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UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE

Subsidiary Body for Scientific and Technological Advice
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Item 5 of the provisional agenda
Issues relating to agriculture

Views on issues relating to agriculture

Submissions from Parties and admitted observer organizations

Addendum

1. In addition to the six submissions contained in document FCCC/SBSTA/2015/MISC.1, three further submissions have been received.

2. In accordance with the procedure for miscellaneous documents, these submissions are attached and reproduced* in the language in which they were received and without formal editing.[1]

* These submissions have been electronically imported in order to make them available on electronic systems, including the World Wide Web. The secretariat has made every effort to ensure the correct reproduction of the texts as submitted.

[1] Also available at <http://www4.unfccc.int/submissions/SitePages/sessions.aspx?showOnlyCurrentCalls=1&populateData=1&expectedsubmissionfrom=Parties&focalBodies=SBSTA>.

Contents

Paper no. 1: Brazil

Views on the development of early warning systems and contingency plans in relation to extreme weather events and assessment of risk and vulnerability of agricultural systems to different climate change scenarios

Submission from Brazil

1. The Government of Brazil welcomes the opportunity to submit its views on issues related to agriculture: (a) Development of early warning systems and contingency plans in relation to extreme weather events and its effects such as desertification, drought, floods, landslides, storm surge, soil erosion, and saline water intrusion; and (b) Assessment of risk and vulnerability of agricultural systems to different climate change scenarios at regional, national and local levels, including but not limited to pests and diseases (document FCCC/SBSTA/2014/2, paragraph 86).

2. Consideration of this matter builds on previous work done by SBSTA, where previous discussions have highlighted the need for further scientific and technological knowledge on adaptation measures in the agriculture sector. SBSTA plays an important role in providing opportunities for sharing scientific knowledge on adaptation practices and approaches among Parties and exploring ways to apply current scientific and technological knowledge, as well as developing new knowledge, in agriculture adaptation.

3. Agriculture is a unique issue-area, determinant to food security and key to the economies of most countries, in particular developing countries. Agricultural activities provide a source for wealth generation and job creation, playing a crucial role in poverty eradication and sustainable development. At the same time, agriculture suffers the main brunt of the negative effects climate change impacts, with significant developmental impacts. Consequently, the main aspect of the discussions related to agriculture under the UNFCCC is to ensure that food production is not threatened, as expressed in the ultimate objective of the Convention (article 2). Along with efforts under the Convention to limit the increase in global average temperature below 2 °C above preindustrial levels, it is therefore important to define actions to support and increase food production capacity and agriculture productivity.

4. Policies and measures should strengthen the capacity of different agricultural production systems to face the negative impacts of climate change, build up resilience and reduce vulnerability and exposure to risk. At the same time, they should not constitute disguised distortions to agricultural trade and production, and shall fully comply with the multilateral trade rules embodied in the WTO, especially the Agreement on Agriculture.

5. Climate variability and the increase in frequency and severity of extreme weather events have adverse and disruptive impacts on production processes, posing a threat to livelihoods and to food security. Excessive disturbances in climate conditions – human activities, microclimatic imbalances, soil integrity – negatively impacts natural processes on which agriculture activities are dependent. Therefore, understanding climate variability as part of policy and decision-making in the agriculture sector is key to ensure that food production is not threatened.

6. The agriculture sector faces the challenge of developing strategies that allow the sector to sustain and increase productive capacity in the face of climate variability and extreme weather events. Efforts go beyond and are different in nature from the current instruments and services offered to producers for decision-making and management of climate risks. Priority should be given to readily-available and accessible information, allowing producers to decide on production processes and technologies in light of increased

climate uncertainty. Developing knowledge and bringing it to the producer requires increasing levels of financing, provision of appropriate technologies and building capacity at all levels.

7. **Early warning systems** should be integrated into different information and communication technology (ICT) platforms and processes, as part of the support system for producers to minimize risks and improve yields, tailored to local realities. EWS coupled with **contingency plans**, based on instruments that allow producers to fully recover in case of extreme weather events, adjusted to productive systems and climate characteristics of each region and including provisions of technical and financial support.

8. **Risk and vulnerability assessments** are critical to direct policies, priorities of action and reassess policy and financial instruments in the light of adverse effects of climate change on existing and planned productive systems, including social and economic impacts. These assessments play an important role in research and development of improved crop and animal varieties, breeds and species. They should include knowledge of how climate change impacts not only pest and disease, but also the impact of new temperature and precipitation patterns (including gradients and intensity) on plant metabolism (flowering, fructification, resistance to water and temperature stress, among others) and animal metabolism (including productive capacity and animal welfare).

9. The UNFCCC should promote, in collaboration with FAO, the CGIAR Consortium, and other relevant international organizations, as appropriate, measures to support adaptation of agroecosystems to the adverse effects of climate change, through:

(a) Providing a mechanism for sharing best practices, experience and information in a dynamic and effective manner, in the following areas:

i. climate monitoring and early warning systems, including integrating ICTs to support producer decision making;
ii. technical support systems that are flexible and able to respond to producers on short notice;
iii. policy, finance and technological instruments that minimize climate risk or that allow for a rapid recovery of productive systems, minimizing impacts on productive capacity;
iv. strategies to assess risk and vulnerabilities, as well as assessment of such assessments, on different aspects of plant and animal productive systems, including vulnerability or resilience of different technological options in the productive systems;
v. assessment of potential economic impacts of risks and vulnerabilities.

(b) Exploring a strategy that allows for developing or sharing of climate monitoring and warning systems, as well as studies on risk and vulnerability, according to different national and/or regional characteristics.

Paper no. 2: New Zealand

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

Issues related to agriculture

May 2015

Context

1. The fortieth 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:

a) development of early warning systems and contingency plans in relation to extreme weather events and its effects such as desertification, drought, floods, landslides, storm surge, soil erosion, and saline water intrusion;

b) assessment of risk and vulnerability of agricultural systems to different climate change scenarios at regional, national and local levels, including but not limited to pests and diseases.

Summary

2. The New Zealand government policy framework is focused on providing timely and relevant climate change information to land managers, and ensuring that government policy does not weaken natural incentives to adapt. Under this environment land managers are able to take appropriate adaptation measures in relation to their individual farms. When adverse events occur, New Zealand farming families have access to welfare assistance comparable to other sectors of the New Zealand economy.

3. The New Zealand policy approach is suitable for the New Zealand-specific context. The same approach would not be appropriate in all countries, however there are learnings that can be tailored to broader contexts as appropriate.

Views on future work of SBSTA on issues relating to agriculture

4. This first phase of SBSTA work is an opportunity for Parties to gain an understanding of the various Parties' circumstances and experiences in regards to climate change issues relating to agriculture (mitigation, adaptation, food security). In this first phase, it is important that SBSTA undertake a comprehensive review of the evidence base, including: the observed and projected impacts of climate change on agriculture; greenhouse gas emissions arising from agriculture and possible mitigations (including technical innovations); possible synergies and trade-offs between mitigation; adaptation and food security; and identification of suitable measures and practices. In this regard, New Zealand welcomes the conclusions of SBSTA 38 and SBSTA 40. New Zealand looks forward to further technical discussions at SBSTA 42 (June 2015) and SBSTA 44 (June 2016).

5. This work will lead to a clear understanding of the particular challenges and opportunities that are unique to the agricultural sector. Parties will need to consider which issues require further work by SBSTA, or require forwarding to other UNFCCC bodies for consideration or decision.

6. New Zealand suggests that conclusions on further work may be most appropriately finalised after the final workshop in June 2016. However, there may be opportunities for Parties to begin to consider options during this first knowledge building phase.

New Zealand experience in regards to early warning systems, contingency plans in relation to extreme weather events, and assessment of risk and vulnerability of agricultural systems

Elements of successful adaptation

7. Successful adaptation at the farm level largely depends on three elements: timely recognition of the need to adapt; an incentive to adapt; and an ability to adapt. Government policy in New Zealand focuses on ensuring these elements are present in the New Zealand context.

8. ***Timely recognition of the need to adapt:*** The New Zealand Government funds an extensive climate change research programme. The 'Sustainable Land Management & Climate Change Research Programme' includes 'Impacts of Climate Change and Adaptation' as one of three priority topics (further discussed below). Farmers have access to early warning systems including the New Zealand Drought Monitor (outlined below). The New Zealand government works with the existing network of sector organisations in New Zealand to ensure the dissemination of this information to farmers.

9. ***Incentive to adapt:*** The incentive to adapt occurs naturally in the absence of government policy (due to timely recognition of changing climatic conditions). It is important that government policy does not weaken this natural incentive or create perverse incentives for maladaptation (for example, by providing subsidised insurance mechanisms). New Zealand has the lowest level of government agricultural support of any OECD country (less than one percent of total farm receipts), ensuring that farmers face the full incentive for all changes to the farming environment. New Zealand's 'Primary Sector Recovery Policy' (outlined below) ensures that government responds appropriately in the event of extreme weather events, while also ensuring that government action does not weaken the incentive for farmers to adapt.

10. ***Ability to adapt:*** New Zealand land managers have extensive experience managing risk including adapting farming systems and agricultural land use to changing market and economic conditions (commodity prices, interest rates, exchange rates, etc) due to the market based and export orientated nature of New Zealand's agricultural sector. Climate risk (risk of drought, flood, etc) is a core aspect of normal due diligence for any farm purchase or land conversion, and managing climate variability is a key aspect of successful farm management. The role of the government is to ensure farmers have access to high quality information on the expected changes to New Zealand's climate (at the local level) and suitable adaptation measures. New Zealand

farmers are then able to adapt their individual farming systems to the extent they judge appropriate.

Adaptation framework

11. The New Zealand government is ensuring the land-based sectors have knowledge of the comprehensive choices they have to tactically, strategically and structurally adapt to a changing climate and are well positioned to capture the opportunities and meet the challenges ahead. Adaptation measures are viewed in the following categories:

a) **Tactical adaptation** modifies an existing production system using commonplace contemporary management, allowing land managers to respond effectively to mild climate change. These options – such as altering timing of sowing and harvesting – are already familiar and relevant to operational managers today. Tactical approaches can be implemented immediately or the in the short-term.

b) **Strategic adaptation** involves shifting to other production systems, or making substantive changes to current ones, but still using familiar practices and technologies. This level of change may be warranted in the face of moderate to significant climate change, but could require capital investment in some cases. Detailed guidance may be needed from specialists, especially during planning stages. Strategic adaptation can involve planning and implementation in the medium term, for example, changing cultivars in a viticulture operation, which can involve planning 3–10 years ahead.

c) **Transformational adaptation** is the development of completely new production systems or even industries. It encompasses innovative technologies, as well as long-term planning, that balance uncertainties against the need for immediate action. This is the least defined level of adaptation, as it demands more novel approaches to land management. It may be a necessary response where climate changes preclude current practices. Transformational adaptation options are likely to evolve over the longer term and take 5–20 years, or possibly more, to realise.

Early warning systems

12. The New Zealand National Institute of Water and Atmospheric Research (NIWA), a government research institute, operates the New Zealand Drought Monitor. This includes the publishing of weekly soil moisture balance plots for a number of locations around New Zealand and up-to-date maps of soil moisture deficits. NIWA also produces a periodic climate outlook which includes computer modelled probabilities of likely soil moisture levels that will persist over the next three-month period. This information is available publicly, including to farmers, and is widely publicised in national and rural media.

Contingency plans in relation to extreme weather events and their effects

Primary sector recovery policy

13. A government response in relation to an extreme climatic event in New Zealand is governed by the Primary Sector Recovery Policy. In addition to climatic events this policy also includes responses to natural disasters (such as earthquakes, volcanic eruptions and tsunami) or major biosecurity incursions.

14. This policy is centred on the key principle that the responsibility for risk management lies with producers (farmers). Government assistance is only available when the scale of the event is beyond the capacity of the community to cope. The full list of 12 guiding principles for the Primary Sector Recovery Policy are included in Appendix-1.

15. The policy is designed to create appropriate community assistance without taking away the need for farmers to adequately manage the risks posed by adverse events. Providing higher levels of assistance to farmers may create a perverse incentive for farmers to farm too intensively in areas susceptible to climate risk, or over-leverage compared to a situation of full exposure to climate risk. For example, a suitable contingency plan in relation to drought is for land managers to reduce debt levels (or increase financial reserves) to allow for the eventuality of non-profitable years. Farmers will not have the incentive to do this if the expectation of non-profitable years is removed by government intervention.

16. Under the Primary Sector Recovery Policy, events are categorised depending on both the degree of impact and the likelihood of the event occurring. The category of the event then guides government response. Support is comparable with that which would be given to other sectors of the New Zealand economy, but is tailored for the agricultural sector.

Localised event measures	Medium-scale event measures	Special recovery measures
Tax relief measures (on a case-by-case basis), normal welfare assistance for farm employees.	In addition to localised event measures, funding for Rural Support Trusts to coordinate rural recovery, fund community events, provide psychosocial support and some volunteer costs reimbursement. Tax relief measures, Enhanced Taskforce Green, Welfare Assistance for basic living costs where families have no income or realisable assets.	In exceptional circumstances partial reimbursement for: uninsurable losses to infrastructure, clean-up of silt and debris. Humane livestock disposal.

17. For an event to be categorised “medium scale”, it must be infrequent and of a regional scale. In medium scale events farming families with no income or realisable assets may be entitled to receive 75% of New Zealand’s unemployment benefit in recognition of the loss income and hardship on rural households. Workshops are organised to provide information to farmers on financial or farm management options.

18. In very rare cases events are declared as “large scale”. In these cases the government may, at the discretion of Cabinet, partially fund some uninsurable clean-up costs and the re-establishment of rural infrastructure.

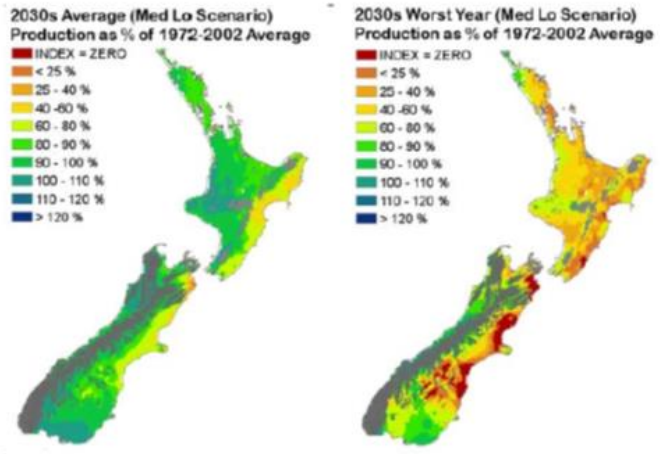
19. In general, the support provided to farmers under this policy could be characterised as light-handed. This is a deliberate approach which recognises the capacity of New Zealand farmers to manage climate risk within their business operation.

Assessment of risk and vulnerability of agricultural systems to different climate change scenarios at regional, national and local levels

20. New Zealand research initially focused on downscaling global climate projections to understand changes to New Zealand temperature, rainfall, wind, carbon dioxide fertilisation, and drought frequency. This has been updated as new climate change projections become available. The first order impacts of climate change are becoming better and more widely understood. Recent research has looked at the second order impacts of issues such as fire, disease, pollination, nutrient cycling, pests and disease and ecosystem services. However, not all second order impacts have been considered. Interactions between various first and second order impacts (third order impacts) remain an area for future work.

21. Research on first order impacts was conducted in 2007 and found that: the projected changes to pasture production are small when viewed nationally and annually. This annual and national picture hides important regional and seasonal differences: 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 a 1972-2002 reference period decreased the pasture growth for the 1977-78 season by 29 percent, while research projected the worst drought in the period 2030-2049 would be expected to decrease a season’s pasture growth by 48 percent.

Figure 1: Relative production projections for the 2030s



Source: EcoClimate Report

Sustainable Land Management & Climate Change Research Programme

22. New Zealand has operated the Sustainable Land Management & Climate Change Research Programme (SLMCC) since 2007. The programme is focused on the following three research themes:

a) impacts of climate change and adaptation;

b) mitigation of agricultural and forestry greenhouse gas emissions;

c) cross-cutting issues, including economic analysis, life-cycle analysis, farm catchment systems analysis, and social impact.

23. As part of the theme "Impacts of climate change and adaptation", this programme has commissioned a number of research and development of tools to disseminate this information to farmers. The following are snapshots of a small sample of the research conducted under this theme.

ClimateCloud.co.nz
The Climate Cloud digital library (climatecloud.co.nz) has been developed to provide timely access to information and research findings so as to assist sector land managers in understanding and responding to the challenges and opportunities of climate change. Farmers can access the latest climate change research through Climate Cloud in full, in fact sheet form and web-blog style. (link)

Impacts of Climate Change on Land-based Sectors and Adaptation Options
A major study was completed in 2012 which applied a bottom-up approach by modelling the impacts of climate change on a range of sample farm types. This study then looked at a variety of farm manager responses and modelled the economic and productivity consequences of the adaptation measures. New Zealand summarised the findings of this report in our previous submission under this agenda item in September 2013.
The findings from the report helped build an understanding of the varied impacts climate change will have on different farming systems and regions within New Zealand, and the varied ability for adaptation measures to mitigate the impacts of climate change, and in some cases, consolidate and improve the overall situation of land managers. In the event of more severe climate impacts, 'transformational' measures were identified to drastically change the farming system (developing new production systems, or changing land use to a new industry).
A technical report was produced for the science community and a stakeholder report was produced for the farming community. The stakeholder report has been particularly well received. 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. (link)

Tomorrow's pastures: subtropical grass growth under climate change

New Zealand's pastoral agricultural sector is primarily based on ryegrass and white clover, which have a C3 photosynthetic pathway. Presently, in the area of north of Auckland and coastal areas immediately south, C4 photosynthetic pathway grasses, in particular Kikuyu, can dominate. Pastures based on the C4 pathway can produce a higher volume of dry matter than C3 grasses, however, this is of lower quality to the C3 alternatives. Furthermore, kikuyu pasture growth is more seasonal than C3 alternatives, with the majority of growth occurring in the summer and very little growth in winter months. Therefore the amount of metabolisable energy for animal consumption available year-round is much lower.

It is well understood that C4 grasses can dominate C3 grasses in warmer climates, especially warmer drier climates that may eventuate in eastern New Zealand under a changing climate. However, C3 plants typically respond better to atmospheric CO_2 enrichment than do C4 plants in terms of increasing their rates of photosynthesis and biomass production. The combined impact of warmer-drier conditions, and elevated CO_2 levels was not understood. This research used a unique experimental facility that enables large areas of intact vegetation to be grown (and grazed) under ambient or elevated CO2 combined with control or warming regimes. The experiment was conducted in a region where a number of C4 species occur at relatively low abundance and provides an ideal opportunity to test how C4 abundance might alter under global change. The aim of the experimental work was to find parameter values and insights that would enable the modelling of a range of future scenarios involving C4 grasses.

The experiment was the first (to our knowledge) to document climate change impacts on C4 grasses in a grazed field experiment. The results showed that under a combined warming and CO_2 enrichment scenario the enhanced C4 grass growth less than a warming only scenario. This was due to an indirect effect of increased CO_2 reducing the increase in soil mineral nitrogen levels experienced by warming, and therefore a greater ability for C3 grasses to recover dominance in the autumn.

Adapting to Climate Change Case Studies

Government developed 35 case studies of farmers taking actions to adapt to climate change impacts. These case studies are developed into fact sheets for farmers, to provide an information resource for land managers. Fact sheets follow a common format quickly summarising property characteristics, a summary of the actions taken, and the key points relevant to other farmers. Fact sheets can be found on climatecloud.co.nz. Some of the topics covered include:

- Autumn calving: Building drought resilience in a dairy system (link)
- Reducing risk: Combining complementary farming blocks in different climatic zones (link)
- Monitoring and planning: Maintaining production in a changing climate (link)
- Managing climate change: Farming in the high country (link)
- Winegrowing: Managing in a changing climate (link)
- Bay of Plenty kiwifruit orchard: Balancing climate concerns with market realities (link)
- Central Otago orchard: Maintaining a competitive advantage (link)
- Drought: Learning from the past (link)
- Pasture renovation and kikuyu management: A Northland beef farm (link)

A number of case studies were also carried out on Iwi corporations (indigenous Māori people of New Zealand). For example: Wairarapa Moana Farms: Build buffers into farm policy for resilience (link); Arai Matawai: Breeding for facial eczema tolerance (link).

Development of Advanced Weather and Climate Modelling Tools to Help Vineyard Regions Adapt to Climate Change

Grapevines are highly sensitive to environmental conditions, with each variety having an optimal temperature range within which it will produce a definitive wine style. High-resolution computer modelling and mapping systems were used to investigate localised weather patterns to predict environmental conditions for vineyards and grape production in New Zealand. The project will help New Zealand's wine producing sector adapt to climate variability and take advantage of opportunities that result from a changing environment.

The detailed analysis of air temperature trends in the main vineyard regions over recent decades has shown that the problem of assessing impacts of climate change on the country's vineyard regions is more complex than suggested by simply applying IPCC scenarios based on global models. In particular, it is clear that differences in temperature trends between vineyard regions in different parts of New Zealand are the result of the interaction between the main weather systems and the complex terrain of New Zealand, especially the Southern Alps.

Collection of additional weather and grapevine development data over two growing seasons (2013-14 and 2014-15) has been used to evaluate the integration of a high-resolution weather/climate model (Weather Research and Forecasting model - WRF) with a new phenological model (Grapevine Flowering Véraison model - GFV) to predict grapevine response in changing New Zealand climatic conditions. This is the first time that these two types of model have been coupled to provide such information about grapevine response across vineyard regions in complex terrain. The integrated modelling system is now run operationally during the growing season and maps and data provided via a project web site (www.wineclimate.co.nz).

The new modelling tools can assist New Zealand wine-producers to better adapt grape varieties to fine scale spatial variation of climate, and to reduce the impact of climate risk factors such as frost, cool spells and high temperatures. Improved optimization of wine-grape production through better knowledge of climate at high resolution within vineyard regions will contribute to the continued sustainable production of New Zealand wine that is of a consistent style and high quality. The same approach could also be applied to other horticultural and agricultural industries worldwide.

Appendix 1 - The 12 guiding principles of the Primary Sector Recovery Policy:

1. The primary responsibility for risk management lies with individuals, local communities, local government and industry and these groups must take all reasonable steps to mitigate and manage risks;

2. The Crown provides incentives for risk mitigation and management, so any recovery assistance is contingent upon the expectation that reasonable steps to manage and mitigate risks have been taken;

3. The Crown is not the insurer of first or last resort;

4. Assistance is aligned with local government, industry, and community group recovery; on-farm adverse events recovery policy; biosecurity compensation provisions under the Biosecurity Act 1993; the Government Industry Agreement for biosecurity readiness and response; and the government's 1999 *Recovery Plan for Natural Disasters and Emergencies within New Zealand;*

5. Basic family welfare needs are met in a timely manner through appropriate and equitable recovery measures;

6. Assistance is based on restoring community capacity to self-help and ensuring recovery occurs at optimal speed;

7. Recovery assistance is delivered efficiently and minimises the Crown's fiscal risk;

8. The Crown is seen to be acting fairly and reasonably to citizens in hardship while recognising the role of individuals, local communities, local government and industries during the recovery process;

9. Assistance is scalable and based on the economic, environmental and social impact on the wider community and whether the community has the capacity to cope, rather than focusing on recovery at an individual level;

10. Compensation is paid only for verifiable losses that were the direct result of the actions of the Crown, not the effect of the incursion or event, so that the recipients of compensation are no better or worse off than others who are not eligible for compensation;

11. Assistance does not interfere with current commercial solutions, i.e. private insurance, nor preclude the development of commercial solutions where they currently do not exist; and

12. Assistance is consistent with New Zealand's obligations under the World Trade Organisation (WTO).

Paper no. 3: Uruguay

Submission by Uruguay to the Subsidiary Body for Scientific and Technological Advice (SBSTA) on the development of early warning systems and contingency plans in relation to extreme weather events and assessment of risk and vulnerability of agricultural systems to different climate change scenarios at regional, national and local level, including but not limited to pests and diseases.

Uruguay welcomes this opportunity to share our experience on the development of early warning systems and contingency plans in relation to extreme weather events and assessment of risk and vulnerability of agricultural systems to different climate change scenarios, as requested by the document FCCC/SBSTA/2014/2 of June 2014.

Challenges of climate change related to agriculture

The reports of the IPCC and the experience of countries provide enough evidence to support that climate change can increase the frequency and intensity of adverse climatic events, such as torrential rains, long droughts, frosts and hailstorms, among others, threatening seriously the future development of the agricultural production systems, according to conditions of each country or local area. The joint increase of temperatures and humidity generate favorable conditions for the proliferation and outbreak of pests and diseases that will make agriculture productive systems even more vulnerable.

Climate information has a big potential to help climate risks management. Uruguay believes that to be effective it should be produced in coordination with those who might use it (public sector, farmers, and other agents). This would avoid under-utilization and inappropriate use and increase user friendliness. It is essential to initiate collaborative processes at national and regional level that connect those who produce climate information to those who use it. This can also facilitate the increasing incorporation of climate information into policy making and practice at all levels.

Uruguay shares the views that early warning systems are one of the major tools to reduce climate change impacts in agriculture, as they can estimate the probability of occurrence of risky climatic events, and help making decisions that prevent or reduce damages (e.g. support activation of timely contingency plans). Reducing damages in agriculture normally produce benefits that go beyond the sector, and reach the whole value chain, including industry and transportation. In the case of Uruguay, it has been estimated that losses produced by droughts in the beef sector are higher off-farm than on-farm: for every dollar lost on farm, 2 dollars are lost in the rest of the value chain. In the case of pests and diseases, climate change can increase the frequency of outbreaks and can induce the appearance of new diseases and pests. There is the need to implement early warning systems related to diseases and pests in order to minimize damages. For example, in Uruguay the increase in frequency of warm and humid springs is already producing significant losses in wheat and barley due spike diseases caused by fungi (*Fusarium sp.*), which affects the yield and quality and aptitude of the grains for human consumption. As it is very likely that climate in Uruguay will become warmer and wetter, the pressure of pests and diseases is expected to increase.

Early warning systems and contingency plans are essential to ensure the sustainability of agricultural systems, safeguarding the food production capacity and welfare of those working in the field and other related activities. On this regard, they are a key component of any adaptation strategy. But efficient and effective early warning systems cannot be based only on meteorological or sanitary information: they need to be based on the analysis and prioritization of vulnerabilities in a holistic way. Having an adequate system for the assessment of risk and vulnerability is the basis for the reduction of the negative economic, environmental and social impacts of variability and extreme weather events. Vulnerability assessment is necessary to identify risks and design appropriate measures to prevent or reduce the negative effects of climate change. For example only sound information on vulnerability and risks allows selecting the right species and varieties, selecting planting and harvesting times; application of fertilizers and pesticides, management of stocking rate in grazing systems, among others. Uruguay emphasizes that when assessing vulnerability, following IPCC, it is important to disaggregate this concept in its components: exposure, sensitivity and adaptive capacity, as vulnerability can increase or decrease depending on each of the three.

Experiences and actions taken by Uruguay on early warning systems and vulnerability assessment

The agricultural sector in Uruguay is highly vulnerable to climate variability and extreme climate events as droughts, floods, excessive rainfall, heat and cold waves, frosts, hailstorms and strong winds. Most farmers in Uruguay are smallholders representing about 65 percent of farming population, and suffer disproportionately in the face of climate variability, severe droughts, and other extreme weather events. Extreme weather events affect productivity and threaten the sustainability of this type of farmers. Adaptation has been defined as a strategic priority by the government of Uruguay and a set of initiatives have been undertaken in the framework of the National Climate Change Response System (SNRCC) created in 2009.

a) Early warnings and contingency plans

To cope with the situation of greater climatic uncertainty and risk, the Ministry of Agriculture, Livestock and Fishery (MGAP) is implementing different coordinated actions to mainstream adaptation into sustainable development plans and policies. These actions will be soon part of the National Adaptation Plan (NAP) for Agriculture, to be prepared with collaboration of UNDP and FAO, and with support from the German government.

Regarding climate and meteorological information for decision making and early warnings, websites like GRAS (INIA - National Institute for Agriculture Research) (http://www.inia.uy/en/research-and-innovation/units/GRAS) and INUMET (Instituto Uruguayo de Meteorología) (http://www.meteorologia.com.uy/) are designed to provide climatic and agro-meteorological information (meteorological conditions, weather forecast, standardized precipitation index (SPI), water balance, vegetation monitoring, seasonal climate forecasts, etc.) and links to relevant centers as ECMWF (Europe), CPTEC (Brazil) and IRI-Columbia University (USA). The

GRAS platform also supports early warning for diseases as “fusarium head blight” in wheat, for southwestern Uruguay, based on temperature, humidity and precipitation of previous days.

The Ministry of Agriculture of Uruguay is implementing a decision making support system with the general objective of improving adaptation to climate change in the agricultural sector. This system aims at improving the country’s ability to manage climate risk through the provision of climate services in the framework of a National System for Agricultural Information (NSAI in English / **SNIA** in Spanish). This initiative is based on work that the International Research Institute for Climate and Society (IRI) of the Columbia University (USA) has previously conducted with the National Institute for Agricultural Research (INIA) of Uruguay and integrates the efforts of the public and private institutions and the local academia into an interoperable platform able to integrate diverse data to obtain value-added information. **SNIA** is an information system with user oriented information that allows farmers to face more efficiently extreme weather events. On the other hand, this instrument offers significant information for planners and policymakers in order to implement public policy, insurance coverage, land use and agro-ecological zoning, among others. For example, this system aims to concentrate most of all climatic, meteorological, productive and environmental information of interest to the agricultural and forestry sector. As climate risks and vulnerabilities are the result of the combination of weather and climate events, interacting with exposed and vulnerable human and natural systems (IPCC, SREX 2012), SNIA (see Figure 1) will reflect these interactions through the combination of different layers (climate information, biophysical information, socio-economic information, infrastructure, etc.).

SNIA has been designed as a public good; its specific objectives are:

(1) Increase the capacity to monitor and forecast climate and vegetation, including early warnings.
(2) Perform historic analysis of risks associated to climate.
(3) Establish good practices for adaptation with a timeframe of 10-30 years.
(4) Develop tools to assess climate variability and extreme events, including outbreaks of pests and diseases.
(5) Develop tools to optimize land use in watersheds and landscapes and use natural resources in a more sustainable way.
(6) Establish a consultation platform accessible for policymakers and private sector, including farmers and farmer´s organizations. A Data Library will be a free service to visualize and download geophysical data.

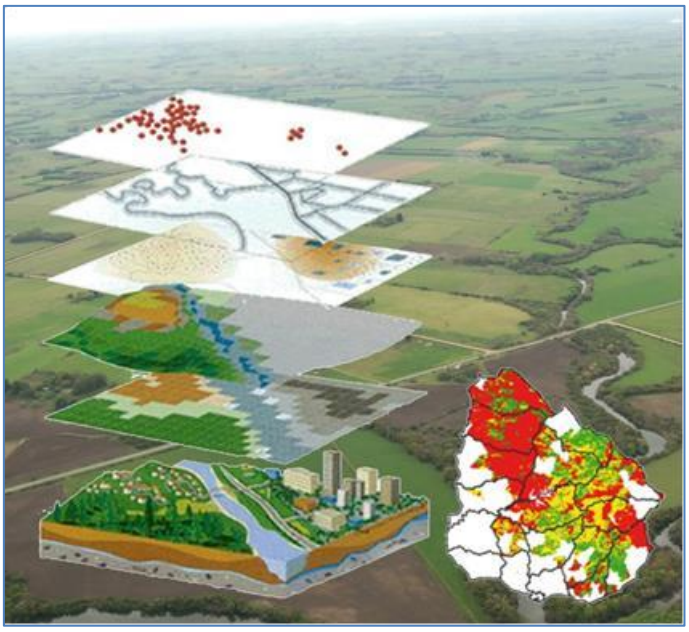


Figure 1: National System for Agricultural Information (SNIA) to adapt to climate change and variability

Contingency plans have been implemented in Uruguay in many occasions mainly in relation to droughts, windstorms and floods. These contingency plans have been financed by a specific fund established by law: the **Agricultural Emergencies Fund**. The existence of the fund is considered very important as it ensures the availability of financial resources to implement public support actions. In the last 8 years there was the need to declare agricultural emergencies in three occasions, and the MGAP implemented vast actions to deliver rations for cattle to farmers.

Uruguay has also created its National Emergency System (SINAE), depending of the Presidency of the Republic. SINAE is a permanent public system created by Law No. 18,621 on October 1, 2009. Its purpose is to protect people, property and the environment from the possible or actual occurrence of disasters, through the joint coordination between the State and the proper use of public and private resources, so as to create conditions for sustainable development. The operation of the National Emergency System is the set of actions of competent state bodies (including the MGAP) for the prevention of risks related to natural disasters or human, including climate extreme events, foreseeable or unforeseeable, periodic or sporadic, and the immediate rehabilitation and recovery as required. In this framework, the National Emergency System is promoting the **Interagency High-level Committee on Water Balance** (with representatives of public bodies with responsibility in public policies on information generation, management and use of water in Uruguay), in order to perform continuous monitoring of the risks of emergencies and disasters associated with water deficit or excess, produce relevant warnings or alarms, and activate mechanisms for prevention, mitigation and response of the relevant institutions.

b) Assessment of risks and vulnerabilities

A recent study on vulnerability has been financed in Uruguay by FAO to update information on climatic exposure, sensitivity and adaptive capacity of main productions as beef, dairy, crops and fruit growing, in order to assist public policies design. The study was published in http://www.fao.org/climatechange/84982/es. This study considered vulnerability to current variability and extreme events, but there is still need to assess risk and vulnerability of agricultural systems to different climate change scenarios, updating the national and local scenarios based on the new set of scenarios produced by the AR5 of the IPCC, using downscaling methods.

Uruguay is already implementing **index insurances** for horticulture against risk of excessive rainfall, based on rain gauges. This insurance was developed with collaboration of INUMET, BSE[1], IFPRI[2] and IDB[3], and is implemented by the BSE. A second index insurance is starting its pilot phase in October 2015: it is a drought index based on the monitoring of a vegetation index (NDVI) and will be offered to beef producers in areas of shallow soils. It was designed with support of World Bank and the University of Buenos Aires (UBA).

In addition, the MGAP is implementing three projects at farm level oriented to adaptation. One of them is financed by a grant of the Adaptation Fund ("Building resilience climate change and variability in vulnerable smallholders"); the second is a loan of the World Bank to facilitate the adoption of good practices and infrastructure to adapt and to create the risk management decision support system mentioned above; the third one is implemented with the collaboration of New Zealand and aims at developing conditions for more sustainable and resilient cattle farms.

These projects focus mostly on current variability, as most farmers are yet not well adapted to it. The rationale behind prioritizing current variability is that this first step will make farmers better prepared to more uncertain medium and long term climate change. The policies of the government look for 'win-win' options which mainstream ecosystem-based adaptation actions, sustainable land and water use planning, soil conservation and social policies oriented to the more climate vulnerable smallholders. For example, the promotion of ecosystem management practices of rangelands, covering 65 per cent of the surface of Uruguay, offer co-benefits for disaster risk reduction from droughts and build more resilient agro-ecosystems, while contributing to adaptation to future climates, and take advantages of opportunities to increase productivity, efficiency and farmer´s income.

Proposals to Parties for addressing these issues under the Convention.

Uruguay believes there is a wide space for collaboration among Parties in order to build better early warning systems, adapted to the local national and regional circumstances. There are also big opportunities to draw and share lessons from the experience of the different Parties. Developed countries with high capacities in terms of human and material resources can play a very positive

[1] Banco de Seguros del Estado, in Spanish; National Insurance Bank, in English.
[2] International Food Policy Research Institute
[3] Inter-American Development Bank

role in technology transfer and capacity building with developing countries in addressing adaptation. Uruguay believes that some of the following list of potential opportunities could be considered during the workshops and could be part of the SBSTA process afterwards.

1. Generate definitions for different types of "extreme weather and climate events affecting agriculture", and common and comparable criteria to evaluate their consequences in physical, economic and social terms, at local, national and regional level. This implies the integration of different disciplines as climatology, agriculture production and social sciences.

2. Take stock among Parties of early warning systems and methods to assess vulnerabilities and gather lessons learned, involving also relevant international institutions as FAO, UNEP, WMO, CGIAR, IPCC, UNISDR, World Bank, etc.

3. Identify and assess climate vulnerabilities that reveal opportunities in which climate information can reduce vulnerability and build resilience. This means assessing who is sensitive to climatic risks, how they are sensitive, what capacities exist/miss to adapt and cope, and in what ways public policies and climate information can help support better risk management and resilience building decision-making.

4. Develop and deploy systems and methods to assess risk and vulnerability to extreme weather and climate events and pests and diseases outbreaks associated to current variability and climate change scenarios, promoting regional integration through developing compatible national systems and/or multinational systems allowing for joint actions to face risks associated to climate change. The focus may be on vulnerability and resilience, which requires understanding the networks of institutional actors and stakeholders who influence adaptive capacity. The assessment of risks and vulnerabilities may require assistance for updating and downscaling at national and local level the new series of IPCC scenarios available (AR5).

5. Promote and support Parties to generate or improve early warning systems and contingency plans at national or sub-national level, as appropriate. Collaborative and compatible warning systems and contingency plans could be established with neighboring countries or other countries that share common realities in terms of vulnerability to extreme meteorological events. Support may be needed also for the design and implementation of the contingency plans in relation to extreme weather and climate events and for the assessment of risk and vulnerability of agricultural systems to different climate change scenarios (e.g. facilitating the access to financial resources, technology transfer and capacity building, promoting north – south and south – south collaboration).

6. Exchange information and experiences on innovative insurance systems, based on indexes such as NDVI, precipitation, water balances, and/or others, in order to protect agricultural activities from extreme weather and climate events, including systems to cover territorial catastrophes. Parties may also consider promoting collaboration through information exchange, technology transfer and capacity building, particularly in relation to issues as institutional arrangements and stakeholders participation related to the implementation of these instruments.

7. Parties could promote the exchange of information, experiences and lessons learned regarding the reduction of the effects of extreme weather and climate events on agriculture. This information

can refer to good practices, information services, institutional innovations, policies, etc. Uruguay believes there is an opportunity to produce, deploy and evaluate relevant climate information, early warning systems experiences and decision-support systems with regional partners, benefiting from enhanced critical mass and infrastructure. An example of this is the Working Group on Climate Change Policies of the Southern Cone Agricultural Council (Ministries of Agricultures of Argentina, Bolivia, Brazil, Chile, Paraguay and Uruguay), that coordinates activities and exchange information since 2009. Another example is the regional public goods project GEOSERVER BPR, created with support of IDB, and with the participation of institutions of Argentina (CONAE[4]), Chile (CIREN[5] and ACE[6]), Paraguay (CONACYT[7]) and Uruguay (INIA and MGAP). This regional project will deliver from august 1° 2015, relevant information from different remote sensors including: drought index (NDDI), fires and heat points, hailstorms risk, forestland areas, etc. Information will have a user friendly interphase to facilitate use by famers, technical advisers, policymakers and other stekeholders.

8. Uruguay believes SBSTA could consider the creation of a **web platform,** under the UNFCCC Secretariat, for exchanging experiences, tools and lessons learned on early warning systems and contingency plans and on the assessment of risk and vulnerability of agricultural systems to current variability and different climate change scenarios, including pests and diseases, and the consideration of the vulnerabilities of smallholders. Having this platform may be a cost effective way to make information accessible and to implement capacity building actions, such as training courses, webinars, data libraries, etc.

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[4] National Commission of Space Activities
[5] Natural Resources Information Centre
[6] Chilean Space Agency
[7] National Council for Science and Technology