NEW ZEALAND

Submission to the Subsidiary Body for Scientific and Technological Advice (SBSTA)

Views on issues related to agriculture

September 2013

Context

The thirty-eighth session of the Subsidiary Body for Scientific and Technological Advice (SBSTA) invited Parties and admitted observer organisations to submit to the secretariat their views on the current state of scientific knowledge on how to enhance the adaptation of agriculture to climate change impacts while promoting rural development, sustainable development and productivity of agricultural systems and food security in all countries, particularly in developing countries, taking into account the diversity of agricultural systems and the differences in scale as well as possible adaptation co-benefits.

2. This submission will focus on work done in New Zealand on agricultural adaptation. The New Zealand Government has financed two major assessments of climate change impacts on agriculture in New Zealand. In addition, many smaller studies have also been conducted on more discrete aspects of impacts and adaptation. This submission will share New Zealand's experiences and lessons learned and conclude with suggestions for further work on issues related to agriculture under the SBSTA.

Key points

3. New Zealand's understanding of the impacts of climate change on New Zealand agriculture has progressed from a focus on macro-level impacts to a second stage of modelling the effectiveness of farm-level adaptations.

4. Climate change adaptation occurs locally, is enterprise specific and requires value decisions made by land managers on what is best for their particular system in response to climate change, and their particular environmental, cultural, economic and social context.

5. There are many areas where future work is needed to reduce scientific uncertainty. A key area for New Zealand will be understanding climate change adaptation constraints and synergies in a future where farmers may face changing market or regulatory conditions.

6. New Zealand finds the SBSTA submissions process an especially useful way to share our experiences and lessons learned, and learn from the experiences of other Parties. New Zealand looks forward to participating in the workshop on this topic at COP19. In New Zealand's view the SBSTA should build on this work by having further targeted submission

processes and workshops on other areas of interest within the agenda item 'Issues relating to agriculture', and by advancing the work on these issues through further SBSTA special events.

Background to New Zealand climate and agriculture

7. New Zealand's climate is complex and varies from warm subtropical in the far north, to a cool temperate climate in the far south, with alpine conditions in the mountainous areas. Mountain chains extending the length of New Zealand provide a barrier for the prevailing westerly winds, dividing the country into dramatically different climate regions. These diverse climatic zones result in a diverse range of climate change impacts and therefore means of adaptation to a changing climate.

8. New Zealand's agriculture sector is market-based and export-oriented. Economic reforms during the 1980's in New Zealand removed virtually all subsidies, including agricultural subsidies. New Zealand now has the lowest level of agricultural support of any OECD country (less than one per cent). The market-based nature of New Zealand's agricultural sector influences the approach to climate change adaptation, including the role of government in agricultural adaptation in New Zealand.

9. The market-based and export-oriented nature of New Zealand's agricultural sector reduces barriers to land use change. In many other countries, land use change (for example switching land use from rice to corn production) may not be a simple decision, due to local culture and food demand. To an extent, New Zealand farmers are experienced with adapting production systems and changing land use in the face of changing market demands. For example, due to favourable market conditions dairy land use has increased 68 percent since 1990 and wine production has doubled since 2005. The ability to change land use has influenced our approach to adaptation research, in that New Zealand research often assumes farmers will change land use and/or production system if it is profitable to do so.

Climate change adaptation in New Zealand

10. The New Zealand economy depends heavily on biologically-based industries. Around the world agriculture is already experiencing the impacts of climate change, and New Zealand's awareness of these impacts has been sharpened by the severe droughts of the 2007-08 and 2012-13 southern hemisphere summers.

11. Science, research and modelling is essential to help inform decisions but cannot be a sole basis for decisions. The role of government in New Zealand agriculture is to ensure land managers, rural advisors and industry organisations have access to the knowledge needed to guide decision-making, but ultimately, farm adaptation decisions are made by private land managers. Appropriate policy settings at national and regional levels ensure that adaptation by land managers can occur effectively.

12. New Zealand has developed scientific capacity to identify and analyse drought risk. In recent years the consequences of changes in drought risk and agricultural production under climate change have been more clearly identified. However, it has been recognised that there is a need to progress this further, to understand secondary and tertiary impacts of

climate change, and the role management or adaptation can play in reducing the negative impacts of climate change.

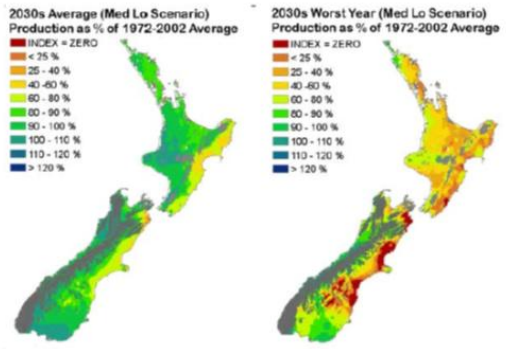
13. Understanding impacts and looking for viable adaptation options provides a constructive approach to managing both current climate variability and changes in future variability. Managing variability has always been a feature of the New Zealand production environment and many of the techniques to address climate variability will provide a degree of resilience to future climate change.

Current state of New Zealand scientific knowledge on how to enhance the adaptation of agriculture to climate change

14. To prepare for the impacts of climate change on agriculture, the initial need of agricultural policy makers in New Zealand was to understand the long-term macro-level impacts of climate change. This included assessments of the change in average production and also variability in production for the purpose of macro-level policy decisions. These assessments enabled policy makers to understand the economic risk posed by climate change, the value of new infrastructure projects (such as irrigation schemes) and the pressures placed on current infrastructure. New Zealand conducted a large-scale study in 2007 that assessed these broad impacts.[1]

15. The research found that: the projected changes to pasture production are small when averaged; winter production will increase while summer production will fall; and, production will increase in some areas while decreasing in others (Figure 1, left). Projections also indicate a more variable climate in the future with droughts becoming increasingly severe. For example, the worst drought during the reference period 1972-2002 decreased the pasture growth for the 1977-78 season by 29 per cent, while the study projected the worst drought in the period 2030-2049 would be expected to decrease a season's pasture growth by 48 per cent (Figure 1, right).

Figure 1: Relative production projections for the 2030s



Source: EcoClimate Report

Climate change adaptation to maintain and enhance agricultural productivity, rural development and food security

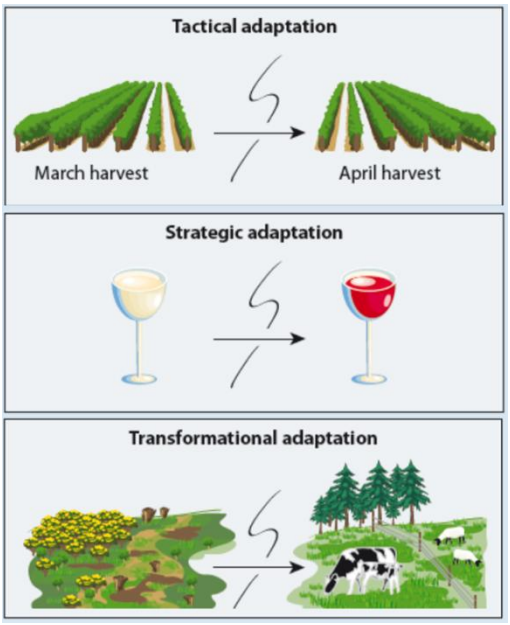
16. The second phase of research has been focused on providing relevant information for individual land managers. A second major study was completed in 2012 which applied a bottom-up approach by modelling the impacts of climate change on a range of sample farms. This study then looked at a variety of farm manager responses and assessed the economic and productivity consequences of the adaptation measures. A technical report

[1] *The EcoClimate Report: Climate change and agricultural production*, Ministry of Agriculture and Forestry, 2007. Available at http://docs.niwa.co.nz/library/public/ecoclimate.pdf

was produced for the science community and a stakeholder report was produced for the farming community.[2,3] The stakeholder report has been particularly well received.

17. New Zealand's land based sectors have a comprehensive choice of adaptation options. They are well positioned to meet the challenges ahead and, at times, also capture potential opportunities. Adaptations were considered to range from 'tactical', to 'strategic', to 'transformational' (Figure 2). Tactical adaptations include the adjustment of current practices. For example, increasing the rate of rotation used for pasture grazing. Strategic adaptations include the use of existing technologies that were not previously suited to the location of the farm, for example, shifting pasture to a more drought resistant species. Transformational adaptations were considered to be where new production systems, infrastructure or technologies were needed in order to adapt land to climate change.

Figure 2: Adaptation Categories



18. While tactical adaptations can be implemented in the short-term, they are more suitable for small to moderate levels of climate change. Transformational adaptations are more appropriate where climate change is severe, but will take time and funds for land managers to implement.

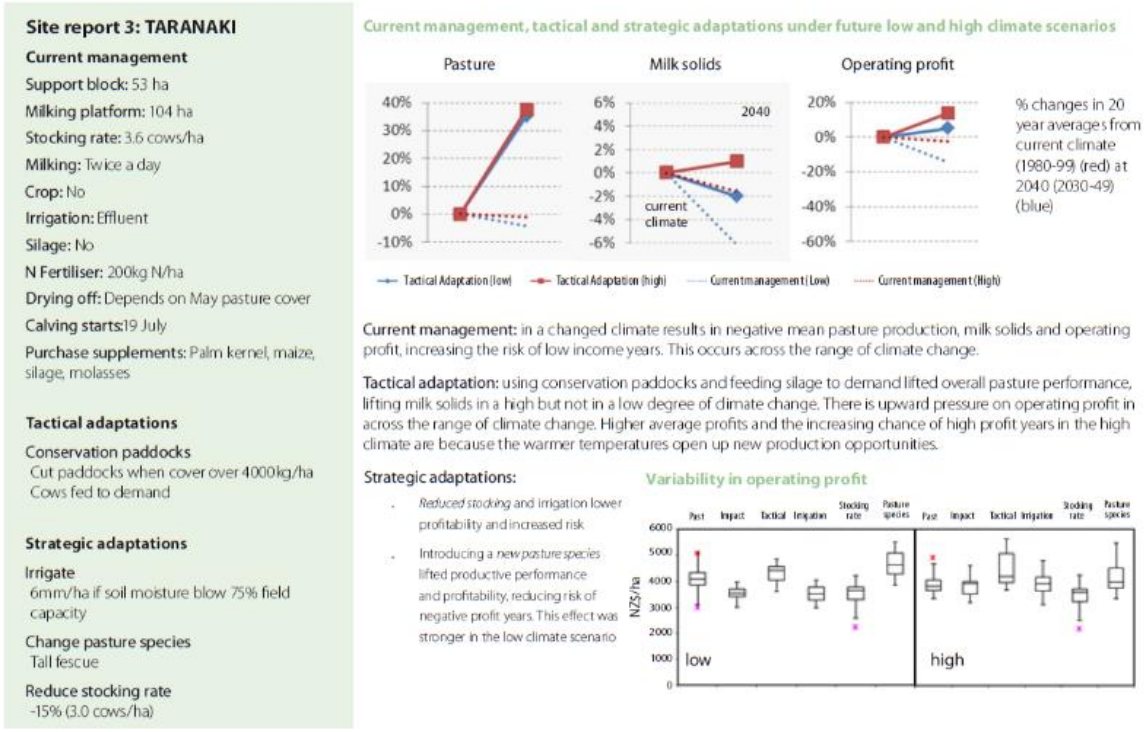
19. Policy-makers found that a key benefit of this work was the level of engagement from farmers. Farmers were able to relate the work done to their own farm circumstances and management choices.

20. Figure 3 shows an example of bottom-up farm level modelling results. For this example the existing production system would have experienced moderate reductions in operating profit under a high and low climate forecast for the 2030-49 period. With tactical adaptations however the production could be maintained and profit could be increased above previous levels. Strategic adaptations offered only mixed results for the period analysed, but may have been more profitable under a longer-term scenario.

[2] *Impacts of climate change on land-based sectors and adaptation options: Technical Report*, Ministry for Primary Industries, November 2012.

[3] *Impacts of climate change on land-based sectors and adaptation options: Stakeholder Report*, Ministry for Primary Industries, November 2012. Available at: http://www.mpi.govt.nz/Default.aspx?TabId=126&id=1581

Figure 3: Site report for Taranaki dairy farm



21. Increased variability is a key theme of climate change research. Figure 4 shows the change in gross margin for a model New Zealand (Hawkes Bay) sheep and beef farm in moving from a 1990 to a 2030-2049 climate. While the adaptations modelled have the potential to preserve the current average gross margin under a changing climate, the variability in gross margin is increased. The cumulative impact of back-to-back climatic events is little understood but is potentially a large challenge for land managers and rural communities.

Figure 4: Box-plot of gross margin for Hawkes Bay Sheep and Beef farm

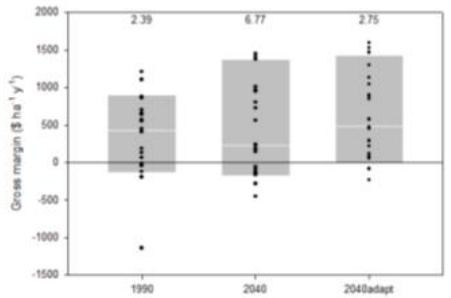


Figure 4.14. Boxplots of the gross margins for Hawke's Bay using the high climate change projections for the current farming system in the time period 1980 – 1999 (labelled '1990'), the current farming system with projected pasture growth for 2030 – 2049 ('2040') and an adapted farming system with projected pasture growth for 2030 – 2049 ('2040adapt'). The bottom boundary of the box indicates the 10th percentile, the line within the box marks the 50th percentile (median), and the upper boundary of the box indicates the 90th percentile. The individual annual gross margins are also shown and the variability indices for each period are shown above the boxplots (see text for details).

Climate change adaptation in the context of sustainable development

22. Sustainable development, including greenhouse gas mitigation and reducing nitrate loss from agricultural land, is currently an area of focus for government, agriculture sector organisations and farm managers in New Zealand. The impact of agriculture on water quality has been a recent area of particular focus.

23. It should be noted that potential future constraints on greenhouse gas emissions and nutrient losses may potentially constrain the options farmers have for adaptation. This link

between sustainable development and climate change adaptation, in New Zealand, is an area that requires further research. A holistic approach to climate change issues, both adaptation and mitigation, will allow policy makers to ensure that sustainable development and climate change adaptation are approached in harmony.

24. Measures to improve efficiency and productivity will often improve sustainability and assist farmers to be more resilient in the face of a changing climate, while at the same time managing greenhouse gas emissions. For example, in New Zealand sheep farmers have emphasised the breeding of ewes that will produce twins rather than a single lamb. As a result New Zealand has increased lamb production while reducing the size of the sheep flock by 47% since 1990. This reduction in the size of the flock needed for lamb production will ensure farmers are more resilient through extreme events as fewer sheep are needed to maintain lamb production.

25. There are both areas of commonality and trade-offs between the actions that farmers will take to specifically adapt to climate change and the actions New Zealand farmers are taking to mitigate greenhouse gas emissions and reduce nitrate leaching. The implications of a single farm management decision will often result in a complex series of outcomes, with varied implications for greenhouse gas mitigation and climate change adaptation.

For example:

i. As an adaption to a series of recent droughts, many northern New Zealand dairy farmers have installed feed pads to allow increased use of supplementary feed during dry periods (pasture continues to provide over 90 per cent of average total dietary needs).
ii. Increased use of supplementary feed will have greenhouse gas emissions implications depending on, amongst other things, the carbon footprint of the feed used.
iii. Farmers find that feed pads can also be utilised during high rainfall events as stand-off pads to reduce pasture and soil damage, reducing direct excretion to pasture and resulting in more effluent entering a management system rather than deposited directly to pasture.
iv. Reducing direct excretion to pasture, especially while soils are saturated and during winter months, will reduce nitrous oxide emissions and nitrate leaching, however storing effluent may result in increased methane emissions.

26. Increased atmospheric carbon dioxide (CO_2) concentrations have been shown to increase carbohydrate levels and decrease protein content of C_3 plants (non-tropical grasses). Currently the protein content of most New Zealand pastures is generally greater than animal requirements. Increased carbohydrate levels due to elevated CO_2 could potentially lead to increased nitrogen efficiency and productivity and decreased nitrous oxide emissions and nitrate leaching (however, associated changes in soil microbial populations, pasture plant species composition, soil water dynamics and partitioning of ingested plant protein in animals under elevated CO_2 makes the direction of these system changes difficult to predict, and this remains an area of on-going research).

27. Meanwhile, increasing temperatures will see the continued southward movement in New Zealand of sub-tropical grasses and weeds. A spread of tropical grasses and weeds will reduce pasture digestibility and likely increase greenhouse gas emissions (per unit of production).

28. Adaptation measures focused on limiting the spread of tropical grasses, weeds and pests will result in avoided emissions increases. While measures to maintain non-tropical grasses in the presence of increased CO_2 concentrations may further reduce greenhouse gas emissions, creating a synergy between adaptation and mitigation efforts. Again, more research is needed here.

Conclusions and next steps

29. New Zealand is pleased to have this opportunity to share our experiences and lessons learned in this important area. The process of compiling this submission has also been useful for the New Zealand Government in understanding its own current capacity. In New Zealand's view Parties should make this submission process, and the upcoming workshop, the first step in a broader discussion on climate change issues related to agriculture.

30. New Zealand also suggests that the SBSTA build on this first step, which has had an adaptation focus, with a similar process to understand the current state of the science on agricultural greenhouse gas emissions and measures to improve emissions efficiencies (per unit of production, or from business-as-usual levels). Such work should of course take into account, amongst other things, interactions with individual party development needs, the socio-economic importance of agriculture, and the need to increase food production in the face of growing global populations.

31. This submission process is only one step in understanding agricultural adaptation to climate change. More work is needed to progress this work to more tangible outcomes for farmers in regions around the world. The next phase of SBSTA work could include, amongst other things, organisation of expert meetings and reports; IPCC special reports; and SBSTA special events, taking into account relevant work under the Nairobi work programme.

32. Work under the SBSTA should take care to focus on both the macro-level impacts of climate change on agriculture and the farm level responses. The diversity of global farm systems must be taken into account. It is also important that this work takes into account co-benefits and trade-offs with sustainable development needs, such as greenhouse gas mitigation and enhancing rural development. Interactions with resilience and social, economic, environmental and cultural adaptation options need to be taken into account.

33. New Zealand looks forward to discussions with Parties at the up-coming SBSTA workshop. New Zealand would welcome the opportunity to make a presentation building on the information in this submission at this upcoming workshop.