g. a warming cap of 1.5°C) will require a significant decline in global GDP
Renewable energy technologies	Renewable energy technologies can power a modern industrial civilization	Some, but not all, degrowth proponents doubt whether renewable energy technologies can power a modern industrial civilization
Negative emissions pathways	Negative emissions pathways are technically viable and will become increasingly feasible economically	Both the technical and economic viability of negative emissions technologies are doubtful; some are highly speculative; it is too risky to rely on such technologies to achieve global GHG mitigation goals
Governance capacity and policy reform	Enough governments globally will design and implement sufficient 'green' policy reforms to enable sustained global GDP growth during the 21st century	The evidence to date raises serious doubts about the capacity and willingness of governments, whether democratic or otherwise, to implement the policy reforms needed for ecological sustainability
The damaging economic impacts of ecological problems	The negative impacts of climate change and other ecological problems have the potential to impede long-term global GDP growth which is why a green growth strategy is essential	The negative impacts of climate change and other ecological problems are likely to cause large-scale economic losses, damage critical infrastructure, and undermine existing social and political institutions

consumption and environmental impacts from global GDP growth is ecologically essential. Net zero greenhouse gas emissions globally, for instance, requires full decoupling, regardless of the level of economic activity. Plainly, this represents a demanding constraint. How best to respond remains hotly contested. Against this, there is no dispute that the pace of resource and impact decoupling can be changed and will, among other things, be influenced by the nature, scale and uptake of technological advances. That said, whether GDP growth can be rendered completely independent of environmental degradation remains uncertain.

Fifth, there is general agreement that the quest for ecological sustainability must not ignore other important goals (as reflected, for instance, in the Sustainable Development Goals), and especially the needs of the world's poorest citizens. This includes several billion people who currently lack access to electricity and proper sanitation, and nearly one billion people who experience regular or periodic hunger. It is recognised that ensuring an acceptable standard of living and universal access to basic services globally (e.g., education, health care, fresh water and energy) will require massive investment over a generation or more and almost certainly much higher GDP per capita in all low-income countries; achieving such outcomes will be challenging (see Millward-Hopkins et al., 2020). While degrowth advocates tend to be egalitarians and strongly support a just transition to a zero-emissions, circular and more inclusive economy, green growth advocates have widely divergent distributional preferences.

Finally, there is a partial consensus on the demand-side and supply-side policies required for greater sustainability. These include: better environmental governance, with improved goal setting, monitoring and reporting (see Petrie, 2021); 'green budgeting' (e.g., taxing/pricing environmental externalities such as greenhouse gas emissions, removing subsidies for the wasteful use of land, energy and natural resources, and robust resource rentals); a range of industry- and sector-specific measures; comprehensive regulatory measures to limit environmental harms, protect biodiversity and enhance the efficient use of resources (e.g., strict efficiency standards for all buildings and appliances, requirements for firms to recycle their products along their entire lifetimes, standardised requirements to lower the transaction costs of technology and network integration, etc.); and higher investment in environmentally relevant research and development. Many degrowth proponents go much further, arguing for comprehensive national planning, massive public investment (with long-term horizons) and vigorous 'technology-forcing' regulation, if not the fundamental rethinking of modern capitalist institutions and market-oriented policies (e.g., monetary and fiscal policies, the nature and role of property rights, the operation of major financial institutions, etc.).

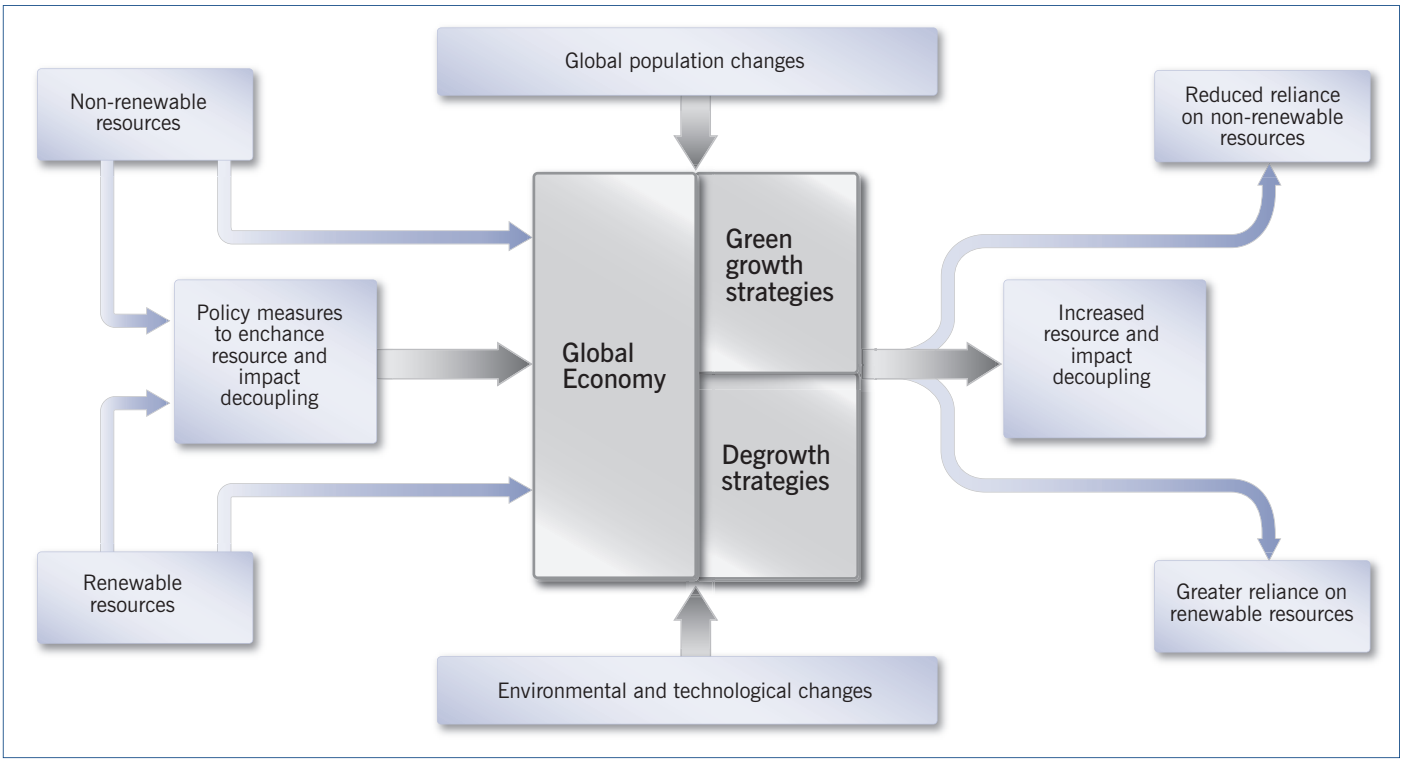
Key areas of disagreement

Turning now to the empirical and normative issues at the centre of the green growth–degrowth debate, these are summarised briefly below (see also Table 1), followed by a more detailed discussion of absolute decoupling.

The overall long-term desirability of GDP growth

While both schools of thought acknowledge the limitations of GDP as an indicator of societal progress and reject *unconditional* GDP growth, green growth advocates believe that GDP growth, at least of a particular kind, not only enhances overall human wellbeing and reduces poverty, but also facilitates improved environmental outcomes and more rapid technological and structural transitions. Indeed, if properly regulated, growth will both drive the required ecological transformation and trigger new sources of growth. By contrast, it is argued that a degrowth strategy – to the extent that a long-term contraction of GDP can be engineered, whether across the OECD or globally, perhaps by comprehensive planning and/or quantitative caps on resource use – will increase unemployment and inequality, reduce resource efficiency, undermine public finances, diminish the capacity to invest in resilient, climate-aligned infrastructure, and provoke deep political tensions. Accordingly, deliberately contracting GDP is neither necessary nor sufficient for ecological sustainability; economic growth should thus

Figure 1: The global economy and resource and impact decoupling



remain a core policy goal, including in high-income countries.

As noted earlier, degrowth proponents disagree on all these points. In particular, they reject the proposition that GDP growth will help catalyse the required technological transitions, including a radical recomposition of global consumption patterns; on the contrary, it will make such transitions harder by increasing the aggregate demand for resources and energy.

The speed, scale and scope of the required technological innovations

Overall, green growth advocates believe that current and likely future technologies, if supported by suitable policies, can enable both absolute resource and absolute impact decoupling to occur at a speed, scale and scope necessary to achieve crucial ecological goals (e.g., global decarbonisation at a rate sufficient to avoid warming of more than 1.5°C or 2.0°C). For various reasons, many degrowth advocates doubt such assumptions. These include the limits to resource substitutability, the constraints imposed by the laws of thermodynamics on efficiency, the challenges of path dependence (e.g., due to the long lifetime of most physical infrastructure, including carbon-intensive energy systems), and related barriers to socio-technical transitions (see Geels and Schot, 2007; Geels et al., 2017; also Chapman, 2019).

The political feasibility of the respective strategies

Green growth advocates believe that the fiscal and regulatory reforms needed for environmental sustainability will be unacceptable politically if citizens in high-income countries (and subsequently elsewhere) are confronted with a stark choice between, on the one hand, environmental responsibility and, on the other, continued improvements in living standards (e.g., as reflected in higher per capita incomes, comprehensive social services, adequate pensions, etc.). Moreover, a degrowth strategy is considered politically implausible: proactively engineering a long-term contraction of GDP while simultaneously transforming economic structures and energy systems and redistributing income and wealth to low-income citizens would require policy measures well beyond those possible in a democracy, certainly in peacetime.

Degrowth advocates dispute such claims, arguing that a completely new 'social contract' is imperative and, ultimately, unavoidable.

> … questions arise over proposals to rely heavily on bioenergy with carbon capture and storage … to assist with the energy transition and subsequently to secure negative net emissions globally …

Prevarication will only increase the overall economic and other sacrifices required. Equally, some doubt the political viability of critical aspects of the green growth approach (e.g., because of the power of vested interests).

Psychological dispositions

Standing back from all the particulars of the debate, the respective schools of thought diverge in their psychological dispositions, or mental models. First, imagination: degrowth advocates find it hard to imagine a world where GDP growth continues more or less indefinitely, while green growth advocates find it equally hard to conceive of a world without ongoing GDP growth (e.g., some kind of stable or steady-state economy). Second, optimism: relative to many of their degrowth counterparts, (most) green growth advocates tend to be technological optimists, with a high confidence in human ingenuity. Also, to the extent that both camps include optimists, their hopes lie in different futures for humanity. That said, some degrowth advocates are undoubtedly pessimistic, if not fatalistic, about humanity's prospects.

Absolute decoupling

At the core of the debate over absolute decoupling are several crucial questions, none of which are amenable to a simple answer. First, what rates of resource and impact decoupling are needed to achieve various desired ecological outcomes (e.g., the key goals of the Paris Agreement and other relevant international instruments)? Clearly, answers will depend, among other things, on exactly how such goals are specified, including the level of acceptable risk. Second, what assumptions can reasonably be made about the speed, scope and scale of resource and impact decoupling by, say, 2050? And are the optimistic claims of many green growth advocates about both the potential and likely rates of decoupling justified? Third, and related, would global GDP growth, other things being equal, facilitate a significantly higher sustained rate of both resource and impact decoupling than would otherwise be possible (e.g., by increasing relevant public and private investment, encouraging more rapid shifts in consumption patterns, and enabling faster technological and structural transitions)? Alternatively, will any additional efficiency gains associated with GDP growth be overwhelmed by the tendency for such growth to increase overall environmental impacts (via the rebound effect or Jevons paradox)?[5] This section offers some brief reflections on the issues surrounding resource and impact decoupling. Figure 1 provides a simplified representation of the process of resource and impact decoupling at the global level.

Absolute resource decoupling

Natural resource use globally reached an estimated 100 billion metric tons annually in 2020. This is claimed to be about double the maximum sustainable boundary level (Bringezu, 2015; Bringezu et al., 2017; Hoekstra and Wiedmann, 2014; Hickel and Kallis, 2020; Hickel and Hallegatte, 2021). If so, a massive reduction in aggregate resource use will be necessary during the 21st century, as well as large shifts in consumption patterns to reflect the relative scarcity of different resources. Achieving such changes, even with much lower (or zero) GDP growth, will require dramatic gains in resource efficiency (well above average historical rates), large-scale substitution, and a huge increase in resource recycling. Realistically, from a technical perspective, how rapidly could such changes be achieved? And could the required transformation occur within the very limited time frame available if the global economy continued to grow at a moderate pace?

Degrowth advocates are pessimistic. First, it is acknowledged that a relative decoupling

of global GDP from total world material and energy consumption has occurred since the mid-20th century, with an expanding gap between GDP and resource use. But the pace of dematerialisation of GDP growth slowed in recent decades (Hickel and Kallis, 2020). More importantly, there is no evidence yet, despite the large shift in consumption towards services and away from manufacturing, that the world economy has experienced sustained absolute resource decoupling (Ward et al., 2016). At best, such decoupling has been limited to specific countries (e.g., Germany) and certain resources (e.g., via efficiency gains and/or substitution). For the future to be radically different, a massive upswing in the pace and diffusion of technological change and related material efficiency improvements would be needed, one sufficient and sustainable in the long term to negate the Jevons paradox and counteract the impact of continuing global population growth (see Schandl et al., 2016). Degrowth advocates doubt whether such outcomes are realistic.

Second, and related, it is argued that permanent decoupling, both absolute and relative, is 'impossible for essential, non-substitutable resources because the efficiency gains are ultimately governed by physical limits' (Ward et al., 2016). Such resources include land, fresh water, soil and a stable climate: they lack obvious substitutes (excluding other planets), yet are essential to meet basic human needs. Moreover, physiological constraints govern the efficiency of water use by crops and there are photosynthetic limits to plant productivity. Many non-renewable resources are, of course, substitutable, but their substitutes may also be non-renewable and thus limited in supply.

Third, some degrowth advocates highlight both the technical (e.g., thermodynamic) and societal limits to a largely circular economy. Currently, aside from biomass, less than 10% of all materials processed globally are recycled. Further, many materials cannot readily be recycled or reused, high levels of path dependence will slow the pace of recycling where it is technically viable, many countries and sectors are unlikely to follow best practice in efficient resource use, and in-use stocks of materials (e.g., physical infrastructure and buildings) continue to grow, thus constraining the scope for circularity. Yet without high levels of circularity, certain non-renewable resources – even gravel and sand – will eventually run out.

In brief, green growth advocates generally respond to these concerns as follows. They accept that some essential resources are non-substitutable and that, thus far at least, population growth and increased affluence globally have nullified (most of) the resource efficiency gains from technological innovation, but they maintain that the future can be different. For one thing, the current technical limits to improved efficiency and substitution are far from being reached; for another, breakthrough technologies (e.g., nuclear fusion) could extend these limits radically. Hence, hitherto unprecedented gains in resource efficiency (e.g., several times higher annually than the historical average) are technically possible, thereby making rapid absolute resource decoupling a realistic option (Hatfield-Dodds et al., 2015; Schandl et al., 2016; see also the reply to both from Lenzen et al., 2016). It is accepted, however, that this would require major policy reforms globally, massive investments in research and development, and the swift uptake and diffusion of many current and new technologies.

> Given the existing ecological crises, both green growth and degrowth advocates readily accept the need for radical technological changes, including rapid de-carbonisation and greatly enhanced energy and resource efficiency.

Of course, much the same requirements would apply under a degrowth scenario. Degrowth by itself is thus no substitute. Yet, as noted earlier, securing sustained political support for transformative policy reforms may well be much harder if governments are simultaneously pursuing a long-term strategy of economic contraction (or even zero GDP growth), let alone seeking to implement fundamental changes to the core institutions of modern capitalist economies.

Absolute impact decoupling

Any limits to absolute or relative resource decoupling will necessarily constrain the scope for absolute impact decoupling, even with a concerted shift to lower-impact resources and different consumption patterns. Equally important, absolute impact decoupling (e.g., to meet global greenhouse gas mitigation goals) will depend heavily on whether: a) global energy and transport systems can be rapidly and fully decarbonised (e.g., by 2050 or soon after); and b) there is a significant reduction in the energy intensity (the amount of energy used per unit of output) of the global economy (e.g., via improved energy-service efficiency and conservation). Degrowth advocates accept the possibility of absolute decoupling of greenhouse gas emissions from global GDP growth, but doubt whether the required magnitude and speed of such decoupling is technically possible and/or likely in practice even if technically possible (e.g., because of political resistance and inappropriate policy settings) (Hickel and Kallis, 2020).

First, questions arise over proposals to rely heavily on bioenergy with carbon capture and storage (BECCS) to assist with the energy transition and subsequently to secure negative net emissions globally (that is, later in the century to address the likely overshooting of global warming limits) (Anderson and Peters, 2016; McLaren and Markusson, 2020). BECCS involves sequestering CO_2 from the atmosphere via large plantation forests, harvesting the trees, burning them for energy, and then capturing and storing the released CO_2. Yet any significant reliance on BECCS would require massive forest plantations covering extensive areas of land, with likely negative implications for global food production and biodiversity loss. Success would also depend on large-scale, permanent and secure storage of CO_2. The technical challenges to such a strategy are likely to be daunting, yet even more essential to overcome under a scenario involving continuing global economic growth.

Second, degrowth advocates argue that aggressive mitigation strategies to achieve net

zero CO_2 emissions by around 2050 without BECCS (or other negative emissions technologies) will face formidable hurdles. If global GDP grows at an average annual rate of about 3% over coming decades, it is estimated that to have a roughly two-thirds chance of avoiding warming of more than 1.5°C, the rate of decoupling annually must be at least 10% – or around 7% to meet a 2.0°C warming cap (Hickel and Kallis, 2020). Even greater decoupling rates will be needed in high-income countries if such countries are to make a fair contribution to the global mitigation effort (and/or reduce the risks of overshooting the warming caps). With zero or very low annual global growth, the required decoupling rates would be somewhat lower. Even so, the required rates would exceed anything hitherto achieved globally by a large margin. Might this be possible?

There are various studies using different models and assumptions (including varied growth assumptions) exploring this question (IPCC, 2018). In short, any potentially plausible scenario involving the rapid absolute decoupling of greenhouse gas emissions from GDP growth requires most, if not all, of the following elements:

- a massive expansion of renewable energy technologies (RETs), especially solar and wind, and related energy storage capacity, with total renewable energy capacity needing to double every five to eight years by 2050 (depending on trends in aggregate energy demand);
- the complete decarbonisation of the world's transport fleets (including around one billion cars and 400 million trucks and vans) and key industrial processes (e.g., the production of steel and cement);
- large-scale afforestation and soil regeneration;
- a significant reduction in the energy intensity of the global economy;
- substantial efficiency improvements in the use of non energy-related resources;
- significant changes in food production (e.g., away from livestock agriculture);
- minimising any rebound effects; and
- various behavioural, social, cultural and institutional changes to enable systemic reforms and accelerate the diffusion of new technologies (see, for instance, Grubler et al., 2018; IPCC, 2018).

Degrowth advocates doubt whether many of these outcomes are achievable, particularly under scenarios involving significant economic growth. Take, for instance, a rapid transition to a 100% reliance on RETs and the related uptake of electric vehicle technologies (EVTs). According to many degrowth advocates, not only will such transitions require substantial additional overall electricity-generating capacity (even more so with economic growth), but they will also require hitherto unprecedented levels of investment in new energy systems. It is claimed that the scale, complexity, and cost of the energy transition, including likely information asymmetries, supply chain problems, bottlenecks and path dependencies, has been seriously underestimated by green growth advocates. Replicating the remarkably efficient energy storage function of fossil fuels, whether via electro-chemical batteries, pumped hydro storage or other means, will be massively challenging technically, as well as costly economically and in resource terms (Palmer and Floyd, 2020). In this respect, Aotearoa New Zealand is relatively fortunate given its substantial hydro storage capacity and the option to develop pumped hydro.

> Leaving technological uncertainties aside, our governance arrangements, both democratic and otherwise, remain deeply problematic.

Related to this, many degrowth proponents argue that various natural resources essential for RETs and EVTs, including many 'critical raw materials' (e.g., cobalt, lithium, rare earth elements, etc.), are relatively scarce, often environmentally and socially damaging to exploit, and sometimes located in areas of political instability (Michaux, 2021; Seibert and Rees, 2021; see also Sovacool et al., 2020). Another common claim is that RETs cannot power a modern industrial civilisation without some reliance on fossil fuels. This is because – or so it is argued – some RETs (e.g., corn ethanol, biodiesel and solar PV) have low energy returns on energy invested (EROEI or EROI), some raise energy storage issues (e.g., wind and solar), and some have limited lifespans and/or significant recycling costs (Ferroni and Hopkirk, 2016; Hall, 2017; Murphy and Hall, 2010). Aside from this, many degrowth advocates doubt that current market-based or neo-liberal policy approaches can achieve the non-marginal, disruptive, system-wide re-engineering of global energy systems by 2050.

Unsurprisingly, these claims have generated a large literature, with substantial debate over numerous technical, methodological and measurement issues (see, for instance, Fthenakis et al., 2021; Raugei et al., 2017). Assessing all the claims and counterclaims of energy economists and other experts is not possible here. Importantly, however, concerns about low EROI for RETs have been vigorously rebutted point by point (see Diesendorf, 2021; Diesendorf and Wiedmann, 2020; Raugei and Leccisi, 2016; Raugei et al., 2017). Much the same applies to other key objections to relying fully on RETs and EVTs (note that EVs have energy conversion efficiencies about three to five times those of internal combustion engines). It is accepted, however, that the projected demand by 2050 for some material resources may exceed currently known reserves (Bobba et al., 2020; Junne et al., 2020) and that much better environmental regulation of mining is vital. But technological innovations over the coming decades, including recycling and substitution, and efforts to diversify supply sources are expected to ease critical resource pressures.

Such rebuttals have given green growth advocates confidence that a growing global economy can be powered 100% by RETs for some time, if not indefinitely, and that the investment funds required for the massive energy transition can be mobilised, as long as governments implement supportive regulatory and pricing policies. Indeed, the transition is already well underway, albeit too slowly currently to meet ambitious global mitigation targets (International Energy Agency, 2021).

Whether, and to what extent, the global transition will accelerate during the 2020s depends heavily on policy settings in the major economies, especially the US, EU, China and India, and the investment decisions of large international corporations and financial institutions. Currently, the outlook is mixed. If the Biden administration fails to secure congressional support for significant federal decarbonisation measures

and/or if the US Supreme Court blocks vital regulatory initiatives, other major global players, particularly China, may be less inclined to take bold measures. In this scenario, the global transition will be much slower than desirable. Against this, Russia's invasion of Ukraine may spur investment in RETs and EVTs, contributing to significant technological innovations. Realistically, what Aotearoa New Zealand does on the climate mitigation front will have little global impact, except perhaps for livestock emissions. But this does not lessen the long-term economic wisdom of, let alone the moral case for, radical policy measures to enhance ecological sustainability.

Conclusion

There is increasing recognition that humanity must live within real, non-negotiable biophysical constraints at multiple scales. Failure to do so will eventually prevent, if not reverse, economic and social progress. But what level and form of global economic activity is ultimately compatible with ecological sustainability remains uncertain. That said, continued global GDP growth over an extended time horizon – and even maintaining current levels of economic activity – will only be possible under strict conditions. These include adequately protecting the resilience of vital ecosystem services and biophysical systems. Currently, these conditions are not being met.

Given the existing ecological crises, both green growth and degrowth advocates readily accept the need for radical technological changes, including rapid decarbonisation and greatly enhanced energy and resource efficiency. They differ, however, over whether ecological sustainability will also require significantly (and perhaps rapidly) slowing, if not reversing, global GDP growth and the political feasibility of their respective policy approaches.

Assessing the validity of these contrasting perspectives is difficult because of multiple deep uncertainties. Two such uncertainties are critical. The first concerns the speed with which current and future breakthrough technologies are developed and comprehensively applied, and hence the potential pace and scale of absolute resource and impact decoupling. The second concerns the capacity of current governance arrangements, both global and national, to design and implement policy frameworks sufficient to catalyse and accelerate the necessary energy and resource transitions, including widespread and substantial changes in consumer behaviour. In both cases, the judgements of experts appear to be influenced not only by evidential considerations, but also by philosophical, ideological and psychological dispositions. In short, technological optimists, neoclassical economists, and those who doubt the political viability of economic contractionism (whether in democracies or autocracies) are drawn more strongly to the green growth camp.

Leaving technological uncertainties aside, our governance arrangements, both democratic and otherwise, remain deeply problematic. Here the evidence points unequivocally to a fundamental mismatch between the scale of humanity's ecological challenges and the capacity and willingness of citizens and policymakers to respond (Hagens, 2020). If this mismatch persists for a decade or more – perhaps due to a combination of cognitive biases (including myopia and denial), ideological preferences, geo-political conflicts, short-term electoral pressures and powerful vested interests – then the required transitions may be too slow. In this scenario, the ecological crises will deepen and the negative impacts will increase, eventually causing large-scale damage to critical physical infrastructure and widespread supply disruptions. At that point, global degrowth may become inevitable (Keen, 2021). The resulting social and political tensions will be immense, and probably unmanageable. In short, modern civilisation could destroy itself. Such an outcome, while tragic, would not be totally unprecedented. Previous civilisations have mismanaged their environments and suffered dire consequences – the Sumerians, Babylonians and Mayans, to name but a few (Diamond, 2005).

But suppose enough governments respond swiftly and effectively and the required systemic, technological and behavioural changes occur within ecologically sustainable time frames: is indefinite GDP growth then a plausible scenario? Interestingly, some ardent supporters of green growth say no. To quote Nicholas Stern: 'Strong growth, of the right kind, will be both necessary and feasible for many decades … [But] This is not to claim that the world can continue to grow indefinitely … A picture of indefinite expansion is an implausible story of the future' (Stern, 2009, p.10).

Yet perhaps humility, in the face of deep uncertainty and complexity, requires a more equivocal answer.[6] As Hickel and Kallis (2020) acknowledge, 'as long as ultimate limits in efficiency and substitution have not been reached', the question cannot be answered definitively. That, in my view, constitutes a prudent response.

Nevertheless, to minimise the risk of a catastrophic ecological collapse globally, prudence also requires immediate, bold and transformative actions, at all levels of society and in every sphere of economic and social life. As a recent editorial in the authoritative journal *Nature* (2022, p.361) concluded, 'the world is running out of time'.

1 See, for instance, Carney, 2021; Fiorino, 2018; Hall, 2016; Pollin, 2018; Stern, 2007, 2009.
2 See, for instance, Brown et al., 2011; Costanza et al., 2014; Hagens, 2020; Hickel and Kallis, 2020; Hickel, 2021; Kallis, 2011; Jackson and Victor, 2019; Mastini et al., 2021; Murphy et al., 2021; Otero et al., 2020; Pollitt, 2022; Schröder and Strom, 2020; Vogel et al., 2021; Ward et al., 2016; Wilkins and Murphy, 2021.
3 But note that expanding the reliance of the global econoy on solar and wind energy requires the exploitation of many non-renewable, and hence finite, resources, as discussed later.
4 See, for instance, Arrow et al., 2004; Bradshaw et al., 2021; Dasgupta, 2021; Folke et al., 2021; IPCC, 2018, 2021, 2022; IPBES, 2019; Stern, 2007; UNEP, 2011a, 2011b.
5 The Jevons paradox or rebound effect involves the tendency for cheaper and more energy-efficient services, whether arising from technological progress or policy changes, to increase the demand for energy and other resources, thus resulting in smaller reductions in overall energy consumption than otherwise expected.
6 On the need for and virtues of humility in the public sphere, see Annala et al., 2021.

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Sonia Mazey and Jeremy Richardson

Is the Aotearoa New Zealand Policy Process Fit for Purpose?

Abstract

New Zealand is generally thought to be well governed by international standards, with low levels of corruption, innovative policies in some sectors, and high levels of trust in the system of government. But all is not well in the public policymaking system. Rather, the system resembles an endless conveyor belt of unsolved, or partially solved, policy problems that have a tendency over time to become bigger 'crises'. Effective public policymaking is hard and policy 'stuff-ups' happen worldwide. But New Zealanders should not accept policy failures as a fact of life. Our central thesis is that, via a series of reforms, the policymaking process could become much more effective in achieving successful policy outcomes.

Keywords policy failure, deliberation, policy commissions, implementation, ministers, public servants

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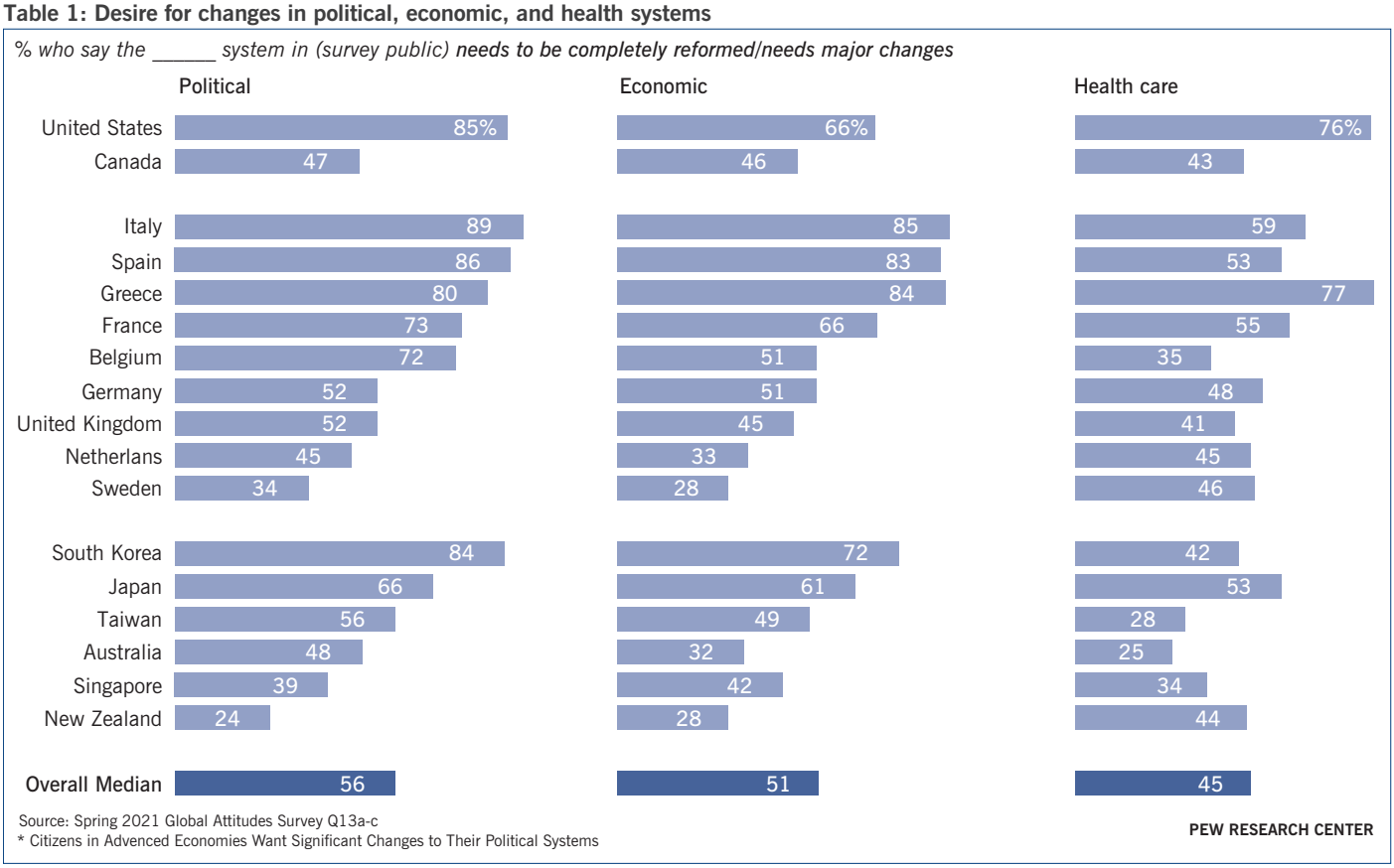
Introduction: the New Zealand paradox

We are puzzled. As public policy analysts who have been researching public policy processes over decades and across several countries and jurisdictions, we find the New Zealand case unusual. New Zealand is highly regarded internationally as a policy innovator, specifically with regard to the establishment of an independent central bank, the introduction of Kiwisaver, the creation of Pharmac and of ACC.[1] Additionally, the New Zealand politico-administrative system ranks highly internationally for lack of corruption, high-quality public service and high levels of public trust in governance institutions. Along with the country's 'clean and green' environmental image, New Zealand's governance structures are widely admired overseas. Many insiders also share this view. As a former chief executive of the Department of the Prime Minister and Cabinet has noted, 'New Zealand is relatively well served in its policy formulation processes and decision-making' (Wevers, 2021, p.209). Similarly, the Public Service Commission's deputy commissioner, Hannah Cameron, recently argued that the public service's 'focus on building confidence in the public service ... has paid off: it was already strong prior to the pandemic, and broadly speaking, we're seeing that maintained throughout time' (Ross, 2022).

Yet just as New Zealand's environmental policy track record is not as clean and green as widely marketed overseas, our public policy system is also less robust than typically portrayed. Our central thesis is that there is a very different way of 'framing'[2] the New

Table 1: Desire for changes in political, economic, and health systems



Source: Wike et al., 2021

Zealand policy system. Many insiders, and even more overseas observers, focus on the 'good' aspects of New Zealand's governance system: low levels of corruption, high levels of public trust and lack of deep social cleavages.[3] In contrast, our 'frame' is anchored in a critical evaluation of policy outcomes: namely, does the policymaking system deliver effective policy outcomes to those who need them? Viewing the system through this lens, we see a disconnect between what we – as policy researchers – see as an almost overwhelming conveyor belt of unsolved policy problems and the relative lack of demand among policymakers,[4] or indeed from the general public, for reform of the New Zealand public policymaking process.

Indeed, in a recent survey of advanced democracies undertaken by the Pew Foundation, New Zealanders were the most satisfied with their political and economic system (see Figure 1). As the report indicated, citizens of many advanced democracies see need for significant political, economic and healthcare reform (Wike et al., 2021). By contrast, fewer than a quarter of New Zealanders believed complete or major reform of our political system was needed, and only just over a quarter thought major economic reform was necessary. Only in healthcare does New Zealand come close to the median level of concern. Interestingly, citizens in Germany, which by international standards has a well-funded public health service, were slightly more concerned than their New Zealand counterparts about public healthcare provision. (German per capita public spending on health is US$5,729, compared to US$3,355 in New Zealand.) Similarly, when we compare New Zealand with a much smaller country, Sweden, its per capita public spending on health is US$4,895 (OECD, 2021), but Swedes are also more inclined to see healthcare reform as necessary than are New Zealanders. To use a topical comparison in the context of the current Covid-19 Omicron outbreak, in 2020 Germany had 33.9 ICU beds per 100,000 population and Sweden 5.8 beds, compared to New Zealand's 3.6 (OECD, 2020).

There are many possible reasons for this apparent disconnect, but one obvious explanation is to be found in two related concepts drawn from sociology, 'relative deprivation' and 'reference groups'. In relatively affluent societies, individuals feel deprived not in absolute terms, but relative to a chosen reference group, namely a group that enjoys a lifestyle to which those individuals aspire. Regarding the public healthcare data cited above, few New Zealanders will have experienced the German or Scandinavian healthcare systems. Scandinavian countries compare themselves closely with each other and there is much policy learning between the various systems. But New Zealanders' main comparator is Australia, and New Zealanders have for many years now accepted the fact that Australia is a wealthier nation. Only occasionally does 'catching up with Australia' reach the political agenda. Back in 2008 Prime Minister John Key pledged to close the wage gap with Australia; 14 years later this remains an unrealised goal, but it is no longer a burning public issue. Moreover, the perception that 'things are generally getting better' economically in New Zealand, at least for most people, has dampened feelings of relative deprivation.[5] Rising prosperity buys off a lot of discontent. Additionally, national cultural traits may also play a role in explaining New Zealanders' relative lack of discontent about poor public policy outcomes. As English immigrants, we are struck by the fact that New Zealanders (unlike their English counterparts) are not a nation of grumblers. For example, in 2022 New Zealand was very highly ranked (9th) in the World Happiness Report, behind Finland, Denmark, Switzerland, Iceland, Netherlands, Norway, Sweden and Luxemburg (World Happiness Report, 2022).

A conveyor belt of policy problems leading to policy stuff-ups

New Zealand may rank alongside the wealthy (and highly taxed) Scandinavians in terms of happiness, but in Aotearoa (as elsewhere in the world) the reality is that we have an overcrowded conveyor belt of serious unsolved policy problems. These include a longstanding housing crisis, increasing levels of child poverty, the highest youth suicide rate in the OECD, growing economic inequity, lower productivity and lower wage levels than comparable countries, declining educational standards, grossly polluted waterways, failing infrastructure, an overloaded judicial system, and a health service in seemingly constant crisis. These problems are well publicised, extensively debated and firmly on the political agenda. Other serious policy problems, however, are recognised only by those working at the delivery point of public policies. These issues include a tsunami of type-2 diabetes cases likely to hit the health service in future decades, as well as a predicted severe shortfall in palliative and dementia care for the elderly over the next 20 years. We could go on. When we started work on our book (Mazey and Richardson, 2021), we decided to monitor our local newspaper (the Press) for policy issues that, if we were working in the prime minister's office, we would wish to bring to her attention. After a few months we gave up, as hardly a day went by without at least one such issue arising which would justify a 'Dear Prime Minister, you might need to ask your minister about this' memo.

Faced with so many policy problems, it is no wonder that policy failure, policy fiascos, and plain old stuff-ups seem to be rife worldwide. As governments stuff up everywhere, why should we expect New Zealand to be different? Our central argument is that although stuff-ups and implementation failure will always occur, we can do significantly better. Some stuff-ups can be avoided, and some can be much less serious. Doing better is not rocket science.

Studying the New Zealand policy process might sound boring to most people, but when governments make mistakes the consequences are not 'just' traffic jams, declining educational standards or a worsening housing crisis. People also die. Of course, governments facing exceptional crises, such as a global pandemic, are bound to make errors. However, public policy blunders and implementation failure are common even in 'business as usual' circumstances. An irony of New Zealand's response to the Covid-19 pandemic is that, having long failed to heed warnings from qualified experts that we were ill prepared for a pandemic (one epidemiologist told us they 'had been preaching to empty halls for years'), New Zealand's 'hard and fast' initial response to the pandemic (lockdown and border closure) was initially very effective in keeping Covid-19 out of the country. However, quite quickly the policy process reverted to business as usual – i.e., muddling through – and as a consequence we started to encounter some very basic implementation problems.

> Of course, governments do occasionally ignore problems in the hope that they will eventually 'go away', or they wait for new issues to displace challenging issues currently in the spotlight.

The New Zealand government's Covid-19 policy response is 'a game of two halves: strong defence and no own goals in the first half, but plenty of defence errors and own goals after the half-time break' (Mazey and Richardson, 2020, p.564). When we wrote that in 2020 we didn't realise just how many defensive errors and own goals would eventually occur in the management of the MIQ system, the vaccine roll-out, government business subsidies and the introduction of the RAT testing system. Particularly worrying were failures in what used to be regarded as basic public administration, namely the ability to devise sensible and practical 'on the ground' policy delivery systems. We should not be too hard on New Zealand policymakers, however, as there are some generic causes of policy failure, common to all democratic systems. We outline some of these below.

Managing the political agenda

In democratic regimes the political agenda is always crowded. Faced with a never-ending conveyor belt of new policy issues and demands from diverse groups, governments cannot simply say 'nothing can be done'. Voters expect them to 'do something'. This phenomenon is not new. Nearly 50 years ago political scientists were writing about 'governmental overload': as Anthony King wrote, 'once upon a time ... man looked to God to order the world. Then he looked to the market. Now he looks to government ... the hungry sheep look up and reckon that they have at least a reasonable chance of being fed', with the result that 'government [has] come to be regarded ... as a sort of unlimited-liability insurance company in the business of inuring all persons at all times against every conceivable risk' (King, 1975, pp.164–6). (For an informative recent reflection on overloaded government, see Moran, 2018.) While government overload is not a new development, however, we believe that some trends, such as the apparent general decline of the influence of civil servants, the decreased role for technical expertise in particular policy areas – what Catherine Knight refers to as the 'de-sciencing' of policymaking (Knight, 2021, pp.184–5) – and the seemingly inexorable rise of politically appointed advisors ('often relatively young and with political ambitions of their own' (Gluckman, 2021, p.158)), has reduced the capacity of governments to cope with overload.

Faced with a constant stream of policy issues, policymakers often end up 'managing' the policy agenda rather than addressing the underlying policy issues. At worst, governments resort to 'placebo' policies, introducing measures that they know will have little – if any – beneficial impact, but which will hopefully deflect unwelcome public (and media) interest. This is not to suggest that politicians and governments are cynically dismissive of voters' concerns; rather, that they get caught in 'policy traps', situations where a government is under intense pressure to 'do something', but has very limited capacity to do so meaningfully (McConnell, 2020). There are two variants of placebo policymaking commonly used by governments. The first variant is what we might call 'inquiryitis'. While we are in principle strongly in favour of policy reviews (see below), it is not uncommon for

governments to commission an inquiry into a policy issue as a means of 'kicking the can down the road'. Mental health in New Zealand is a case in point. Since 1985 there have been no fewer than 13 official inquiries of one kind or another into youth suicide. Sadly, youth suicide deaths have continued to rise in New Zealand. The other variant of placebo policymaking is to restructure the agency/ministry/institutions of government responsible for the policy sector in question. In many cases, however, organisational restructuring ('reorganisitis') is akin to rearranging the deck chairs on the Titanic.[6]

Of course, governments do occasionally ignore problems in the hope that they will eventually 'go away', or they wait for new issues to displace challenging issues currently in the spotlight. Allegedly, General Franco, the Spanish dictator, had just two trays on his desk: one marked 'problems that time will solve' and the other marked 'problems that time has solved'. In reality, few policy problems resolve themselves, but over time some do fade from public attention, albeit often remaining unsolved. As Anthony Downs argued, there is a natural dynamic to policy issues, what he called 'the issue attention cycle' (Downs, 1972). We are right to blame government for policy failures, but we voters are equally to blame. When a problem comes onto the political agenda, we are initially enthusiastic: something must be done. Quickly, the cost of tackling the problem dawns on us. Solving the problem will cause inconvenience and probably cost money, and we may also have to change how we behave (think of global warming). Consequently, our initial enthusiasm wanes and we turn our attention to some other issue that has forced its way onto the public policy conveyor belt. Meanwhile, the original problem, no longer in the spotlight, remains unresolved, though a burgeoning 'industry' of advocacy groups and experts continue to beaver away, working at trying to solve the original problem.

Detailed policy implementation: yet more policy process problems

Even when governments do enact bold policies, successful policy outcomes are far from guaranteed. Two of the most common problems at the implementation stage are the 'law of large solutions' and the 'law of unintended consequences'. The first law is particularly depressing. As the originator of the concept put it, 'the evils that worry us now spring directly from the good things that we tried to do before' (Wildavsky, 1979, p.64). Put simply, many of today's policy problems are the result of yesterday's large policy solutions. For example, the massive expansion of dairy farming in New Zealand, though an economic success, has created major water pollution and carbon emission problems that are now incredibly difficult to solve.

A more serious example of how intended policy outcomes get 'lost in translation' is provided by the amendments to the Credit Contracts and Consumer Finance Act introduced in December 2021.

The second law, the 'law of unintended consequences', often comes into play, even with carefully designed policies that are introduced for very good reasons and seem perfectly sensible at the time. For example, in recent years New Zealand governments have increased tobacco taxes to reduce smoking, and hence lower the incidence of many diseases, notably lung cancer. The policy is working. However, increasing the price of cigarettes via tax increases has turned what was a relatively cheap commodity into a very expensive one. Two unintended consequences have resulted from this policy. First, the number of violent and armed attacks on dairies selling tobacco products has increased dramatically. Second, the black market in illegally imported cigarettes has boomed: professional criminals 'are using the same supply lines employed for methamphetamine to bring in illicit cigarettes' (Block, 2021). Similarly, the government's well-intentioned policy of subsidising the purchase of electric vehicles, announced in June 2021, quickly produced some adverse unintended consequences. As one importer of second-hand EVs explained to us just a few weeks after the announcement: 'The value of the rebate to the New Zealand consumer has already been swallowed by the price increases overseas. This has led to a situation where the rebate money ends up in a foreign economy ... it is Economics 101.' We are unsure why this unintended, but entirely predictable, outcome was not identified at the policy design stage.

This oversight underlines the need for consultation processes to be sufficiently finely grained to ensure that those 'at the coalface' (in this case, those at the car yard) are asked for their views as to whether and how policy proposals might work out in practice.[7] A more serious example of how intended policy outcomes get 'lost in translation' is provided by the amendments to the Credit Contracts and Consumer Finance Act introduced in December 2021. This reform was intended to protect vulnerable borrowers, such as first-time home buyers and small business owners, from loan sharks; thus, undeniably a good idea. However, the way in which it was implemented by banks (which are trying to act within what has proved to be a very restrictive law) resulted in intrusive investigation into the spending habits of potential borrowers, such as how much they spend on Netflix or on Friday night fish and chips. The lesson here? It is that we have a policymaking system that is often weak regarding detailed policy design. As a result, good ideas generate policies that are simply unworkable – or plain daft – in practice.

It doesn't have to be like this: how might the New Zealand public policy process be improved?

Our policy landscape is littered with time bombs quietly ticking away; they could probably be defused or controlled by early government intervention, but they are not. Instead, known problems are left ticking away until such time as they become a crisis that can no longer be ignored. In summary, the prevalent national 'policy style' in New Zealand has been reactive, not anticipatory. (For a detailed analysis of the lack of anticipatory policymaking, see Boston, 2017, and for an overview of the post-war New Zealand policy style, Easton, 2021.)

The current government's proposed Three Waters reform of the nation's drinking, waste water and storm water management is illustrative of the eventual consequences of this policy style. Whatever the merits or

demerits of this particular proposal, the problems that the government is now trying to address are chronic in nature. They have been a long time in the making and policymakers have known about them for years (including opponents of the Three Waters reform). The Three Waters initiative is a classic example of a government finally addressing a 'reform deficit' (but see below). Similarly, as suggested above, New Zealand has a serious and growing type 2 diabetes problem, exacerbated by the fact that the country has one of the highest levels of obesity, a common cause of type 2 diabetes, in the OECD. A recent report to Parliament predicted that the number of people in New Zealand with type 2 diabetes will increase by 70–90% over the next 20 years, and that the annual cost to the economy of type 2 diabetes is likely to rise to $3.5 billion during this period. Despite this chilling prediction, New Zealand still has no national strategy or plan for managing what is widely regarded by medical experts as a disease that has reached epidemic proportions, but one that can in most cases be controlled or reversed by diet and (inexpensive) drugs.

In fairness, very few liberal democratic governments are good at anticipatory policymaking. It is seen more often in political science textbooks than found in the wild. Hoping for governments to be more anticipatory – i.e., to think in the long term – is akin to hoping to find that pot of gold at the end of a rainbow. Yet, the policy machine grinds on. Bearing this in mind, what could be done to improve the New Zealand policy machine?

More deliberation, more policy continuity

A recurring theme of contributions to our book is the lack of continuity in policymaking. Political change is a normal feature of democratic government; elections are, as Winston Churchill said, our opportunity to 'turn the buggers out'. However, there is now widespread agreement among political parties that our three-year parliamentary term is too short. It impedes anticipatory policymaking. Rather than moving to a four-year term, we believe that a slightly longer five-year, fixed-term Parliament like the UK model would be even better. A five-year term would allow time for inevitable mistakes to be forgotten and for initially unpopular policies to begin to show benefits. But reducing the pressure of the electoral churn, though helpful (even necessary), will not be sufficient.[8] The fundamental policy style itself needs to change. We need to change *how* we make public policy to achieve better policy outcomes for the team of five million.

> The number of MPs is quite small in New Zealand; consequently, the pool of talent from which to select ministers is tiny and the proportion of MPs on the 'payroll vote' is arguably too high.

The key, fundamental change needed is a general shift to a more *deliberative* approach to policymaking. Deliberation needs to be the overriding characteristic of the policy system. Lack of deliberation is a common cause of policy blunders. King and Crewe argue that a deliberative approach has three main components: carefully considering and weighing up options (exactly what is the problem and what options do we have?); taking sufficient time to analyse the problem and available options (do you want it now or do you want it right?); and ensuring that relevant interests and organisations (those who know where the shoe pinches) have been appropriately consulted and their views taken into account (King and Crewe, 2014, p.386–7).

Alongside a change in policy style, we advocate some institutional changes to the way policy is made. For example, we suggest that New Zealand adopt the traditional Swedish model of policy development, characterised by extensive use of independent policy commissions. Alas, the Swedish model has itself been considerably eroded over recent decades. However, at its height the commissions system mobilised expertise, facilitated negotiation between competing interests, and often fostered compromises across the political divide. The system had two outstanding advantages. First, it was a slow, deliberative process (commissions often took one or two years to produce a set of policy recommendations). Second, commission reports (which had a major influence on the content of subsequent legislation) were often a 'negotiated consensus', which facilitated policy stability. Here in New Zealand, the Climate Change Commission (though in our view having a far too narrow membership) holds some promise as a model, as does the tripartite collaboration between the government, BusinessNZ and the New Zealand Council of Trade Unions which collectively produced the proposals for an income insurance scheme. The current disagreements surrounding the Three Waters reform programme might have been avoided had the government *started* with a broadly based commission, rather than setting up a working group only when the policy change process was well underway and the issue had become heavily politicised. In this instance, the shift from intramural to extramural policymaking (i.e., involving a wider range of actors) has come much too late in the game.[9]

On a related theme (inclusive policymaking), much work needs to be done to give meaningful effect to the principles of te Tiriti o Waitangi throughout the policy process. As highlighted by policy outcomes across several sectors, particularly education, health and housing, mainstream policy processes have often failed to meet the specific needs of Māori communities and iwi. (The initial roll-out of the Covid-19 vaccination programme was an obvious policy blunder in this regard.) At a formal level, some progress has been made, but we need to ensure that our policy processes are responsive to and incorporate knowledge and values of te ao Māori. Iwi are not 'just' another interest group to be consulted; they are Treaty partners and quite rightly expect to be treated as such by decision makers. Public debate (and political disagreement) about the true meaning and policymaking implications of co-governance (tino rangatiratanga) is now gaining momentum. While this will be a challenging conversation for New Zealand, it is one we need to have in order to ensure that our policymaking processes deliver for all New Zealanders.

More analytical capacity and capability

The analytical capacity of opposition parties to formulate policies also needs to be

increased. Having opposition parties enter government with half-baked policy promises developed on the campaign trail (KiwiBuild being an obvious example) is not in anyone's interest. We suggest establishing a publicly funded, independent policy consultancy agency tasked with providing independent but confidential policy analysis support for opposition parties.

A more radical reform would be to consider a departure from the Westminster parliamentary model of government whereby all ministers must be drawn from the legislature. Party candidates are rarely chosen for their policy expertise or their capacity to run large organisations. The number of MPs is quite small in New Zealand; consequently, the pool of talent from which to select ministers is tiny and the proportion of MPs on the 'payroll vote' is arguably too high. Not all parliamentary systems insist on all government ministers being appointed from among the legislature. Instead, they seek to maximise the government's policymaking capability by seeking ministerial talent from outside Parliament.[10] In Norway and Denmark, ministers do not need to be drawn from the legislature and it is common for some ministers to be appointed on the basis of their technical expertise and knowledge of the policy sector. In such cases ministers are still accountable to Parliament via question time and select committee hearings. Indeed, Denmark's Parliament can force the resignation of a minister if there is a majority vote against him or her in Parliament. A further advantage of including ministers from outside Parliament is that portfolios can be shared among more ministers, reducing the workload of each. Our ministers have multiple and disparate portfolios, to the extent that one wonders how some of them find the time to master complex policy issues and build meaningful relationships with key policy actors and stakeholders.

We are aware that this idea is regarded by some people as contrary to the principle of parliamentary democracy and, therefore, unworkable in New Zealand. Such sentiments are akin to those expressed by opponents of proportional representation in Britain, who argue that 'it just won't work in the UK', despite the fact that electoral systems of this kind function perfectly well in several European countries, as well as in the UK for European parliamentary elections. Moreover, the 'end of parliamentary democracy as we know it' refrain loses its credence when the impact of the New Zealand list system is considered. Essentially, we already have ministers in office who have not faced the electorate at all. They are simply party nominees, rarely placed on the party list for their policy expertise or experience of running a large organisation. More worryingly, perhaps, is the fact that MPs can be turned out by their electorates in a general election, only to return as MPs (and ministers) via the list system.

> … we conclude with an odd request to our political leaders: think of your obituary, rather than winning the next election.

Ministers are not the sole actors in the policy process, of course. They are at the apex, but are served by a raft of public servants. Thus, just as we need to increase the analytical capacity of ministers, we also need to further strengthen the analytical capacity of the public service. As one senior civil servant remarked privately to us, 'the ranks of capable policy advisers are thin'. A significant amount has been done in this area by the Public Service Commission and the Department of the Prime Minister and Cabinet. However, we recommend building on these reforms by introducing a centrally managed and competitive graduate recruitment scheme for certain categories of national public servant, to be run by a new public services recruitment agency. Under such an arrangement, individual government departments would lose their exclusive recruitment function for policy-related grades. The careers of entrants would be managed centrally, rather than the existing 'market' system whereby public servants in one department advance their careers by applying, of their own volition, for higher posts in another department. As one insider has noted:

> Each agency hires its policy staff according to its own job descriptions, trains and manages them according to its own preferences, and remunerates them largely as it sees fit. There are few controls at the centre and agencies are free to do as they like in building and maintaining policy quality … remuneration practices encourage analysts to hop from agency to agency rather than mature in one place. (Parkin, 2021, pp.198–9)

In similar vein, Peter Gluckman, reflecting on his former role as chief science advisor to the prime minister, also notes that, 'as public management is seen as a generic skill, and given the relatively high rotational rates across senior levels of agencies, deep domain knowledge can be hard to find' (Gluckman, 2021, p.155). Apart from helping to break down 'departmental silos', a centralised recruitment system might also make the public service a more prestigious and attractive career prospect for our brightest graduates, as it is in the UK and other European countries.

Another, related public service reform would be to establish a well-funded national public service college (based in two centres, one in the North Island and one in the South Island) to provide ongoing professional development in public policy analysis and public policy management, across the whole of the public service, including local government and all public agencies. This college should also provide training for MPs and ministers in policy analysis. We also believe there is considerable scope for New Zealand universities to engage with public policymakers, policy formulation and implementation via the creation of policy transfer units in each of the eight universities. The Covid-19 pandemic has clearly illustrated both the existence and the value of policy-relevant knowledge within our universities. There is an abundance of policy-relevant knowledge within universities (including in the social sciences). Universities, we believe, need to reflect more on the question, 'what do we know that is useful to public policymakers?' As Gluckman notes, 'the gulf between academia and the civil service is obvious … in general consultants are more likely to be used than academic expertise' (ibid., p.157). Compared to other advanced liberal democracies, New Zealand is light on independent think tanks, and universities have a public responsibility to make a bigger contribution to public policymaking than they do at present. By doing so, they would help expand the market for policy ideas, consistent with our plea for increased analytical capacity in New Zealand.

The importance of obituaries

Our overriding message is that we need to improve our policymaking processes to achieve better public policy outcomes. Of course, even the best-designed public policies need money, but a further New Zealand paradox is that we face the litany of unsolved policy problems at a time of the highest level of average income and net worth in our history. The problem is not lack of money; it is how we spend it. Thus, our wish list of reforms will come to nothing without bold political leadership. Alas, we voters want jam today, not jam tomorrow, but our politicians need to have courage. We do not need to have quite so many policy failures. And so, we conclude with an odd request to our political leaders: think of your obituary, rather than winning the next election. Election victories are just footnotes to history. Major successful policy reforms warrant a full-length chapter.

1 However, overseas observers seem unaware of the increased questioning of, particularly, Pharmac, but also of ACC, and even KiwiSaver.
2 Frames are structures of beliefs or perceptions: see Schön and Rein, 1994.
3 Space does not permit a discussion of social cleavages here, but recent events relating to vaccine mandates, the emerging politicisation of co-governance issues, and the expansion of the gap between rich and poor suggest that the 'team of five million' might be more factionalised that previously thought.
4 However, for a very perceptive and frank insider view of weaknesses in the policy system, see Parkin, 2021.
5 This is not to suggest that the issue is not recognised at all: for example, see Rashbrooke, 2021.
6 The current major reorganisation of the health system might prove to be such an example. When we asked a senior hospital consultant (who had worked in the system through several reorganisations) what they thought the effects of the reorganisation might be, the reply came back: 'The heading on the notepaper will change. I will face exactly the same problems as I do now.'
7 One senior public servant commented to us that he was astonished how often policy leaders failed to talk to front-line officials and affected parties.
8 We, of course, recognise that a longer term also allows governments to do more damage. However, we believe that a longer term is the lesser of two evils, as it were. Moreover, lengthening the parliamentary term should be seen as one part of a raft of reforms that we are proposing.
9 For an informed account of the underlying issues relating to the reform, see Mandow, 2022.
10 This idea is not new in New Zealand: see Boston, 1998. For the idea to be implemented, the Constitution Act 1986 would need a simple amendment to section 6, and some amendments would also be required to Parliament's standing orders.

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