Emission reductions that restore nature

What a nature-based Emissions Reduction Plan should look like for Aotearoa New Zealand

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Aotearoa New Zealand has declared a climate emergency and faces a biodiversity crisis, with more than 4000 native plants and animals threatened or at risk of extinction. The Climate Change Commission has proposed a range of nature-based solutions as part of its advice on how New Zealand can meet emission reduction targets. The Government has made nature-based solutions a key part of its approach to tackling climate change. These recommendations are Forest & Bird's initial advice on how the Government can achieve turn these principles into reality.

Forests

Expand browsing pest control to:

- *Reduce possum, feral deer, goats and pigs on all Department of Conservation, Defence and State Owned Enterprise and Land Information New Zealand managed land to lowest practicable numbers*
- *Maintain all existing deer free areas in places like Coromandel and Northland*
- *Reduce feral browsing mammals on land under Land Information New Zealand control to comply with the Land Act*
- *Eradicate wallabies from Aotearoa New Zealand entirely*
- *Control tahr to a level that complies with the Himalayan Tahr Control Plan 1993 and the National Parks Act*

Establish a programme to deliver the restoration of native vegetation cover across all marginal and erodible land in New Zealand. This programme would need to include:

- *Support to scale up private and public pest control*
- *A financial flow to landowners for restoring native vegetation in perpetuity*
- *Crown buy-out of land that lacks an economic land use and that has significant biodiversity*
- *Restoring native ecosystems on degraded Crown land, including any degraded stewardship land*

Gazette and Implement the National Policy Statement on Indigenous Biodiversity to end native vegetation clearance on private land

Support planting of permanent indigenous forests by:

- *Restricting areas where exotic carbon forests can be planted*
- *Providing biodiversity credits to recognise the benefits of native forest restoration and even the economic return (I.e. difference between ETS returns from exotics vs. natives)*

Wetlands

Develop a national wetland restoration plan that restores damaged or destroyed natural wetlands with the goal of doubling the area of New Zealand's wetlands with purposeful connectivity between them

Act on the recommendations of the Parliamentary Commissioner for the Environment's report into estuarine environments (which includes coastal wetlands such as mangroves and saltmarshes) – that is:

- *Make the inclusion of estuaries as part of freshwater management units mandatory within the National Policy Statement for Freshwater Management*
- *Develop and make mandatory a standardised and consistent approach to collecting, managing, and analysing data on estuarine environments, and make that data public*

Include stronger protection for wetlands in the legislation that replaces the Resource Management Act.

Retain the NPS-FM and National Environmental Standard protecting wetlands, and do not allow those documents to be modified in a way that would result in the loss of wetland extent or values

Fund MPI's soil mapping project to inform land management and help identify wetlands at a scale that matches or improves data as required under the new NPS-FM 2020.

Encourage councils to implement and enforce the wetland clearance prohibitions in the NPS-FM 2020 and fund compliance, monitoring, and enforcement, as well as restoration projects.

Include carbon gains/losses from peatlands in New Zealand national carbon accounting

Fund research into the adoption of paludiculture (the re-wetting of peat and cultivating wet-tolerant species to create products with small carbon and pollution footprints).

Blue Carbon

Consider the role of marine species and habitats in storing carbon within the Hauraki Gulf ecosystem when developing the Hauraki Gulf Fisheries Plan

Explicitly consider climate change as an environmental effect of fishing in all Fisheries Act decisions

Address emissions from fishing and the impact of fishing on marine carbon storage in the development of the Fishing Industry Transformation Plan

End bottom trawling to reduce emissions from seafloor damage

Ensure the replacement legislation to the Resource Management Act protects blue carbon, including mangroves and seagrass beds

Include the protection of blue carbon within the proposed replacement to the Marine Reserves Act

Agriculture

Introduce agriculture into the ETS, or directly reduce ruminant animal numbers with a cap.

Develop a programme to support farmers to convert to low input and regenerative agriculture systems to reverse biodiversity loss, improve soil carbon retention and water management, and reduce nitrous oxide emissions.

Invest in the further development and use of the E2M model by

- *Investing directly in the model itself to increase its capability and capacity,*
- *Rolling-out its use within Pāmu/Landcorp as a State-owned Enterprise,*

- *Increasing its accessibility to all farmers, such as by making it available as a publicly-funded tool and by funding the training of farm advisors (e.g. Landcare Trust staff) and case-studies in its use*

Make OverseerFM opensource and public, opening research and development and integration opportunities for others in the agricultural industry (including integration with E2M)

Direct Pāmu to trial, and roll out at scale, methods for reducing emissions from land-use so that it becomes the best practice climate leader for agriculture, forestry and carbon storage from land-use in Aotearoa.

Phase out the use of synthetic nitrogen fertiliser in Aotearoa NZ

Infrastructure and renewable energy

Adopt a strategic national spatial planning approach to new wind and solar farms so that the expansion of wind not only meets requirements for being sited for good wind and solar resources and risk management, but also so that it avoids harm to nature and to sensitive landscapes.

Defund infrastructure projects that will increase emissions

Biofuels

Except when sourced from waste materials, plant material from species that pose significant biosecurity risks (such as being on Plant Pest Information Network database) should be ineligible for inclusion in New Zealand's fuel supply

New organisms under the definition of the Hazardous Substances and New Organisms Act should not be eligible for consideration as biofuels

Coal

Ensure the proposed Natural and Built Environment Act prohibits resource consents being granted for new or expanded coal mines across New Zealand.

Amend the Crown Minerals Act to prohibit new or renewed coal permits being granted across New Zealand.

Develop a transition plan to phase out existing coal mining, and oil and gas drilling and to reduce regional and national demand for fossil fuel extraction, while addressing the needs of affected communities and those dependent on mining.

Dry year risk

Develop a programme to encourage distributed generation.

Review the structure and operation of the electricity system, including ownership and market operations to minimise dry year risk

Investigate the use of existing hydro lakes for pumped storage, including Tekapo/Pukaki

Ensure any solutions support an overall reduction in greenhouse gas emissions

Introduction: restoring nature and rescuing our climate

Aotearoa New Zealand has declared a climate emergency and faces a biodiversity crisis, with more than 4000 native plants and animals threatened or at risk of extinction. We are also emerging from the major public health threats caused by the global spread of Covid-19. Addressing these global crises will be most successful when we address them together.

Humans have enormously altered our landscapes, which has led to climate change and biodiversity loss. Half of New Zealand's total land area is now used for agriculture, forestry, and housing. Nearly 13,000 further hectares of indigenous land cover area were lost from 2012-2018, continuing a declining trend.[1]

New Zealand needs an Emissions Reduction Plan that builds back better from the disruption of covid-19, and helps the country deal with the interconnected crises of biodiversity loss and climate change.

We rely entirely on the health of native forests, wetlands, and grasslands to absorb carbon, restore a more stable climate, and support the complex natural ecosystems we need to survive. We need climate change solutions that protect and restore our natural world, not destroy it.

Forest & Bird was heartened by the Climate Change Commission's recognition of the need for nature-based solutions to the climate crisis. We hope the Government will focus on nature-based solutions in its approach to developing a national Emissions Reduction Plan. This briefing provides an outline of the policies and programmes the Government could adopt to deliver an Emissions Reduction Plan with nature at its heart.

Six principles for a nature-based climate change response

Forest & Bird's proposed nature-based climate change response is based on six key principles. These principles should underpin all government action to tackle climate change.

Cut emissions first

A commitment to faster emissions reductions must come ahead of removing carbon dioxide from the atmosphere. That means producing and consuming things without generating greenhouse gases. New Zealand needs to get rid of fossil fuels from its electricity system and substantially cut agricultural emissions.

Bring Back Nature

The methods used to cut emissions must protect our native plants and animals and their habitats, not destroy them. This means no new big hydro, stopping mining on conservation land, and ensuring new wind farms, biofuel production and transport infrastructure don't harm nature.

When off-setting emissions that can't be cut, permanent native forest should be incentivised over exotic pine monocultures.

Better land use

[1] https://www.stats.govt.nz/indicators/indigenous-land-cover

Marginal and erodible land needs to be returned to native forests and shrublands. Regenerative farming is needed to cut emissions. There should be fewer cows.

Help nature help us

New Zealand place more emphasis on wetlands, blue carbon, shrublands, mangroves, and pest control. Pest control is critical to protect carbon stocks and deliver the best long term carbon storage in native forests and shrublands.[2] Once fossil fuels are eliminated and agricultural emissions reduced, we will still need to remove carbon dioxide from the air to stabilise the climate. Nature can help us do this, but only if we protect it.

Helping each other

We are all in it together. We need a just transition that helps communities and workforces to adjust, makes sure vulnerable people are not left behind, ensures new technology and ways of working are available to all, and gives effect to the Treaty of Waitangi.

We must also help people in poorer countries to cut emissions, develop and implement clean technology, and become resilient to unavoidable climate change.

Doing our fair share

New Zealand must make a stronger global commitment to cutting our emissions and helping developing countries. Our targets should reflect our economic status, ability to take action, and high current and historical per-capita emissions.

[2] https://www.forestandbird.org.nz/carbonreport

How restoring nature is connected to fighting climate change

New Zealand's social, cultural, and economic wellbeing relies on a healthy natural world, and benefits from natural protection from extreme weather-related events. Yet natural capital is in decline:

- Nearly 80% of our larger native land animals (bats, forest birds, frogs, and reptiles) are classified as either threatened with or at risk of extinction.[3]
- Native habitats continue to be lost, either by intentional clearance, or through the neglect of allowing continued destruction from introduced pests. Indigenous land cover area decreased by 12,869 hectares between 2012 and 2018.[4]
- Ninety-five to 99% of river length in urban, pastoral, and exotic forest areas exceeds water quality guidelines.[5]

New Zealand can create a virtuous circle to help deal with both biodiversity and climate challenges. When we restore and protect the complex natural ecosystems of our forests, shorelines, and mountains, we can sequester more carbon, and enjoy resilience to the more extreme weather events caused by climate change. Nature will help us become more resilient, but only if we help nature itself become more resilient.

Role of nature in providing resilience

One of the precursor agencies to the Department of Conservation, the Forest Service, protected large swathes of native forest for soil and water conservation purposes. Successive governments recognised that forests buffer the water flows that come from storm events and reduce sedimentation and erosion. This forest was called 'protection forest' because it protected downstream farms, towns, and infrastructure from floods and landslides.

This is one example of how nature is our greatest inspiration and ally in providing climate change resilience. Other examples include:

1. coastal dunes protecting land from storm surges
2. lakes and wetlands buffering extreme rainfall and river flows
3. wide riverbeds and floodplains absorbing the energy of high flowing rivers, and reducing the severity of floods
4. mangroves reducing local ocean acidification and buffering the coast from storm surges
5. tussock grasslands capturing water and preventing erosion
6. natural catchments providing reliable, clean, water.

Emission reduction pathways that protect nature will deliver significant co-benefits in resilience to the impacts of climate change.

Role of nature in carbon dioxide removal

[3] https://www.stats.govt.nz/indicators/conservation-status-of-indigenous-land-species
[4] https://www.stats.govt.nz/indicators/indigenous-land-cover
[5] https://environment.govt.nz/assets/Publications/Files/our-freshwater-2020-summary.pdf

New Zealand's natural ecosystems, like native forests, shrublands, and tussocklands, store a phenomenal amount of carbon, around 1,450 million tonnes in above-ground vegetation.[6] Better management of land and sea provides opportunities for increased carbon dioxide removal.

We can sequester more carbon and help both climate change and biodiversity by:

1. protecting existing native forests, shrub-lands, and tussock-lands to maintain substantial carbon stocks
2. controlling browsing pests and ending vegetation clearance to avoid destruction of native vegetation prevents emissions and maintains carbon stocks[7]
3. retiring marginal land from grazing and restoring native forest, shrub, and tussock ecosystems on those lands
4. improving estuarine and coastal fisheries and resource management to restore seagrass, mangroves, and kelp forests, with blue carbon storage potential.

Risks to nature from our climate change response

A poorly designed response to climate change will create conflict with other statutory decision making and create risks for nature and biodiversity, such as:

1. attempting to grow resilient grasses or shrubs for fodder, which could introduce new serious weeds
2. inappropriate locations or trees for plantation forestry, resulting in loss of natural habitats and spread of wilding pines
3. inappropriately located renewable energy infrastructure, causing habitat destruction or degradation
4. excessive extraction of geothermal energy, leading to loss of geothermal features and their associated rare and localised ecosystems
5. expansion of irrigation into areas of indigenous habitat such as tussock grasslands, resulting in damage to habitats, downstream water pollution, de-watering of rivers, and loss of mauri
6. relocating infrastructure, causing a loss of rare ecosystems in the new locations.

The Hazardous Substances and New Organisms Act, Resource Management Act, Conservation Act and National Parks Act may all come under pressure if pathways for emission reductions involve inappropriate and environmentally damaging proposals.

Climate change responses that further destroy the interconnected living ecosystems of the planet are extremely counterproductive. The destruction of our natural world is what has led to rampant climate change in the first place. Protecting what natural areas remain is essential for protecting the complex

[6] https://www.forestandbird.org.nz/sites/default/files/2021-06/Protecting%20our%20natural%20ecosystems%27%20carbon%20sinks%20-%20Forest%20%26%20Bird%20report.pdf

[7] Forest & Bird has attached a paper on the significant role of pests in generating emissions of carbon dioxide and methane, preventing regeneration and degrading carbon stocks. www.forestandbird.org.nz/carbonreport

ecosystems we rely on for clean water, air, and soil, and essential for the restoration of climate stability.

What does nature-based emissions reduction look like?

Recommendations of He Pou a Rangi/the Climate Change Commission

Forest & Bird acknowledges the work of He Pou a Rangi/the Climate Change Commission (the Commission) to recognise the role of nature in New Zealand's climate change response. The final advice strengthened its focus on nature-based solutions with recommendations for forests, wetlands, agriculture and for state owned enterprises to take climate change into account in their work. The recommendations of the commission are highlighted in the sections below.

The Government can put nature at the core of its climate change response largely by boosting or reconfiguring programmes it already has underway:

- boost existing government programmes that give effect to the Commission's proposals for nature-based solutions to climate change
- plug gaps in proposals put forward by the Commission, particularly in the marine environment
- take a strategic planning approach to removing fossil fuels from energy supply in a way that does not destroy habitat and cause biodiversity loss
- ending fossil fuel extraction to reduce supply, as well as demand-side measures.

Forests

New Zealand's natural ecosystems store many billions of tonnes of carbon. Their sheer size means that even very small changes to their extent or condition can have a massive impact on the country's greenhouse gas emissions profile. The Commission Climate Change Commission identified 1.2-1.4 million hectares of erosion prone land. Government policy should ensure that all of this land is reverting to native forest or other native ecosystems by 2050

All of New Zealand's natural terrestrial ecosystems are under stress from feral introduced mammalian herbivores which a responsible for an estimated direct biomass consumption and methane production of between 2.3 and 4.0 $MtCO_2e$ per annum. Kamahi-podocarp forests are showing a particularly significant decline that is likely to be the result of introduced herbivores. Key pests include: deer, goats, pigs, possums, tahr and wallabies.

Forest & Bird supports an approach of focussing on new and restored permanent native forests to create a long-lived source of carbon removals rather than plantation forestry which can have negative outcomes for soil health, landscapes, and pose fire risks. This would have significant co-benefits in terms of water quality, erosion protection and human and natural resilience.

As mentioned above, Forest & Bird considers removal of pest animals to be largely additional to decarbonisation of the economy. In practice we need to do everything we can to ensure that native forests and ecosystems can restore themselves naturally and to ensure as much biological diversity as possible.

Advice of the Commission

The Commission proposes a change in emphasis away from relying on plantation forest for long term carbon storage and instead to rely on permanent native forest for long term storage. The three key elements in the Commission's approach are:

- Limiting plantation forestry's access to carbon markets
- Encouraging large scale replanting and restoration of native forests
- Protecting forests from pests

In particular the Commission proposes

- Comprehensive national programme to incentivise reversion and planting of new native forests
- Reduce reliance on forestry removals (pines as carbon sink)
- Managing pests in an integrated way to ensure forests are established and all forests are maintained long term
- Protect and increase carbon stocks of pre-1990 native forests with fire and pest control

Recommendations

Expand browsing pest control to:

- *Reduce possum, feral deer, goats and pigs on all Department of Conservation, Defence and State Owned Enterprise managed land to lowest practicable numbers*
- *Maintain all existing deer free areas in places like Coromandel and Northland*
- *Reduce feral browsing mammals on land under Land Information New Zealand control to comply with the Land Act*
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Establish a programme to deliver the restoration of native vegetation cover across all marginal and erodible land in New Zealand. This programme would need to include:

- *Support to scale up private and public pest control*
- *A financial flow to landowners for restoring native vegetation in perpetuity*
- *Crown buy-out of land that lacks an economic land use and that has significant biodiversity*
- *Restoring native ecosystems on degraded Crown land, including any degraded stewardship land*

Gazette and Implement the National Policy Statement on Indigenous Biodiversity to end native vegetation clearance on private land

Support planting of permanent indigenous forests by:

- *Restricting areas where exotic carbon forests can be planted*
- *Providing biodiversity credits to recognise the benefits of native forest restoration and even the economic return (I.e. difference between ETS returns from exotics vs. natives)*

Wetlands

Wetlands are increasingly being recognised for their important role in carbon sequestration and storage. Peat-forming wetlands (peatlands) sequester and store carbon when healthy – that is, when they are wet and forming peat. However, when peatlands are drained (e.g. for farmland), the carbon in the dried peat reacts with oxygen and releases carbon dioxide into the atmosphere. Healthy wetlands and well-managed agricultural peat soils can make a significant contribution to our national climate change response, with healthy peat-forming wetlands storing the carbon they sequester indefinitely, as long as they remain wet (e.g. the 10,000 ha Kopuatai Bog in the Hauraki Plains has been sequestering up to 2 tC/ha/year for around the last 11,000 years).[8]

Wetlands can also contribute to our resilience to the effects of climate change – by retaining soil moisture and helping maintain stream flows, helping to recharge aquifers, dampening the effects of high rainfall events, and providing habitat for native species. In some circumstance, they may also offer a productive land use – whether it be through flax production and harvesting (which Aotearoa undertook extensively for some time) or other forms of paludiculture (the re-wetting of peat and cultivating wet-tolerant species).

Aotearoa must transition away from unsustainable grazing on sinking peat soils; protect, restore, and reconstruct wetlands; and adopt paludiculture on currently farmed peat soils. Other wetlands - mangrove, salt marsh and sea grass wetlands – must also not be forgotten.

Advice of the Commission

The Commission has identified that protection of wetlands is important to protect soil carbon levels. It proposes an objective of preventing further loss of carbon from organic soils, particularly due to the degradation of drained peatlands and destruction of wetlands.

Recommendations

Develop a national wetland restoration plan that restores damaged or destroyed natural wetlands with the goal of doubling the area of New Zealand's wetlands with purposeful connectivity between them

Act on the recommendations of the Parliamentary Commissioner for the Environment's report into estuarine environments (which includes coastal wetlands such as mangroves and saltmarshes) – that is:

- *Make the inclusion of estuaries as part of freshwater management units mandatory within the National Policy Statement for Freshwater Management*
- *Develop and make mandatory a standardised and consistent approach to collecting, managing, and analysing data on estuarine environments, and make that data public*

Include stronger protection for wetlands in the legislation that replaces the Resource Management Act.

Retain the NPS-FM and National Environmental Standard protecting wetlands, and do not allow those documents to be modified in a way that would result in the loss of wetland extent or values

Fund MPI's soil mapping project to inform land management and help identify wetlands at a scale that matches or improves data as required under the new NPS-FM 2020.

[8] https://www.wetlandtrust.org.nz/wp-content/uploads/2021/05/Climate-Commission-Response_National-Wetland-Trust_28-March-2021_Cover-page.pdf

Encourage councils to implement and enforce the wetland clearance prohibitions in the NPS-FM 2020 and fund compliance, monitoring, and enforcement, as well as restoration projects.

Include carbon gains/losses from peatlands in New Zealand national carbon accounting

Fund research into the adoption of paludiculture (the re-wetting of peat and cultivating wet-tolerant species to create products with small carbon and pollution footprints).

Oceans and blue carbon

Marine life, such as seagrass, seaweeds, coastal mangrove forests and shell forming organisms have the potential to remove and store substantial amounts of carbon. Bottom methods of fishing can release stored carbon back into the atmosphere by disturbing the seabed and releasing stored methane. Lack of good data has meant that the Commission deferred making recommendations, however there are actions the Government can undertake already.

Advice of the Commission

The Climate Change Commission notes that marine protection can help maintain stores of carbon such as sea grasses, salt marshes and marine sediment. It notes a recent study showing that stored carbon can be released from the seafloor from bottom trawling. The Commission recommends more work be done to understand and quantify marine carbon stores, sinks and sources. The Government can go further and take immediate steps now to safeguard marine carbon and improve marine sequestration.

Recommendations

Consider the role of marine species and habitats in storing carbon within the Hauraki Gulf ecosystem when developing the Hauraki Gulf Fisheries Plan

Explicitly consider climate change as an environmental effect of fishing in all Fisheries Act decisions

Address emissions from fishing and the impact of fishing on marine carbon storage in the development of the Fishing Industry Transformation Plan

End bottom trawling to reduce emissions from seafloor damage

Ensure the replacement legislation to the Resource Management Act protects blue carbon, including mangroves and seagrass beds

Include the protection of blue carbon within the proposed replacement to the Marine Reserves Act

Agriculture

New Zealand's current policy settings largely protect our largest source of emissions from responsibility for its emissions. This means that the remainder of the economy must pick up the slack. Beyond efficiency gains, the Government needs to explicitly acknowledge that land use change is both desirable and inevitable. Dairying is exceeding the local environmental carrying capacity in some places and so is likely to shrink as it is brought back into line with environmental limits

A net change in nationwide land-use overall from high emission forms of production to lower emissions forms of production is needed. This would most likely to achieved through a reduction in dairy production

in areas where it exceeds environmental limits and the expansion of permanent native forests and other natural ecosystems to provide permanent carbon storage.

Direct control of inputs (especially supplementary feed and synthetic/mined fertilisers) that help drive greater emissions through intensification

The current approach makes very little economic sense as it:

- Distorts investment towards increasing emissions and away from activities that might reduce emissions and so acts against the country's overall policy goals
- Fails to recognise that in some parts of New Zealand the dairy sector already exceeds the carrying capacity of the local environment
- it deprives our society of the co-benefits from reducing agricultural emissions (reductions in excess nitrogen benefit both the atmosphere and water as some excess nitrates go to air, while others go to water)
- Changing farming systems to 'optimise' them within environmental limits is likely to increase profitability and resilience for many farmers, while significantly reducing methane and carbon dioxide emissions, nutrient leaching, and the reliance on bought-in feeds and external inputs that have a high carbon footprint.

There is increasing evidence that moderate changes to farm management, identified using the 'Environ-Economic Model' (E2M), can deliver significantly increased profits for farmers, while reducing emissions and nutrient leaching. Farm optimisation with the E2M model offers enormous potential to reduce the environmental impact of agriculture in New Zealand – through reductions in leaching, more efficient use of fertiliser and irrigation water, reductions in herd size and soil compaction rates, and most importantly, through reductions in greenhouse gas emissions (Appendix One).

Advice of the Commission

The commission proposes:

- Pricing agricultural emissions
- Supporting farmers and growers to identify and make changes on farm to reduce emissions
- Supporting better land-use decisions to create options for greater reductions in future

Recommendations

Introduce agriculture into the ETS, or directly cap ruminant animal numbers.

Develop a programme to support farmers to convert to low input and regenerative agriculture systems to reverse biodiversity loss, improve soil carbon retention and water management, and reduce nitrous oxide emissions.

Invest in the further development and use of the E2M model by

- *Investing directly in the model itself to increase its capability and capacity,*
- *Rolling-out its use within Pāmu/Landcorp as a State-owned Enterprise,*

- *Increasing its accessibility to all farmers, such as by making it available as a publicly-funded tool and by funding the training of farm advisors (e.g. Landcare Trust staff) and case-studies in its use*

Make OverseerFM opensource and public, opening research and development and integration opportunities for others in the agricultural industry

Direct Pāmu to trial, and roll out at scale, methods for reducing emissions from land-use so that it becomes the best practice climate leader for agriculture, forestry and carbon storage from land-use in Aotearoa.

Phase out the use of synthetic nitrogen fertiliser in Aotearoa NZ

Increased renewable energy and climate-friendly infrastructure

Forest & Bird supports a strategic planning approach in line with our submission to the RMA review panel. It is important that this planning takes a nature-first approach so that decisions about our climate response does not inadvertently deepen the biodiversity crisis.

Any 30-year infrastructure plan must avoid placing infrastructure into sensitive environments or where there are protected or at-risk species. Wherever possible, nature-based solutions, such as swales for stormwater, protection of source water quality, or providing room for rivers, should be considered above costly hard engineering.

Forest & Bird notes that the Commission anticipates new capacity would primarily come from wind and solar. To manage risk, the Commission anticipates that wind generation would be widely dispersed across the country.

Too many wild rivers have already been lost to large scale hydro development in Aotearoa. Forest & Bird does not support any more destructive hydro-electricity developments.

Recommendation:

Adopt a strategic national spatial planning approach to new wind and solar farms so that the expansion of wind not only meets requirements for being sited for good wind and solar resources and risk management, but also so that it avoids harm to nature and to sensitive landscapes.

Defund infrastructure projects that will increase emissions

Biofuels

New Zealand already has an expensive problem with wilding conifers. The development of new biofuels must avoid using or introducing crops that could become weedy. Harvesting regimes must not adversely impact on water quality. Fast growing and resilient plants that can become sources of fibre for biofuels, by their nature, will have a propensity to become weeds.

Recommendations

Except when sourced from waste materials, plant material from species that pose significant biosecurity risks (such as being on Plant Pest Information Network database) should be ineligible for inclusion in New Zealand's fuel supply

New organisms under the definition of the Hazardous Substances and New Organisms Act should not be eligible for consideration as biofuels

Coal

The Government should take decisive action to ensure there are no new or expanded coal mines from 2021, as per the net zero 2050 roadmap of the International Energy Agency. Mine development often takes a decade or more, and any new or expanded coal mines initiated in New Zealand today risks either locking-in emissions, or becoming stranded assets and environmental and fiscal liabilities. As other countries end coal use there is an increased risk that the costs of decommissioning and cleaning up abandoned coal mines will fall on the Crown.

Ending coal mining, especially on public conservation land, will have significant co-benefits for the environment, by preventing damage to public conservation land and avoiding water pollution.

Advice of the Commission

The Commission focusses on demand-side policy for phasing out coal (focusing on ending the use of coal rather than its extraction). The Commission proposes that the Government phase out use of coal in electricity as soon as possible, and eliminate coal use in commercial and public buildings by 2030. It proposes converting low- and medium-process heat plants to eliminate coal use in food processing before 2040. This needs to be supported by supply side policy aimed at preventing the establishment of new coal mining operations as these will lock in emissions for decades.

Recommendations

Amend the Resource Management Act and ensure the proposed Natural and Built Environment Act prohibit resource consents being granted for new or expanded coal mines across New Zealand.

Amend the Crown Minerals Act to prohibit new or renewed coal permits being granted across New Zealand.

Develop a transition plan to phase out existing coal mining, and oil and gas drilling and to reduce regional and national demand for fossil fuel extraction, while addressing the needs of affected communities and those dependent on mining.

Managing dry year risk

Dry year risk has been identified as an issue for moving to a fully renewable, low carbon electricity system. Addressing this through the construction of a single large pumped storage system and raising Lake Onslow would be extremely expensive and have unacceptable environmental impacts. The

proposal would destroy nationally and regionally important wetlands as well as the habitats of rare and threatened plant and animal species.

The Tekapo/Pukaki hydroelectric scheme was designed with pumped storage in mind and should be investigated as a potential low impact form of pumped storage for managing dry year risk.

The Government should consider alternatives, including retain a residual role for gas as a dry year back up until technology and improvements in the electricity system adequately solve the dry year risk. Demand-side measures should be prioritised over large-scale supply side infrastructure where that infrastructure would harm nature.

Advice of the Commission

Forest & Bird particularly notes that the Commission expressed caution about the relative cost of relying on massive pumped storage to eliminate the final few emissions from the electricity sector.

The Commission recognises that dry year risk needs to be addressed but warns that increasing water storage (such as proposed multi billion-dollar Lake Onslow pumped storage project) could be very expensive, environmentally damaging, the relative emissions from keeping a back-up supply of gas would be relatively small and that it might be better to prioritise other emission reductions.

The Commission proposes that the Government consider modifying its present 100% renewable electricity target to become a 98% renewable electricity target. The Commission notes that the cost of pumped storage would require increasing electricity prices so a 100% renewable electricity target might simply prevent firms from electrifying their energy use, leading to higher overall emissions.

Recommendations

Develop a programme to encourage distributed generation.

Review the structure and operation of the electricity system, including ownership and market operations to minimise dry year risk

Investigate the use of existing hydro lakes for pumped storage, including Tekapo/Pukaki

Ensure any solutions support an overall reduction in greenhouse gas emissions

Appendix one

Farm models

Lincoln University Dairy Farm (LUDF) is a prominent illustration of how moderate changes to farm management, identified using a modern but under-utilised farm systems model, can deliver significantly increased profits for farmers, while reducing emissions and nutrient leaching. Using the Environ-Economic Model (E2M) (previously known as the GSL model) to identify optimal system changes, LUDF[9] reduced external inputs and the size of its herd (from 630 to 560 cows), which led to increased production per cow (from 400kgMS to over 500kgMS per cow) and profitability, while decreasing its nitrogen leaching by 30% (with significant reductions in CO2 emissions also likely). Increases in production per cow offset the reduction in herd size, so the whole system was more productive, more profitable, and lower-impact than its predecessor.

One consequence of reducing the herd size is that a proportionate drop in methane emissions will have occurred. On this basis the LUDF would have already delivered on its contribution to a 10% reduction in methane by 2030. This reduction was achieved without any adverse impact on farm operations or profitability, and without expensive mitigation technology. Milk solid production at LUDF increased slightly despite the lower stocking rates.

E2M achieves these 'no cost' solutions because it works differently to other farm systems models available in Aotearoa New Zealand (and the world)—and this makes it much more efficient and effective than those models. As explained in the 'Technical Foreword' to E2M (emphasis added)[10]:

> Most farms systems models [e.g. Farmax, UDDER, OverseerFM] available in Aotearoa New Zealand are effectively 'calculators'. Information about a farm management scenario is 'punched in' and the model provides an 'answer' stating the predicted outcomes of that scenario: the profits, costs, nutrient outputs, and/or emissions, among other things. These models are ok (within constraints) for assessing the outcomes of a current or past farm management scenario—i.e. what a farm is doing now or did last year—but are limited when it comes to determining the best options for future management or system change...
>
> If a farmer wants to investigate how to achieve a different outcome on their farm using one of these models (perhaps they want to intensify a part of their farm; remove synthetic fertiliser or Intensive Winter Grazing from their system; reduce nutrient leaching or emissions to meet an environmental regulation or standard; or increase their profitability), the operator of the model must make educated guesses about what changes could be made to farm management to achieve that outcome, 'punch' those changes into the model, and run the model again. They then have to check whether the 'input scenario' achieved the outcome or not and, if not, tweak the input before running the model over and over again until they find a way to achieve the desired outcome (or something close to it) or rule it out as an impossibility within the constraints of that farm. Needless to say it can be a time intensive, inefficient, and costly process, and can mean potential management scenarios are 'missed'...
>
> E2M essentially runs in reverse to these other models. When a 'base run' has been established in E2M using the existing farm management scenario, the outputs of that scenario are provided in an 'outcome report' window. If a farmer wants to investigate how to achieve a different outcome on their farm, the operator

[9] Lincoln University Dairy Farm Focus Day, 2012 - http://www.siddc.org.nz/assets/LUDF-Focus-Days/10-May-2012-.pdf

[10] https://bit.ly/3c6GJZQ

does not have to adjust the input scenario like in other models, but instead can make changes to the output scenario and define constraints for the model to work within. **For example... a farmer might want to determine how they can decrease their nutrient output by 20% without adversely effecting profitability. Rather than running the model over and over with different input scenarios in an attempt to achieve this outcome, the operator of E2M would simply set the output for nutrients at a value 20% lower than that of the 'base run' and indicate to the model that it should attempt to maximise profit within this constraint. When the model is run it effectively tests endless combinations of inputs with the aim of achieving the 20% reduction in nutrient outputs while maximising profitability, and reports back with the most efficient way of achieving that outcome. In this case, it would report the management scenario that reduces nutrient outputs by 20% and is most profitable. All of this can be achieved in seconds and effectively takes the 'educated guesswork' out of the modelling**[11].

Farm optimisation with the E2M model offers enormous potential to reduce the environmental impact of agriculture in New Zealand – through reductions in leaching, more efficient use of fertiliser and irrigation water, reductions in herd size and soil compaction rates, and most importantly, through reductions in greenhouse gas emissions. E2M can be used to model dairy, sheep/beef, or mixed systems (including organic, and is being trialed with regenerative systems), and is already an approved model for quantifying farm-level emissions under the He Waka Eke Noa program. Note E2M goes well beyond just *quantifying* emissions at farm-level – it can identify *how to reduce emissions* at farm level, often with an increase in profitability - and it already has an integrated emissions pricing layer, so it can determine how to farm profitably at a given carbon price. There is also huge potential to build alternative land use or 'offset' layers into the E2M model, so, for example, it could identify when planting native or pine trees for carbon credits on-farm could be more profitable than paying for carbon credits. Integration with Overseer is also possible.

Despite the E2M model having been used for Government-funded (MAF) work in 2007/2008 to assess the potential of farmers to cope with emissions pricing (and MAF having funded the integration of the pricing layer), and farm optimisation with the E2M model having recently been undertaken by Pāmu[12], wider uptake has been extremely limited. Instead, Aotearoa continues to rely on poorly suited and heavily privatised models like Farmax, UDDER, and Overseer. This means that New Zealand has significant low-hanging fruit to achieve **profitable** reductions in methane and carbon dioxides. The profitable nature of lower input farming also means that achieving the current methane target may actually be the cheapest emission reductions in New Zealand and cost farmers little or nothing to achieve.

This is neither fair on others in New Zealand who will have to make emission reductions at a higher cost, nor is it a fair contribution to global effort.

[11] This was summarised well in the Environment Court proceedings for the Proposed Hurunui and Waiau River Regional Plan in the evidence of Dr.David Graeme McCall for Fonterra and Dairy NZ, who stated "The [E2M] model was chosen over Farmax... because [it] is more efficient at finding optimal resource use allocations due to it being an optimising, rather than a simulation model. With simulation models (such as Farmax) the definition of optimal resource use requires the user to iterate their way to an optimum solution. This iteration is time consuming, not always full-proof and optima may be missed."

[12] https://www.youtube.com/watch?v=bl3tuI7im3I