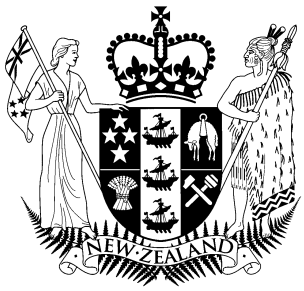

Review of the Scoping Report for an Environmental Assessment of the New Zealand Emissions Trading Scheme and Closely Related Measures

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This report and other publications by the Parliamentary Commissioner for the Environment (PCE) are available on the PCE's website: www.pce.govt.nz.

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Preface

Economic instruments for dealing with environmental problems have been talked about a great deal in New Zealand, but action has been slow to follow discussion. Using an economic instrument to put a price on carbon is not an optional tool for reducing greenhouse gas emissions; it is an essential tool.

In 2007, the New Zealand government decided to set up an emissions trading scheme (ETS) for greenhouse gases that would be an international "first" by including all six greenhouse gases and all sectors of the economy. At the end of that year, the Climate Change (Emissions Trading and Renewable Preference) Bill was introduced into Parliament. At the same time the government established the Climate Change Leadership Forum to provide it with advice. This group of leaders, experts and key stakeholders has sought advice on the environmental impacts of the ETS and the Cawthron Institute was engaged to provide that advice, the outcome of which is the Cawthron Report.

I was asked by the Leadership Forum to review the Cawthron Report and this report is that review. The Cawthron Report is comprehensive, but it is difficult to get a sense of the relative importance of the different environmental impacts, in part because of the sheer number of them. This review may help in that regard.

There are three key messages that emerge from our consideration of the Cawthron Report.

First, there are many ways in which the ETS and associated initiatives could affect the environment. Some of these are positive and some are negative. But any greenhouse mitigation policy response would have similar effects on the environment.

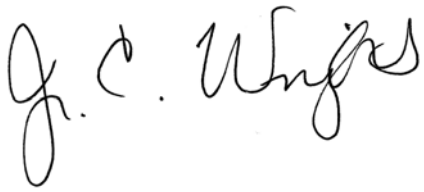
Second, none of the potential negative effects on the environment should delay the implementation of the ETS or require major modifications of the proposed legislation.

Third, the potential negative effect of the ETS that is of most concern is the threat to high value biodiversity from incentivising the planting of exotic forests for carbon storage. Some suggestions for ameliorating this are included in this review.

One of the initiatives associated with the ETS that is assumed by the authors of the Cawthron Report to have been implemented is the proposed biofuel obligation. Recently, I recommended to the Local Government and Environment Select Committee that the bill that would establish this obligation should not proceed. My view of the ETS bill is very different; the ETS should be implemented, and with its major design features intact. It is not perfect, but "the perfect is the enemy of the good".

The principle at the core of the ETS is "polluter pays". Its original design did allow for considerable subsidy of some polluters by the taxpayer. As I write this preface, the "polluter pays" principle has been further eroded through delaying the entry of the transport sector and a much slower phasing out of some free allocations. As a result, New Zealand will inevitably be slower to begin the adjustment to a carbon-constrained world.

This review is concerned with the environmental impacts of measures to slow down human-induced climate change. Our greater concern should be with the environmental impacts of climate change itself.



Dr Jan Wright
Parliamentary Commissioner for the Environment

Contents

1 Introduction

In December 2007, the government introduced into Parliament the Climate Change (Emissions Trading and Renewable Preference) Bill (the bill) to provide the statutory framework for a New Zealand Emissions Trading Scheme (ETS).

The April 2008 *Scoping Report for an Environmental Assessment of the NZ Emissions Trading Scheme and Closely Related Measures* (the Cawthron Report) was subsequently commissioned by the government to inform policy makers and stakeholders about the likely significant environmental impacts, both positive and negative, of the ETS (as proposed in the bill) and about potential response mechanisms.

This document is an independent review of the Cawthron Report prepared at the request of the Climate Change Leadership Forum.[1] The review aims to inform Parliament and the public in their consideration of the bill by:

- assessing whether the potential environmental effects of the ETS have been comprehensively identified and prioritised; and
- identifying any potential environmental impacts that may need to be addressed by changes to the bill or by other means.

It is important to note that many environmental pressures identified in the Cawthron Report as a result of the ETS would arise from **any** coordinated policy response to climate change New Zealand chooses to adopt.

2 Methodology

2.1 The Cawthron Report

The authors of the Cawthron report have used a five-step methodology to assess the environmental effects of the bill.

1. **Defining two future scenarios**
   The base case scenario comprises policies and measures already in place at 1 January 2008, including the Permanent Forest Sinks Initiative, the East Coast Forestry Project, the Sustainable Land Management and Climate Change Plan of Action, and one bill the authors of the Cawthron Report have assumed will be enacted, the Waste Minimisation Bill.

   The ETS-plus scenario includes the bill as proposed and other *closely related measures*, including the limitation on new fossil-fuelled thermal electricity generating capacity (as proposed in the bill), the proposed Biofuel Obligation, the Afforestation Grants Scheme, and the actions of the New Zealand Energy Strategy and the New Zealand Energy Efficiency and Conservation Strategy. The two scenarios are described in Appendix 2 of the Cawthron Report.

2. **Identifying the behavioural changes** that may be generated by the ETS-plus over the base case scenario in 10 sectors.

3. **Describing the potential environmental effects** associated with the behavioural changes identified in step two. This description includes a classification of the potential effects as positive (decreased pressure on the environment), negative (increased pressure on the environment) or uncertain.

4. **Attributing a probability and a 'significance' rating** to the potential environmental effects described in step three.

   'Significance' is defined in the Cawthron Report as a *combined judgement about the size of immediate and longer-term impacts, the rate at which change will occur, the importance of early action and the state of the relevant environmental qualities*.

   The authors use three significance ratings – low, moderate or high – and three probability ratings – possible, likely or expected. These are described in Appendix A to this review.

   The range of potential environmental effects identified and their assessment is recorded in Appendix 4 of the Cawthron Report.

5. **Proposing response measures** for a small number of potential environmental effects assessed to be of moderate-high significance, and some general observations as to options for proceeding, for most other potential environmental effects of the ETS-plus.

The 10 sectors considered by the Cawthron Report authors include:

- all the activities listed in schedules 3 and 4[2] of the bill; and
- additional activities, where behavioural change may be observed as a result of the ETS-plus (energy demand, mining, fishing, aquaculture, tourism and other service industries).

The Cawthron Report authors combined this extensive sectoral consideration with relevant existing reports and expert knowledge to comprehensively identify the potential environmental effects of the ETS-plus.

Finding 1
The methodology used in the Cawthron Report has enabled a comprehensive identification of the potential positive and negative environmental effects of the ETS-plus.

2.2 This review

This review briefly addresses the effect of the ETS-plus on greenhouse gas emissions, but mainly focuses on the non-greenhouse gas environmental effects of the ETS-plus.

In the Cawthron Report, prioritising the potential environmental effects of the ETS-plus is based only on the significance rating allocated to each effect, without accounting for the probability rating allocated to the effects in section 3 of the report.

This review examines both the probability and significance ratings allocated to the non-greenhouse gas environmental effects identified in the Cawthron Report, and combines them in matrix form (See Figure 1: *Pressures and potential* ***positive*** *environmental effects of the ETS-plus*, and Figure 2: *Pressures and potential* ***negative*** *environmental effects of the ETS-plus* in section 3 of this review). A unique identifier[3] has been allocated to the environmental effects listed in Appendix 4 of the Cawthron Report to ease cross-referencing.

Based on Figures 1 and 2, we have identified the major potential positive and negative environmental effects of the ETS-plus, and compared them with the findings of the Cawthron Report.

We then considered in more detail the major potential environmental effects of the ETS-plus and the associated key response measures proposed in the Cawthron Report. Findings are presented throughout this review.

Both this review and the Cawthron Report are solely concerned with the domestic environmental effects associated with the behavioural changes arising from the implementation of the ETS-plus in New Zealand. They do not consider global climate change effects associated with increased or reduced greenhouse gas emissions (such as changes in sea level or extreme weather events). Neither this review, nor the Cawthron Report, assesses the environmental effects of leakage.[4]

3 Greenhouse gas emissions

Appendix 4 of the Cawthron Report lists 16 pressures with resultant positive, negative or uncertain effects on New Zealand's emissions of greenhouse gases. Overall, the report assesses that the effect of the ETS-plus on New Zealand's net[5] greenhouse gas emissions will depend on the timeframe considered, with limited effects until 2013, but some reduction expected over the period to 2020.

Regarding gross[5] greenhouse gas emissions, the Cawthron Report notes that over the period to 2020, even with an ETS operating in New Zealand, gross domestic greenhouse gas emissions are expected to grow relative to 2008. No comment is provided on how this overall growth compares with the base case scenario – a scenario where New Zealand does *not* have a coordinated policy response to climate change.

The Cawthron Report's assessment of the effect of the ETS-plus on New Zealand's net and gross greenhouse gas emissions reflects the government's evaluation.[6]

The Cawthron Report proposes two measures to maximise the greenhouse gas benefits of the ETS-plus:

1. investigation by the government of the extent to which the delay in agriculture entering the ETS puts at risk the (greenhouse gas) benefits of the ETS-plus; and
2. significant strengthening of demand-side response measures in transport and stationary energy use by households and small to medium enterprises.

Regarding the first proposed measure, the following should be considered before any investigations take place:

- the potential for any delay in passing the bill or implementing the ETS that may result from opening the debate on the entry date of a given sector;
- the effect of both the proposed early monitoring of greenhouse gas emissions by the agricultural sector, and the government in-principle decision to set the free allocation of emission units of the agricultural sector at 90% of its 2005 emissions; and
- the signal that will be sent to the agricultural sector once the point of obligation has been clarified.

Regarding the second proposed measure, we agree that while the proposed ETS is a key initiative in New Zealand's response to the climate change challenge, other initiatives will also be required to reduce New Zealand's domestic greenhouse gas emissions. These should include demand-side response measures.

4 Overview of non-GHG potential environmental effects of the ETS-plus

This section considers the potential environmental effects of the ETS-plus relative to the base case, other than the effects of greenhouse gas emissions (discussed above).

4.1 The Cawthron Report

Forty-five behavioural changes and resultant potential environmental effects – referred to as "pressures" – are listed in Appendix 4 to the Cawthron Report. The executive summary of the Cawthron Report highlights seven potential positive environmental effects[7] and four potential negative environmental effects[8] of the ETS-plus, listed in Tables 1 and 2 below.

There are some inconsistencies between the executive summary and Appendix 4 to the Cawthron Report, including:

- the two **positive** pressures *decreased deforestation* and *decreased use of fossil fuel in industry* are listed in the executive summary but not in Appendix 4 to the report; and
- the **negative** pressure *colder and damper households due to the increased cost of heating* is assessed to have a high significance in Appendix 4 to the report

but is not included in the list of the most significant potential negative effects of the ETS-plus in the executive summary of the report.

The prioritisation of the potential environmental effects presented in Tables 1 and 2 are further discussed in sub-section 4.2 below.

Table 1: Potential positive effects of the ETS-plus highlighted in the summary of the Cawthron Report

Environmental effect	**Pressure**
1. Reduced soil erosion and sediment yield	...associated with an increase in afforestation, and a reduction in deforestation and conversion to intensive land use.
2. Gains in biodiversity in some areas	
3. Better water quality	
4. Improvements in air quality	...due to decreased use of fossil fuels in industry, stationary energy and transport, and relative increases in both walking and cycling.
5. More natural river flow	...due to the decrease in irrigation associated with higher electricity prices.
6. Less freshwater contamination from intensive farming run-off	
7. Improved marine ecosystems	...due to the reduction in energy-intensive fishing methods (such as sea-bed trawling).

Table 2: Potential negative effects of the ETS-plus highlighted in the summary of the Cawthron Report

Environmental effect	**Pressure**
1. Loss of some areas of indigenous ecosystem types with high biodiversity values, such as regenerating forest, scrubland and tussock grasslands	...that are eligible to be cleared and afforested to gain forestry sink credits.
2. Impacts on ecosystems	...due to the increased pressure to dam or divert rivers for generation of electricity.
3. Impacts on natural character and alternative uses	
4. Increased pressure on natural character and some landscapes, and potential land use and resource conflicts	… generally arising from both afforestation and the accelerated development of renewable energy sources, notably hydro and wind, but also possibly marine energy.

4.2 This review

4.2.1 Probability and significance ratings

The probability and significance ratings attributed to the potential environmental effects of the ETS-plus in the Cawthron Report are based on existing reports and expert knowledge.

In considering these ratings, we focused on the effects with a high combined probability and significance. Minor comments on the ratings are in Appendix B to this review.

With the exception of two positive and one negative pressure,[9] we have adopted the significance and probability ratings of the Cawthron Report for the purpose of this review.

Finding 2
The significance and probability ratings attributed to the potential environmental effects of the ETS-plus in the Cawthron Report are generally appropriate.

4.2.2 Potential positive effects

Figure 1 below tabulates the pressures and potential **positive** effects of the ETS-plus based on their probability and significance ratings. The shaded cells of Figure 1 identify the major potential positive environmental effects of the ETS-plus.

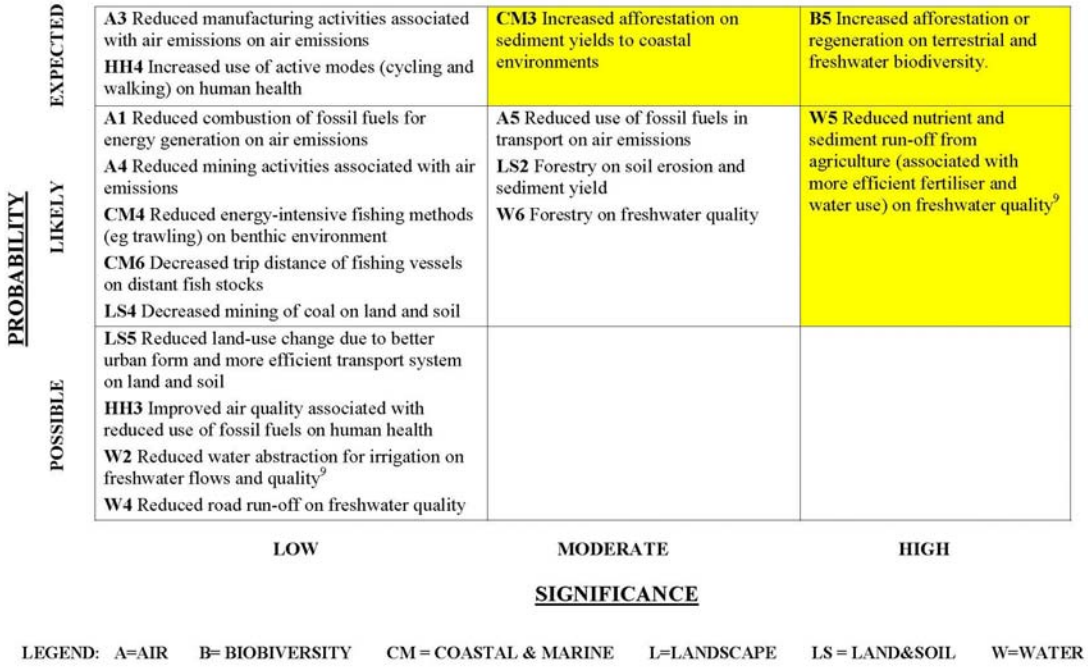
Pressures, their environmental effects and their significance are derived from Appendix 4 to the Cawthron Report; probability is derived from sections 3 and 4 of the Cawthron Report.

The positive effects of the ETS-plus with the **highest combined probability and significance** are:

- the effects of increased afforestation on terrestrial biodiversity, freshwater biodiversity and sediment yields to coastal environment (CM3 and B5); and
- the effects on freshwater quality of reduced nutrient and sediment run-off from agriculture (W5).

It is important to note that the positive effect of afforestation on terrestrial biodiversity applies mostly to the afforestation of agricultural or marginal land or to the regeneration of indigenous forests. It does **not** apply to the replacement of high biodiversity value indigenous ecosystems by exotic forests or to the replacement of high biodiversity value non-forest indigenous ecosystems with indigenous forests. This will be further discussed in section 5 of this review.

Figure 1: Pressures and potential positive environmental effects of the ETS-plus



Finding 3

The **positive** effects of the ETS-plus that are the most significant and likely to occur are:

- the effects of increased afforestation on terrestrial biodiversity, freshwater biodiversity and sediment yields to coastal environment; and
- the effects on freshwater quality of reduced nutrient and sediment run-off from agriculture.

4.2.3 Potential negative effects

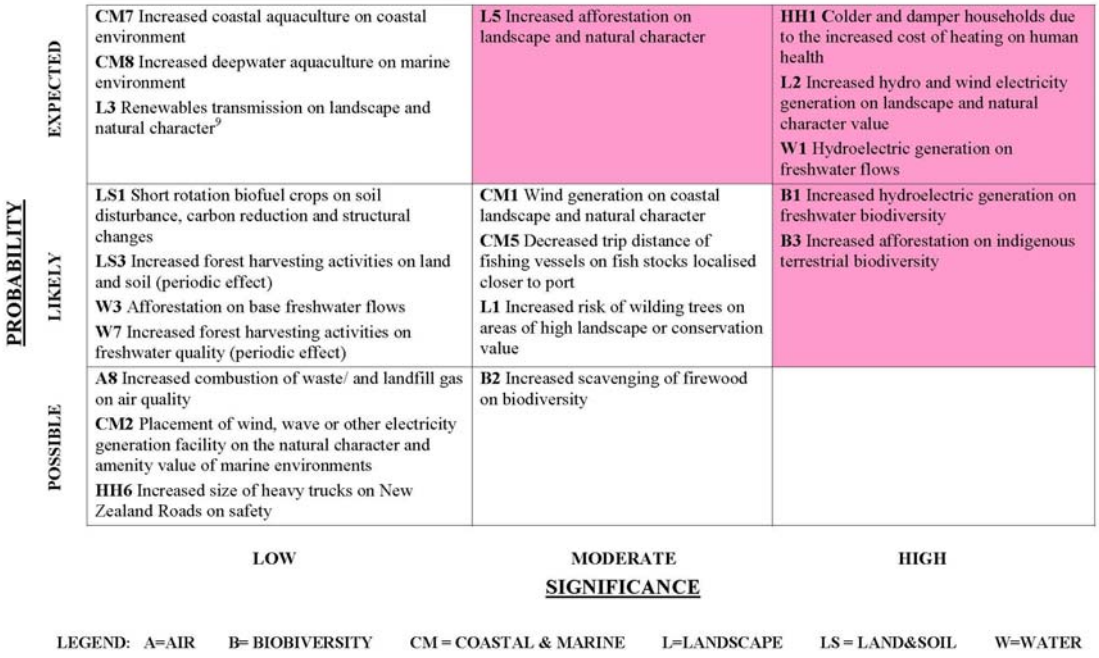
Figure 2 below tabulates the pressures and potential **negative** effects of the ETS-plus based on their probability and significance ratings. The darker shaded cells of Figure 2 identify the major potential negative environmental effects of the ETS-plus.

This review has identified six important potential negative environmental effects of the ETS-plus, on:

- landscape, from the increased number of renewable energy generation facilities (particularly hydro-electricity and wind farms) and increased afforestation (L2 and L5);
- freshwater biodiversity and flows, from increased hydroelectric generation (B1 and W1);
- indigenous terrestrial biodiversity from afforestation of high biodiversity value land (B3); and
- human health from colder and damper households due to the increased cost of

heating on human health (HH1).

Figure 2: Pressures and potential negative environmental effects of the ETS-plus



Finding 4

The **negative** effects of the ETS-plus that are the most significant and likely to occur are those on:

- landscape, from the increased number of renewable energy generation facilities (particularly hydro-electricity and wind farms) and increased afforestation;
- freshwater biodiversity and flows, from increased hydroelectric generation,
- indigenous terrestrial biodiversity from afforestation of high biodiversity value land; and
- human health from colder and damper households due to the increased cost of heating on human health.

5 Potential effects of the ETS-plus on terrestrial biodiversity

The Cawthron Report assesses that the ETS-plus, by creating a deforestation liability and providing an incentive to afforest, may affect terrestrial biodiversity, both positively and negatively. The potential **positive** effects derive from the increase in afforestation of agricultural or marginal land and the decrease in conversion of land from forest to agriculture. The potential **negative** effects derive from the 'likely' exotic afforestation of high biodiversity value indigenous ecosystem types such as regenerating forest, scrubland and tussock grasslands.

The Cawthron Report notes that the protection of areas with high biodiversity value through existing national instruments or local plans varies and in many regions is poor. The report suggests that the risk to biodiversity created by the ETS-plus should

be addressed both by changes to the design of the bill and other measures.

The "key response measures" proposed by the Cawthron Report are in Appendix C to this review, numbered R1-R5.

Finding 5
Additional measures to ensure the protection of high value indigenous biodiversity should be considered because of the incentive to plant exotic forests and the variable quality of the biodiversity management frameworks currently offered by councils. Consideration of these measures should not delay the implementation of the ETS.

The development of such additional measures should take into account the relevant existing strategies and provisions for protecting indigenous biodiversity[10] and the reasons that may have hindered their satisfactory implementation to date.[11] Care should also be taken not to increase the statutory responsibilities of local and regional councils, without providing adequate support.

The five key response measures proposed in the Cawthron Report fall into three categories: deterrents (R1), incentives (R2), and information to support decision making (R3, R4 and R5). The report does not suggest that the risk to indigenous biodiversity created by the ETS should delay the passing of the bill or require a significant redesign of the bill. We comment on the measures below.

Information
Widely available mapping of indigenous biodiversity in New Zealand is needed. However, if the participation of post-1989 forests in the ETS is made contingent on this additional mapping, the complexity and time required may significantly affect New Zealand's ability to optimally reduce its net greenhouse gas emission in the medium term. So we suggest that the additional mapping of indigenous biodiversity continues, but not be made a requirement of the bill.

Deterrents
The legislative framework that enables enforcement action where indigenous biodiversity has been affected is already in place under the Resource Management Act 1991, and is used by a number of councils. Introducing to the bill a penalty or enforcement provision associated with damage to indigenous biodiversity would result in an additional and unnecessary layer of complexity. The existing legislative framework should be used where deterrents and enforcement relating to indigenous biodiversity issues are required.

In addition, the ability of participants to gain carbon credits under the ETS should be made contingent to them having complied with all relevant legislation while undertaking the registered schedule 4 activity.

Incentives
The ETS offers an opportunity to exclude or give preference to certain emission units.[12] 'High biodiversity value units', for which the unit holder is able to demonstrate that the creation of the unit had **positive** effects on indigenous biodiversity, have a number of advantages.

In an international carbon market, that is likely to become stratified (with different prices for different types of emission units), New Zealand 'high biodiversity value units' are likely to have a high value and be widely accepted by participants in the domestic and the international carbon market. They would also contribute to the integrity of the ETS and help maintain the clean-green image of New Zealand. The bill could therefore contribute to the protection of indigenous biodiversity and mitigate the risk to indigenous biodiversity it creates by:

- enabling the identification of high biodiversity value units; and
- providing an incentive to create high biodiversity value units.

This may be achieved by requiring that the unique identifiers of emission units under clause 30G(1)(e) of the bill enable discrimination between high biodiversity value and other emission units. Other incentives could include lower administrative costs associated with the registration or verification of high biodiversity value units.

Finding 6
Both minor changes to the bill and complementary measures should be considered to address the potential risk to indigenous biodiversity created by the ETS. These could include enabling the identification of high biodiversity value units and providing an incentive to create high biodiversity value units.

6 Potential effects of the ETS-plus on freshwater

The Cawthron Report identifies a number of positive and negative potential environmental effects of the ETS-plus on freshwater quality, flows and ecosystem health, and assesses that overall the potential environmental effects of the ETS-plus are:

- likely to be positive on freshwater quality and ecosystem health; and
- expected to be mixed in terms of freshwater flows and levels.

According to the report, the potential **positive** effects of the ETS-plus on freshwater biodiversity, quality and flows are associated with an increase in afforestation and a reduction in deforestation, conversion of forest to agricultural land use, and water abstraction. The major potential **negative** environmental effects on freshwater flows and biodiversity are associated with a significantly increased pressure to dam or divert more of New Zealand's rivers.

The Cawthron Report proposes three key responses measures to address the negative pressure created by increased hydro-electric generation on freshwater. Details of these response measures are in Appendix C to this review, numbered R6-R8.

We have already noted our general agreement in section 2 of this review on proposed response measure R6, related to improved energy efficiency and demand-side management. Proposed response measures R7 and R8 call for further strategic environmental assessment and guidance for decision-makers. These can be addressed,

in parallel with the implementation of the ETS, through, for example, the current Sustainable Water Programme of Action and the proposed National Policy Statement on Renewable Electricity Generation.

7 Potential effects of the ETS-plus on landscape

The major potential effects of the ETS-plus on landscape arise from increased renewable energy generation (particularly associated with damming rivers and installing wind turbines) and increased afforestation. These effects can be either positive or negative including, for example, loss of natural character or change from an open to a closed landscape (such as may occur when converting pastures to forests) but also revegetation of eroding areas.

The legislative framework that enables the protection of outstanding natural features and landscapes is in place under the Resource Management Act 1991. Successful use of that framework to date has been varied, with little input at a national level on how to define, evaluate and manage landscapes, and considerable differences in the way regional and district plans and policy statements address landscape and natural character.[13]

The Cawthron Report proposes two key response measures to address the **negative** effects of the ETS-plus on landscape. These measures (listed in Appendix C and numbered R9 and R10) do not imply that any modification of the bill or delay in the passing of the bill is required.

In addition, any potential negative environmental effects of the ETS-plus on landscape can be addressed under existing processes and policies, or policies being developed, such as the proposed National Policy Statement on Renewable Electricity Generation. If these processes or policies need improving, this could be done in parallel with the implementation of the ETS.

8 Potential effects of the ETS-plus on human health

The Cawthron Report identifies both positive and negative potential effects of the ETS-plus on human health, including a major potential negative effect associated with colder and damper households. The report proposes that financial assistance be provided to low-income households in order to address the potential exacerbation of any ‘cold homes’ problem created by the ETS-plus.

Government assistance (through the actions of the New Zealand Energy Efficiency and Conservation Strategy) and the incentive created by the ETS-plus to improve the energy performance of existing homes (so reducing heating requirements) will, to an extent, counter the potential negative effect of the ETS-plus on homes’ temperature and humidity.

Finding 7
Any potential negative environmental effects of the ETS-plus on freshwater, landscape or human health should not require the bill to be modified, nor delay its implementation.

9 Uncertain effects of the ETS-plus

Appendix 4 of the Cawthron Report lists eight uncertain effects, for which *there is insufficient information to even undertake a preliminary assessment of the significance of the effect in the near term and no suggestion that a precautionary approach is appropriate*. These effects are listed in Appendix D to this review. The report proposes to address the uncertain effects of the ETS-plus through further investigation rather than *more active policy response measures*.

This review notes that the uncertain effects of the ETS-plus listed in the Cawthron Report are either minor,[14] more likely to be generated by drivers other than the ETS-plus, or can be addressed via existing legislation or processes, so do not require the bill to be modified, nor its implementation delayed.

10 Conclusions

Climate change is expected to alter not only the environment, but also social and economic patterns. It calls for a collective response. As a signatory of the Kyoto Protocol, New Zealand has agreed to reduce its greenhouse gas emissions during the first Kyoto commitment period (2008-2012) to its 1990 level of emissions, or to take responsibility for any excess. This is a legally binding target.

The government proposes to meet this target by establishing an Emissions Trading Scheme, and has formalised the legal framework for this scheme under the Climate Change (Emissions Trading and Renewable Preference) Bill, currently being considered by Parliament.

The Cawthron Report is a valuable tool for helping understand the potential environmental effects of the bill. The methodology used in the report has enabled a comprehensive identification of the potential positive and negative environmental effects of the ETS-plus, and the attribution of generally appropriate significance and probability ratings for those effects.

It is important to note that many environmental pressures identified in the Cawthron Report as a result of the ETS-plus would arise from **any** coordinated policy response to climate change New Zealand chooses to adopt.

As well as reducing net greenhouse gas emissions, the ETS-plus will have a number of other potential **positive** environmental effects, including reducing nutrient and sediment run-off from agricultural land and improving sediment yields, and terrestrial and freshwater biodiversity, where afforestation of agricultural or marginal land, or regeneration of native forests occurs.

The ETS-plus may also potentially generate important **negative** environmental effects on:

- landscape, from the increased number of renewable energy generation facilities (particularly hydro-electricity and wind farms) and increased afforestation;
- freshwater biodiversity and flows, from increased hydroelectric generation;
- indigenous terrestrial biodiversity from afforestation of high biodiversity value land; and
- human health from colder and damper households due to the increased cost of heating on human health.

Most of the important potential negative effects of the ETS-plus can be addressed as part of existing or proposed processes and policies. Neither the Cawthron Report, nor this review, have found that any of the potential negative effects of the ETS-plus should delay the implementation of an emissions trading scheme or require major modifications of the bill.

The only issue that would benefit from additional measures at this stage is the protection of high value indigenous biodiversity from exotic afforestation. Such measures could include:

- making the ability of participants to gain carbon credits under the ETS contingent to them having complied with all relevant legislation while undertaking the registered schedule 4 activity;
- enabling the identification of high biodiversity value units in the unit register; and
- investigating the feasibility of providing an incentive to create high biodiversity value units.

Appendix A: Probability and significance ratings used in the Cawthron Report

Probability ratings	Significance ratings
"It is expected that means that there is strong probability, based on stakeholder views and reference material, that a behaviour change or environmental effect will occur - this is the highest level of probability attached to potential outcomes described in this report."	"**High** – the expected change in environmental pressure is significant. New response measures may be required to ameliorate adverse effects or reinforce positive changes or both. Further investigation may be proposed."
"**It is likely that** means that a behaviour change or environmental effect is reasonably likely to occur. The outcome is considered much more likely than unlikely."	"**Moderate** – the expected change in environmental pressure is of some significance but is likely to be able to be managed through existing mechanisms. However the effectiveness of these existing response measures needs to be assessed and, where necessary, enhanced. Ongoing monitoring of environmental pressure is usually required and further investigation may be proposed."
"**It is possible that** means that it is reasonably plausible that a behaviour change or environmental effect will occur, but the probability is at the low end."	"**Low** – the expected change in environmental pressure is not significant. This judgment should be revisited during any review of the ETS but no additional response or further investigation is proposed at the present time."

Appendix B: Comments on the probability and significance ratings attributed to the potential environmental effects of the ETS-plus in the Cawthron Report

Focusing on the probability and significance ratings of the environmental pressures identified in the Cawthron Report (in the darker shaded and adjacent cells of Figures 1 and 2), this review notes that:

- The Cawthron Report gave a significance rating of 'moderate' to the effect of the ETS-plus on landscape and natural character associated with increased renewable energy transmission needs (L3). This review assessed the significance rating of that pressure to be 'low' for a number of reasons. Independently of the ETS-plus, transmission upgrades are being considered, driven by security of supply issues and increasing electricity demand associated with population growth. In addition, proposed wind farms are increasing in capacity and there is a tendency to locate them close to the existing national grid.
- The Cawthron Report gave a probability rating of 'expected' to the reduction in demand for irrigation caused by an increased cost of electricity for pumping (W2). This review assessed the probability rating for that pressure to be 'possible' because gravity fed irrigation systems do not consume electricity and onsite generation of electricity is likely to become more common as 2013 approaches[15].
- The Cawthron Report gave a significance rating of 'moderate' to the potential positive effect of the ETS-plus on freshwater quality associated with reduced nutrient and sediment run-off (W5). Nutrient run-off is associated with the application of fertiliser to land, which is itself strongly linked with greenhouse gas emissions from agricultural soils. In 2006, agricultural soils contributed 16% of New Zealand's total greenhouse gas emissions.[16] The drive to reduce greenhouse gas emissions from agricultural soils will lead to reduced nitrate leaching. This review assessed as 'high' the significance of the potential positive effect of the ETS-plus on freshwater quality associated with reduced nutrient run-off, because agricultural soils significantly contribute to New-Zealand's greenhouse gas emissions.

Appendix C: Key response measures proposed in the Cawthron Report to address the biodiversity, freshwater and landscape risks created by the ETS-plus[17]

Biodiversity	
R1	Provide criteria in the Afforestation Grant Scheme and the bill to ensure that grants and carbon credits are not awarded for planting exotic forestry on areas of high biodiversity value.
R2	Provide additional incentives for indigenous afforestation.
R3	Ensure that biodiversity mapping is completed across New Zealand as a matter of urgency.
R4	Complete the base map of 'land use at 1990' as soon as possible, at sufficient resolution to identify significant indigenous vegetation and to enable owners to see whether or not their land is 'Kyoto forest' (post-1989).
R5	Undertake further environmental assessment if pre-1990 indigenous forests are included in the ETS, or if the ETS-plus is amended to create more flexibility for land use change for pre-1990 forests.
Rivers	
R6	Strengthen measures to enhance energy efficiency and demand-side management in the energy sector, especially, but not exclusively, in relation to electricity.
R7	Consider undertaking a strategic environmental assessment of the role of further hydroelectric generation in a sustainable energy system.
R8	Provide guidance on the potential use of freshwater resources for hydroelectric generation via the Sustainable Water Programme of Action.
Natural character and landscape	
R9	Develop a national instrument to guide identification, recording and protection of high value landscapes.
R10	Address wind and marine energy development in the Coastal Policy Statement review.

Appendix D: Uncertain effects of the ETS-plus, as listed in Appendix 4 of the Cawthron Report

PCE identifier	Effects	Rating
B4	New or expended renewable energy sources on biosecurity	Uncertain
L4	Changed pressures on landscapes and natural character arising from changes in land-use in response to transport price increases	Uncertain
CM9	More farming of filter-feeders could deplete phytoplankton in nutrient-poor areas or remove excess nutrient in enriched areas, finfish farming has opposite effects	Uncertain
A2	Fuel switching to wood from electricity, gas and coal	Positive to uncertain
A6	Changes in transport patterns on air quality	Low, uncertain
A7	Increased use of biofuels on air quality	Moderate-high, uncertain
HH2	Health impacts arising from changes in ambient and indoor air quality due to fuel switching to wood	Uncertain to positive
HH5	Health impacts of air quality changes due to increased use of biofuels	Uncertain

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Endnotes

[1] A group of leaders, experts and key stakeholders set up by government to advise the government on emissions trading and related issues.

[2] Schedule 3 of the bill lists all activities that must participate in the ETS. Schedule 4 of the bill lists all activities that may participate in the ETS.

[3] For the potential environmental effects identified in relation to land and soil, LS1-LS5; biodiversity: B1-B5; landscape and natural character, L1-L5; freshwater flows and water quality: W1-W7; coastal and marine environment, CM1-CM5; air pollution A1-A8; and human health HH1-HH6.

[4] Emissions leakage "arises when a product's manufacture is re-located to countries without a carbon cap, leading to no (or a smaller) net decrease in global greenhouse gas emissions and potential economic and social disruption from the re-location of that production." (Source: Greenhalgh *et al*., 2007).

[5] Gross greenhouse gas emissions are the sum of emissions from energy (including transport), industrial processes, solvent and other products use, agriculture and waste.

Net greenhouse gas emissions are the sum of gross greenhouse gas emissions plus greenhouse gas emissions associated with the deforestation of pre-1990 forests minus the quantity of greenhouse gases removed from the atmosphere in the land-use, land-use change and forestry sector.

(Source: definition derived from Ministry for the Environment, 2007a: 7).

[6] Ministry for the Environment, 2007b and Climate Change (Emissions Trading and Renewable Preference) Bill - Explanatory note.

[7] All of the 'high' significance, most of the 'moderate' significance and some of the 'low' significance effects of Appendix 4 to the Cawthron Report.

[8] Negative effects with a 'high' and 'low-high (varies)' significance in Appendix 4 to the Cawthron Report, except for the "Health effect arising from household being damp and cold".

[9] "Renewables transmission on landscape and natural character" (L3) assessed to be 'moderate' in the Cawthron Report and 'low' in this review.

"Reduced water abstraction for irrigation on freshwater flows" (W2) assessed to be 'expected' in the Cawthron Report and 'possible' in this review.

"Reduced nutrient and sediment run-off from agriculture (associated with more efficient use of fertiliser and water use) on freshwater quality" (W5) assessed to be 'moderate' in the Cawthron Report and 'high' in this review.

[10] These include the Resource Management Act 1991; Ministry for the Environment, 2004; Ministry for the Environment and Department of Conservation 2007; and covenants on private land.

[11] Some of those reasons are presented in Ministry for the Environment, 2004.

[12] Such as Certified Emission Reduction units from nuclear projects, which the government has decided to exclude.

[13] Office of the Parliamentary Commissioner for the Environment, 2006.

[14] This also includes the effect of the use of biofuels on air quality. If limited to 3.4% of total fuel energy sold, and comprising both bio-ethanol and biodiesel, the use of biofuels is unlikely to have a measureable impact on air quality.

[15] Office of the Parliamentary Commissioner for the Environment, 2004:125.

[16] Ministry for the Environment, 2008:11.

[17] Identifiers R1-R10 attributed to each key proposed response measure by this review, for cross-referencing purposes.