

**URUGUAY CLIMATE CHANGE COUNTRY STUDY
(Second Phase)**

**DEVELOPMENT
OF CLIMATE CHANGE
ACTION PLANS IN URUGUAY**

**A CLIMATE CHANGE ACTION
PLAN FOR URUGUAY**

APPENDIX B

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A. INTRODUCTION

Despite uncertainties about the timing and magnitude of the changes associated with global warming, the problem of global climate change has become one of the most important environmental issues facing the world today. Primary themes in the global climate change debate are the assessment of vulnerability and evaluation of adaptation and mitigation measures. There is strong evidence that the developing countries are significantly vulnerable to climate change and may face serious problems in achieving sustained, environmentally sound economic and social development. Responding to these growing global concerns without hampering the development process of those countries is likely to be one of the significant challenges of our time.

As a response to these concerns, the United Nations Framework Convention on Climate Change (UNFCCC) was ratified by Uruguay in July 1994. The *Ministerio de Vivienda, Ordenamiento Territorial y Medio Ambiente - MVOTMA* (Ministry of Housing, Land Management, and the Environment), through its *Dirección Nacional de Medio Ambiente - DINAMA* (National Environment Office), was then appointed as the national institution in charge of the implementation of the UNFCCC and relevant national policies. This institution undertook the responsibility for the greenhouse gas (GHG) inventory completion and further updating, and the mitigation program. For this purpose, a *Unidad de Cambio Climático* (Climate Change Unit) was created.

On the other hand, the *Comisión Nacional sobre el Cambio Global - CNCG* (National Committee on Global Change) of Uruguay was created in May 1992 in response to the need for an adequate inter-institutional coordination and for the development of an integrated national response to global change issues. The *CNCG* has undertaken the responsibility of leading the efforts in climate change vulnerability and adaptation studies for Uruguay.

Two types of climate change response measures may be distinguished: mitigation and adaptation measures. Mitigation measures are those that can help to reduce the atmospheric accumulation of GHG and thereby delay the predicted impact of GHG on global climate. Such measures may either reduce GHG emissions (abatement) or increase terrestrial storage of carbon (sequestration). Adaptation measures are those that can be taken to moderate the impacts of climate change. They include changes in technologies, practices, and policies. In turn, adaptation measures may be divided into two broad categories, depending on the point in time when they are implemented: reactive and anticipatory. Reactive measures are those that take place as a reaction to changes in climate and, therefore, the need for their implementation will arise as climate change occurs. Anticipatory measures are those that can or should be taken now in anticipation of future climate change.

According to the UNFCCC, all Parties -in addition to the development of national GHG inventories and climate change mitigation measures- shall:

- “Cooperate for preparing for adaptation to the impacts of climate change; develop and elaborate appropriate and integrated plans for coastal zone management, water resources and agriculture, and for the protection and adaptation of areas affected by droughts and desertification, as well as floods;
- Take climate change considerations into account, to the extent feasible, in their relevant social, economic and environmental policies and actions, and employ appropriate methods, for example impact assessments, formulated and determined nationally, with a view to minimizing adverse effects on the economy, on public health and the quality of the environment, of projects and measures undertaken by them to mitigate or adapt to climate change”.

Furthermore, each Party shall communicate to the Conference of the Parties the national GHG inventory, a discussion of measures for responding to climate change, and any other information which the country considers relevant to achieve the objectives of the Convention.

The *CNCG* was the executing agency of the Uruguay Climate Change Country Study. The Study was initiated in October 1994 and carried out in cooperation with several national institutions and with support from the United States Country Studies Program (USCSP). The agricultural and coastal resource sectors -both of which are of particular socioeconomic importance to the country- were the focus of the Study. Following a first

phase mostly devoted to the analysis of the potential impacts of climate change (under the project name of “Assessment of Climate Change Impacts in Uruguay”), a second phase was executed under the project name of “Development of Climate Change Action Plans in Uruguay”. The goal of the second phase of the Study was the development of climate change national action plans containing adaptation measures recommended for the agriculture and coastal resource sectors of Uruguay, in consistency with the country’s mitigation plans.

The present document is a result from the latter phase.

B. PLAN PREPARATION

The planning process was designed to provide the national policy and decision makers with a comprehensive and integrated action plan for facilitating the implementation of response measures to climate change. The effort was led by a small coordinating/planning team and performed mainly through the participation of technical and policy experts from relevant national and local institutions. The process was done in consultation with decision makers and stakeholders from government and non-government organizations.

The selection of the sectors to be addressed was performed as one of the first steps of the process through individual meetings with senior government officials and non-government organizations as well as through a major Scoping Meeting with relevant institutions held on 11 September 1997.

The availability of results from previous vulnerability studies, time constraints, and availability of human and financial resources were major factors in the design of the planning process. As a consequence, relevant sectors such as livestock-grasslands and forestry were not included in the process. Efforts were concentrated on agriculture (crops) and the sectors more closely related to it (soils and water resources), in addition to the coastal resources sector.

The study conducted for the above target sectors focused on the evaluation and development of anticipatory adaptation measures, that is, measures that Uruguay should take now in anticipation of climate change, with special emphasis on those that would produce benefits to the country irrespective of whether climate change occurs. The implementation of anticipatory measures would also facilitate the future adoption of reactive measures when the time comes to do so.

Vulnerability assessments were available for two of the target sectors (crops and coastal resources) through the previous phase of the Study. The adaptation analysis for those areas which were not previously addressed in the first phase of the Study (soil erosion and water resources) was preceded by a vulnerability assessment since no specific information on the impact of climate change on those sectors was available.

Results from vulnerability assessments led to a preliminary identification of some possible climate change adaptation measures which were further complemented through a participatory planning process. All possible options identified for each sector were then carefully screened in order to select priority adaptation measures for evaluation and development.

For the agricultural sector, the following options were selected:

- 1) Enhance seed banks and develop new cultivars.
- 2) Promote soil conservation and minimum tillage.
- 3) Increase irrigation efficiency and water reservoirs.

For the coastal resource sector, the following options were selected:

- 4) Implement integrated coastal zone management (ICZM) in the department of San José.
- 5) Plan coastal development for San José.
- 6) Revise existing setbacks for coastal buildings in San José, according to coastal vulnerability from sea level rise, and ensure enforcement.
- 7) Identify the main areas in San José that should be incorporated into a National System of Natural Protected Areas under climate change.
- 8) Develop a geographic information system (GIS) for the coastal zone of San José.
- 9) Design a system that can provide more accurate and timely predictions of weather and climate that will affect the coastal zone.
- 10) Establish a regular monitoring system of the evolution of the coastline and related variables in order to track the impacts of climate change on the Uruguayan coast.
- 11) Develop a GIS for the entire national coastal zone.

A section of the Uruguayan coastline (the department of San José) was selected as a case study for an in-depth analysis of the coastal resource measures numbered 4 to 8.

The following cross sectoral measure was developed in order to increase awareness of climate change issues and build support for climate change response measures:

- 12) Disseminate information on climate change and its potential impacts, with particular emphasis on adaptation and mitigation options.

A cost-effectiveness analysis was performed to rank the priority adaptation measures to be included in the climate change action plan. Barriers, both current and potential, to the implementation of measures were identified as well as possible actions to overcome these barriers. Following the refinement of measures, implementation strategies were developed for each of the best ranked adaptation measures.

The adaptation options selected as most appropriate for the country with regard to each sector were further revised to ensure consistency of the selected measures across sectors in order to prevent conflicts in their implementation. This implied the consideration of the social, economic, and environmental implications of the various options as a basis for the final selection.

The necessary coordination and exchange of information was established with the *Unidad de Cambio Climático* (Climate Change Unit) of the *DINAMA* with the purpose of determining whether or not any negative interaction could arise between the proposed adaptation measures and the mitigation needs identified by *DINAMA*. It was concluded that no potential conflicts are foreseen between the evaluated measures and mitigation measures that might be developed for the country.

The final step of the process was the preparation of the climate change action plan, based on the country's current development plans and the technical, human and financial resource requirements.

C. SUMMARY OF THE PROPOSED MEASURES

As a result of the above-described planning process, the following adaptation measures are recommended for implementation in order to prepare for climate change in Uruguay.

1. Enhance seed banks and develop new cultivars.
2. Promote soil conservation and minimum tillage.
3. Plan coastal development in San José, and initiate a process of integrated coastal zone management.
4. Establish a regular monitoring system of the evolution of the coastline and related variables in order to track the impacts of climate change on the Uruguayan coast.
5. Disseminate information on climate change and its potential impacts, with particular emphasis on adaptation and mitigation options.

A brief description of these adaptation measures is presented below. Detailed information is provided in the final technical report from this phase.

All the proposed measures are considered to have positive impacts in a wide range of possible scenarios, including the current one.

It is expected that as a result of the Country Study, and this phase in particular, all actors will become more aware of the need to take climate change response measures into account for appropriate development planning. This might in turn lead the governmental and non-governmental organizations and the research and educational institutions to pay sustained attention to climate change and its impacts.

1. Enhance seed banks and develop new cultivars

Justification

Greater variety and availability of germoplasm and seeds allows quicker responses to climate change, both in the long and short term.

According to most general circulation models, an increase in temperature is to be expected. Trends are unclear -at least for Uruguay- with respect to precipitation. Vulnerability assessments have indicated that an increase in temperature would result in

a decrease in yields for the most relevant crops for the Uruguayan economy. This would be the case for winter crops such as wheat and barley, yield decreases expected to be even more drastic for the latter. The decrease in yields would occur because an increase in temperature would shorten the growing season given their limited response to photoperiod, thus affecting negatively the grain filling process. If new varieties with a higher response to photoperiod were developed, higher temperatures effects would be counteracted and the growing season would be less or not affected.

Obtaining genetic materials for new crop varieties with higher response to photoperiod, and thus enhancing seed banks, is proposed as an adaptation measure for the agricultural sector of Uruguay.

The incorporation of other genetic characteristics (water excess resistance and disease resistance) in the new cultivars -although already being considered in Uruguay- is also recommended. Even though these characters would be important in the event of an increase in precipitation, they would also be beneficial under a no climate change scenario. This is particularly the case for resistance to water excess because it is often a cause for the decrease in winter crop yields under current climate.

Summer crops, such as maize, were not included in this measure, based on the fact that seeds for production purposes are not produced locally, but imported. Therefore, seeds with genetic characters adapted to a wide range of possible climate scenarios would be available at local and international markets. Rice vulnerability assessments in Uruguay have not provided a clear indication on the future evolution of yields under a climate change scenario.

Description

This measure is intended to increase the availability of a larger variety of seed types with genetic characters which could maintain or increase yields under a certain range of possible climate change scenarios. Local research centers would work on the development of new cultivars of winter crops that are currently cultivated in Uruguay - basically, wheat and barley- adapted to higher temperatures (that is with increased response to photoperiod) and to soil water excess.

Development of wheat varieties

- *Development of wheat varieties with response to photoperiod*

Genetic improvement and development of long cycle wheat varieties with response to photoperiod. The following actions are included:

- generation of variability (introduction, hybridation)
- testing and selection of introduced materials
- selection in derived populations (segregants)
- selection and testing of materials
- evaluation of materials in two regions
- promotion of outstanding lines to the National Cultivar Evaluation Program
- multiplication of outstanding lines (breeder seed production)
- generation of prebreeding material with resistance to main diseases
- regeneration, conservation, characterization and documentation of germoplasm

Wheat characterization with response to photoperiod

Identification of wheat lines of intermediate cycle with response to photoperiod

- *Development of wheat varieties with resistance to water excess in soil.* The actions involved are the same as the above mentioned for the development of varieties with response to photoperiod.
- *Development of wheat varieties with genetic resistance to diseases.* The actions involved are the same as the above mentioned for the development of varieties with response to photoperiod.

Development of barley varieties

Principles and procedures are similar to those applied for the development of selected genetic characters for wheat varieties.

- *Development of barley varieties with response to photoperiod*

Characterization of barley varieties according to their response to photoperiod
Genetic improvement of barley varieties for response to photoperiod

- *Development of barley varieties with resistance to soil water excess*

- *Development of barley varieties with less protein accumulation in grain*
- *Development of barley varieties with disease resistance*

Implementation Strategy

The implementation of this measure should be a rather simple process, once the priority is granted by the corresponding authorities and fund allocation is approved. The need of an effective action directed to get decision makers and stakeholders involved in this process must be emphasized. In this regard, the *CNCG* would play a key role.

The implementation of this measure should be led by the *Instituto Nacional de Investigación Agropecuaria - INIA* (National Institute for Agricultural Research). This organization, where most relevant agricultural organizations are represented, has the capability to take the responsibility for this task, given the strong scientific research component involved in it. The development of this measure would easily merge with *INIA*'s current research programs (i.e. plant breeding and genetic improvement). Additionally, *INIA* has developed a network of international linkages and cooperation agreements that would be most beneficial.

In the specific case of barley, the active participation of the *Mesa de Cebada* (Barley Board) should be ensured being this board the coordinating organization for barley related activities in the country. *Mesa de Cebada* is composed by representatives from the *Facultad de Agronomía* (School of Agronomy), *Laboratorio Tecnológico del Uruguay-LATU* (Technological Laboratory of Uruguay) and all private brewing companies. It is expected to become strongly involved in the implementation of this measure.

Many of the needed activities are already being carried out by *INIA*, *Facultad de Agronomía* and organizations from the private sector. Therefore, the research objectives proposed (genetic improvement to achieve selected characteristics to prepare for climate change) can be easily integrated into the current research objectives of those organizations. They could be included in research activities for the genetic improvement of long cycle wheat varieties, within the framework of the national programs for genetic improvement of these crops, currently under development. Some additional human resources would be needed. They would be the most significant cost component of the measure.

The financial resources required for the implementation of this measure for a 10-year period are US\$ 3.57 million (present value). The annualized value was estimated at US\$ 0.46 million. Although no funding would be needed for additional infrastructure or equipments, the additional objectives to current research programs would require funding to cover the wages of technical and non-technical staff. Some potential sources of funding are the own resources of *INIA*, other cooperating organizations (mainly *Mesa de Cebada* and *LATU*), and international funds. A possible funding scheme should be designed before the implementation phase. As an example, the following breakdown is proposed: *INIA*, 60%; private: 30%; other: 10%.

Outreach activities should be conducted in order to generate a positive reaction, both from the general public and professional circles, with respect to the proposed adaptation measure and the activities to be performed by *INIA* and participating institutions. Monitoring and evaluation would be done on an annual basis through progress reports.

Expected Impacts

Economic impacts

A substantial benefit would be derived from the availability of a larger variety of seeds with different genetic characters -mainly of winter crops- adapted to higher temperatures and soil water excess. The availability of those new cultivars would allow a much quicker response to climate change and to medium term climate variability (reactive adaptation or crop-preventive adaptation).

By far, the most striking impact of this measure would be of economic order by preventing and avoiding a decrease in winter crop yields. Without disregarding the possibility of shifting to new crops, the availability of new wheat and barley cultivars with genetic characteristics to help counteract a possible climate change, would reduce the compulsory need to shift to alternative adapted crops or production systems. Shifting, when possible, could be costly and/or require a long time; it might also force some farmers to quit agricultural production, with all the undesirable consequences this action might bring.

Ultimately, a decrease in yields may lead to an unsatisfactory cost-benefit relationship which may in turn result in Uruguay falling out of the market for wheat and barley production. The country may have to import wheat and barley from other countries. The

estimation of this impact was out of the scope of this study, but future studies could provide this information.

Environmental impacts

A positive environmental impact is expected since better adapted plants tend to grow stronger and healthier and thus provide an improved soil coverage. A well developed root and aerial system has a positive effect in soil properties contributing to a better soil structure, soil aeration, microfauna development, and to higher levels of soil organic matter content. In addition, a higher protection from the negative impacts of raindrop and runoff energy would be obtained providing a better protection from disaggregation and erosion.

Better adapted plants are also more efficient in the use of water based on a wider and quicker root development. Cultivars with a higher resistance to diseases would also add to these benefits.

Social impacts

The social effects of this measure are associated to its potential economic impacts. This measure would help to prevent individual and national economic losses if negative consequences of climate change are produced.

2. Promote soil conservation and minimum tillage

Justification

Soil erosion has well known economic, environmental, and social negative consequences. To recover the original soil, once it is lost or severely degraded, is costly and difficult, sometimes impossible. Soil formation is a natural process that could take centuries. Land reclamation is costly and not always 100% successful as expected.

Soil water erosion and land degradation contribute to the reduction of the soil water holding capacity, infiltration rates, nutrient availability, and, consequently, soil productivity. It is accepted that soil conservation practices such as “contour” or “leveled” cropping systems reduce soil loss by a half. Minimum tillage and related tillage systems have the advantage of increasing both soil fertility and soil resistance to erosion. Soil erosion is a present undesirable phenomenon in Uruguay that could worsen under higher

precipitation or higher precipitation variability and rainfall erosivity. Under drier-hotter climates, soil erodibility could be increased through a decrease in soil organic matter.

Description

This measure is intended to promote the application of soil conservation practices (i.e. contour strips and contour tillage) and conservacionist management soil systems (i.e. minimum tillage) by a higher proportion of farmers. This measure is based on the development of a promotion program that would disseminate information and on the execution of a continuous promotion campaign on improved technologies for soil conservation and minimum tillage. The following activities are included:

- Create and operate a financially independent executive unit to work in close coordination with the *Ministerio de Ganadería, Agricultura y Pesca-MGAP* (Ministry of Livestock, Agriculture and Fisheries) (i.e. the *División de Suelos y Aguas-DSA* (Soils and Water Division)) and the *Instituto Plan Agropecuario-IPA* (Agricultural Plan Institute).
- Organize series of promotion and demonstrative field meetings to be conducted annually by extensionists, jointly with experts in soil conservation and management.
- Carry out a promotion campaign on soil conservation and management to be conducted through mass communication media such as TV, radio and newspapers.
- Provide incentives for the design, installation, and use of contour strips for soil erosion control and tillage orientation, in crop fields (target area: 172,000 ha) adequately incorporated to production systems and other soil conservation practices.
- Follow up and evaluate the program through surveys on the degree of adoption of conservacionist land use systems and minimum tillage by the appropriate branches at the *MGAP*, i.e. the *Dirección de Estadísticas Agropecuarias-DIEA* (Agricultural Statistics Office). Geographic information systems will be used as appropriate tools. A mid-term and a final evaluation of the program are planned.

This measure includes the promotion of present laws and regulations related to soil and water conservation. The encouragement of a more effective enforcement of those laws would be carried out through the *MGAP* and included in the promotion campaign.

Implementation Strategy

The implementation of this measure would be led by the *DSA* of the *MGAP* together with the *IPA*. The *DSA* is responsible for land surveying and activities related to soil conservation. The *IPA*, an independent extension agency closely related to the *MGAP*, is specialized in technology transfer in the agricultural sector. The created EU would be integrated to the present structure of the *MGAP*. However, the funding and operation of this unit would be independent from those of the *MGAP*.

Cooperating organizations have been identified. *INIA* could participate in dissemination activities, incorporating and/or increasing the treatment of the soil conservation issue in its current extension activities. This institution is already developing significant research and dissemination activities with respect to minimum tillage. The *Asociación Uruguaya de Siembra Directa - AUSID* (Uruguayan Minimum Tillage Association) and the *Facultad de Agronomía* (School of Agronomy) are expected to join this effort through dissemination activities with collaboration from farmers (*AUSID*), teaching staff and students (*Facultad de Agronomía*). Private commercial companies, as well as regional farmer cooperatives, related to the agricultural sector would also participate. Other government agencies such as the *Banco de la República Oriental del Uruguay - BROU* (Bank of the Republic), the *Programa de Manejo de Recursos Naturales y Desarrollo del Riego - PRENADER* (Program for Irrigation Development and Natural Resources Conservation), and the *Dirección Nacional de Medio Ambiente - DINAMA* (National Environment Office) of the *Ministerio de Vivienda, Ordenamiento Territorial y Medio Ambiente - MVOTMA* (Ministry of Housing, Land Management, and the Environment) will coordinate their activities with the dissemination program. The *BROU* would reactivate or reformulate its current credits for crop production with respect to soil conservation practices. *PRENADER* and *DINAMA* would include or intensify the treatment of the subject in their extension and dissemination activities. The *MGAP* would provide additional support through the *DIEA*, which will contribute in land use surveying for monitoring and evaluation. The degree of involvement and participation of each organization will vary according to their roles and characteristics. Integration to the current activities of the *DSA* on promotion of soil conservation and to several programs that the *MGAP* is currently executing (assistance to small farmers, diversification of production, etc.) should be ensured.

Additional human resources would be needed for the EU. The financial resources required for the implementation of this measure for a 10-year period are US\$ 6.77 million (present value). The annualized value was estimated at US\$ 0.87 million.

Funding could be drawn from several sources such as the National Budget, which would be the main source, plus additional support from *PRENADER*. Also private agricultural commercial companies could provide support as sponsors of some promotion activities.

The outreach activities to be carried out in support of the measure are closely connected to the own scope of it. They include a) promotion in mass media targeted to the general public in relation to global change, and soil erosion by water, both present and potential, b) seek the integration of this subject at all teaching levels, particularly into the programs of rural school and teaching institutes, and c) *MGAP* would re-launch the *Comisión Nacional Honoraria para la Conservación de Suelos y Aguas-CONAHCONSA* (National Honorary Committee for Soil and Water Conservation), composed by representatives from the government, farmers, soil and water resources experts and NGOs.

Monitoring activities would be performed in coordination with *DIEA*, by inclusion in *DIEA*'s current annual surveys and statistical analysis. The degree of adoption, given by the proportion of farmers who adopt new soil conservation technologies and the increase in area under soil conservation practices and minimum tillage, will be the main indicators of success to be recorded and analyzed. Two major evaluation events will take place along the duration of the promotion campaign.

Expected Impacts

Economic impacts

The evaluation of the economic impacts of this measure poses some difficulties since environment and natural resources are involved. The assessment of economic losses caused by soil erosion and yield reduction has been attempted with variable success, but most authors concur on the negative effect of soil erosion on crop yields. The intensity of this impact will depend on time and the climate scenarios considered, soil type and associated landscape features. Some models are available today (i.e. EPIC) to allow for the estimation of economic losses derived from soil erosion. Further information on the economic impact of this measure could be obtained by applying those models.

Other considerations about the impact of this soil conservationist measure are related to the fact that production in eroded soils is more costly -thus increasing prices of food and other products-, soil erosion can affect land use capability and the value of land, and soil reclamation is expensive for individuals and for the society as a whole.

Soil erosion can modify land use capability thus reducing the scope of possible land uses, possible crops to be grown, or production systems to be applied. This could eventually result in an increased distance between the food producing locations and the consumers thus increasing transportation costs. It could also imply the shift of land use to less intensive land production systems. The proposed measure would counteract this indirect negative impact.

Environmental impacts

The implementation of this measure would lead to a larger cultivated area at a significantly lower risk of erosion, particularly under climate scenarios with higher precipitation or higher variability in precipitation. It would also have a clear positive environment impact under current climate. Soil conservation and minimum tillage tend to keep or improve the original soil conditions since they preserve the depth of the A horizon - where the best chemical and physical conditions for root growth are given- thus preserving a highly valued natural resource.

Soil conservation and contour cropping in general implies a decrease in runoff volumes. This in turn means not only a decrease in soil loss but also a higher volume of available water in the soil for plants and a more efficient use of water. So this measure would also have an indirect impact in total available water volumes in soil.

Other negative external impacts can be prevented or avoided by a reduction in soil erosion such as sediment accumulation in river beds, lakes and water reservoirs. Sediment accumulation in waterways diminishes their capability to evacuate water excesses during high precipitation periods, thus favouring floods and slowing drainage of lower level lands. Sediments in water reservoirs diminish their water storage capacity and also their role as water ways' flow regulators. Removed sediments are also a source of physical and chemical contamination. Consequently, avoiding soil erosion, fresh water quality is enhanced. A similar positive effect, with respect to sea water, can be found in areas located next to the sea shore.

This measure is also considered significant in the sense that soil is essential for life as it is a basic natural resource for plants and animals.

Soil erosion can modify the landscape in several ways. Severe erosion causes gullies and interrill erosion and other forms of soil degradation, thus modifying the species

composition of the vegetable cover. In turn, this has effects on fauna (macro, meso and micro) and on biodiversity in general.

Finally, it must be kept in mind that soil formation rates are closely linked to climate and the other soil formation factors and that it takes a long time for this resource to recover, when this is possible.

Social impacts

Social impacts are directly linked to economic impacts. This measure would contribute to avoid changes in land use capability. Erosion and other forms of land degradation may lead to unemployment, poverty and migration to other areas, rural or urban. The implementation of this measure is expected to have a positive social impact in this regard, due to the fact that it would keep or increase soil productivity and production levels, preventing farmers from a decreasing income.

The dissemination and training meetings planned within the context of this measure will contribute to increase contacts and communication between farmers. This is expected to have a positive impact. The meetings would also allow to know farmer needs and problems in relation to soil conservation, so that technologies could be adjusted to specific conditions. Also, an increased concern and interest about environment protection and climate change issues would be acquired by farmers and population in general leading to an increase in the educational level.

3. Plan coastal development in San José (including urban growth) to incorporate the potential effects of climate change, and initiate an integrated coastal zone management process

Justification

This measure is deemed to be the most feasible and cost-effective one to address climate change issues in San José and simultaneously produce several other benefits. Because this measure is aimed at achieving an environmentally-sound economic and social development that may be sustained in the long run, it is highly beneficial for coastal resources even under the current climate conditions. San José has been selected as a case study for the implementation of this adaptation measure because it has several attributes that make of it a very appropriate geographic region to test the effectiveness of the

measure for demonstration purposes. If successful, this measure could be applied elsewhere by adapting it to the particular needs and circumstances of the region.

Although San José does not have a high vulnerability to sea level rise in terms of capital at risk, it does have, among all the coastal departments, the highest physical vulnerability, that is, the highest potential erosion rates from accelerated sea level rise. Its sandy beaches, extending along almost 90% of the coastline of San José, are among the narrowest (30 m to 100 m width) of the Uruguayan coast. If available estimates of potential erosion rates are correct, most of them would completely disappear even with only a 0.3 m rise in sea level. Eroding cliffs stand along 45% of the coastline, immediately behind sandy beaches. Coastal wetlands occupy only about 12% of the coastline. Previous studies estimated erosion rates of up to 20 m in 25 years (0.8 m/yr) for these eroding cliffs. The retreat that eroding cliffs have undergone at certain urban developments (sea-side resorts) is at present a matter of concern since it is beginning to affect sea front houses, roads, and has caused total or partial destruction of several stairways to the beach.

The coast of San José is unique in that the space occupied by urban developments is very reduced as compared to the total length of its coastline. Also, it does not seem to have experienced any notable growth in the last decade and has not been subject to a major antropogenic action. Therefore, San José still has the opportunity to decide and plan how to develop its coastal zone. However, the present conditions of the coastline may suffer a marked shift as urban and industrial growth are expected to increase as a result of the extension of the capital city of Montevideo to the west, and the construction of a bridge over the Río de la Plata between the city of Colonia (Uruguay) and the capital city of Buenos Aires (Argentina). Therefore, sensitivity to accelerated sea level rise and other consequences of climate change (such as increased storm frequency and/or intensity) is also expected to increase.

Description

This measure is aimed at achieving an environmentally-sound economic and social development on the coastal zone that may be sustained in the long run. It must be understood as involving two major but, in principle, independent components: (1) **planning coastal development**, which is the main or core component; and (2) **initiating an integrated coastal zone management process**, which would add a new institutional structure to the former and should be simultaneously developed. The initiation of the integrated management process, if feasible and operative, would provide additional

benefits to coastal development planning but, if not feasible or un-operative, should not prevent or slow down the process of coastal development planning.

Planning coastal development, as an adaptation measure to anticipate climate change, implies taking actions to reduce coastal vulnerability or at least prevent it from increasing. One way to achieve this would be to attempt to direct coastal development, particularly urban growth, to less vulnerable areas along the coast or else further inland. However, coastal development planning involves not only actions which are effective to anticipate climate change but also a wide range of other actions that go beyond just climate change adaptation in that the ultimate goal is to ensure sustainable development on the coastal zone.

Among the actions directly related to anticipating climate change, the following are believed to be the most effective ones for the coast of San José:

Enforcing setbacks: attempts to free a coastal strip from fixed constructions in order to allow the coastline to naturally respond and adapt to sea level rise and other potential consequences of climate change. A 150 m setback is recommended for the entire coast of San José, except for wetland areas where a 200 m setback is recommended.

Planning and directing urban growth: with the purpose of anticipating climate change and also preserving natural landscapes, a cluster-type of urban development is recommended for the coastal zone. In principle, urban growth could be encouraged at already urbanized areas: Playa Pascual, Kiyú-Ordeig, and Bocas de Cufre. In these areas, the expansion of urbanization along the sea front should be restricted, and an upside down pyramidal-type of urban growth, with the lateral borders of the pyramide increasing landwards like a staircase, could be encouraged. As a result, the coastline would be prevented from further urban development, while houses built at the border of the pyramide could still have some view of the sea.

Regulating size of land divisions (fractionizations): at the lateral limits of coastal urban areas, new parcels of land to be created by division of land or fractionization should be required to be progressively larger than those of the urban core. Similarly, fractionizations into larger parcels of land should be encouraged at coastal rural areas.

Several other actions, the benefits of which exceed climate change adaptation, should be granted priority while planning coastal development specifically for the department of San José:

Identifying areas for touristic development: summer tourism should be promoted at the nicest sandy beaches, such as Kiyú-Ordeig, which is already urbanized and where eroding cliffs constitute an additional attraction. Bocas de Cufre appears to be the other site with potential for tourism development, since a recreational ship port is being built. Ecotourism could be developed at Arazatí, a vast area with dense vegetation, wetlands and fauna that enlarges inland. Promoting touristic development implies not only identifying appropriate areas but also the provision of the necessary services, infrastructure, and additional attractions.

Planning industrial development: industrial development has taken place predominantly along the *Ruta 1* (Highway 1) and it would not make sense to attempt to relocate it. But a cluster type of industrial development should be encouraged in order to maintain clear spaces and preserve more attractive landscapes along this highway.

Protecting natural areas: even if there are few areas on the coast of San José that may serve as buffer or migrate as a response to higher sea levels, protection of natural areas is deemed to be a priority action for a coastal development plan. In principle, two areas of the coast of San José could be proposed for protection: Playa Penino (beach and surroundings that constitute a landing site for migratory birds, and has already been designated as ecological beach at the department level), and Arazatí (wetlands and associated natural vegetation which could conform an interesting ecotouristic circuit).

Developing agriculture and afforestation policy: given their extension, agriculture and afforestation are the predominant uses of the coastal zone of San José. Appropriate management practices should be developed for soil, water, and agriculture production in order to avoid affecting valuable ecosystems, reduce soil erosion and runoff. The afforestation policy should take into consideration environmental criteria in order to avoid competence with certain ecosystems such as native trees and wetlands. Expansion of cultivated areas and afforestation on the coast should thus be balanced with the conservation of important natural ecosystems and other uses of the coast.

Monitoring artisanal fishery development: artisanal fishing in San José does not appear to have conflicts with other uses of the coastal zone because it is scarcely developed. However, its potential development should be monitored so that appropriate actions may be taken to prevent it from affecting sea water quality and also to avoid possible conflicts with tourism.

Developing guidelines for waste disposal: guidelines for waste disposal should be developed so that all other actions and activities to be conducted under the coastal development plan are not hindered by inappropriate disposal of wastes from different sources. All activities should quantify the wastes they produce and establish adequate systems for waste treatment and final disposal. A strict policy to control waste disposal

from industries should be implemented, as most of them dump their residues into streams that empty into the coastal zone.

The other component of this measure consists of **initiating an integrated coastal zone management (ICZM) process** through which one or more interdisciplinary working teams would make the coastal zone management decisions, acting on behalf of all stakeholders and taking into consideration the diverse activities that take place on or affect the coastal zone as well as its various functions. Initiating an ICZM process implies the establishment of a permanent structure composed of integrated committees that would operate at the local level to address coastal issues of present and future concern, provide a permanent mechanism to solve conflicts between competing uses of the coastal zone, and advice on the diverse aspects of sustainable coastal development.

In the case of San José, 3 to 4 “integrated” Local Committees for Coastal Affairs (LCCA) should be created to take responsibility for different geographic regions of the coast. These committees would develop and implement annual plans and/or lines of action to address priority issues, needs, and concerns related to the coastal zone and its inhabitants, including climate change. In addition, 3 to 4 Local Sub-committees should be created to undertake a surveillance role.

Among the coastal issues of present concern that have already been identified in San José, the following deserve immediate attention: (1) controlling water runoff; (2) restoring degraded areas of the coast; (3) determining drainage capacity requirements; (4) preserving coastal cliffs; (5) developing emergency plans; and (6) having water quality monitored for contaminants (i.e. agrochemicals) and sediment loads in rivers and streams that empty on the coastal zone.

In addition, an important task that the integrated committees should undertake is analyzing the costs and benefits of conflicting uses of the coastal zone and determining a proper balance between preservation of the coastal environment and the development of its present and potential uses for the benefit of the society.

Implementation

The strategy recommended for the implementation of this measure is to prioritize **coastal development planning** which is in itself a difficult task but possible to achieve if there is willingness and support at the department level. Simultaneously, an **integrated coastal zone management process** should be initiated by discussing its concept and

goals with the relevant competent authorities and, provided there is institutional interest and political support, creating the proposed integrated committees.

The *Intendencia Municipal* of San José should take the lead in **planning coastal development**. The opinion and clearance of several national institutions would be required for the implementation of certain specific actions. Depending on the nature of such actions, one or more of the following institutions would have to participate in different stages of the implementation process: the *Ministerio de Vivienda, Ordenamiento Territorial y Medio Ambiente - MVOTMA* (Ministry of Housing, Land Management, and the Environment), through the *Dirección Nacional de Medio Ambiente - DINAMA* (National Environment Office) and the *Dirección Nacional de Ordenamiento Territorial* (National Land Management Office); the *Ministerio de Ganadería, Agricultura y Pesca -MGAP* (Ministry of Livestock, Agriculture, and Fisheries); the *Ministerio de Turismo* (Ministry of Tourism); and the *Ministerio de Industria, Energía y Minería* (Ministry of Industry, Energy, and Mining).

Modification and complementation of existing legislation at the department level must be proposed by the *Intendencia Municipal* and approved by the *Junta Departamental*.

The *Ministerio del Interior* (Ministry of Interior) through the Police Force, and the *Ministerio de Defensa Nacional* (Ministry of National Defense) through the *Prefectura Nacional Naval* could assist in field surveillance and controlling compliance. The opinion of the *Instituto de Teoría de la Arquitectura y Urbanismo* (Institute of Theory of Architecture and Urbanism) of the *Facultad de Arquitectura* (School of Architecture) of the *Universidad de la República* (University of the Republic) on urban development would be most desirable. The *Facultad de Ciencias* (School of Sciences) of the same University could collaborate in several tasks related to the field research.

The main non-official institutions that should be encouraged to participate in the process are national and local environmental NGOs and local *Comisiones de Fomento* (Promotion Committees), all of whom will be directly interested in the outputs of the coastal development plan.

The **integrated management of the coastal zone** requires coordination between different national entities with legal and/or regulatory competence on the coastal area, as well as on the activities and developments that take place on it. Most importantly, it requires the transfer of decision-making capacity from the competent national and departmental authorities to a new structure, composed of representatives from several governmental and non-governmental organizations; and also the establishment of

effective inter-institutional and integrated working teams, where each member is actually enabled to act on behalf of its institution or community, plays the role he/she is expected to, and actively participates in the process. All of the aforementioned has to take place without adding unnecessary bureaucracy.

In the absence of a national legal framework assigning specific faculties and responsibilities for the integrated management of the coastal zone to a given institution or structure, as is the case in Uruguay, the effectiveness of the proposed committees (LCCA and LSCS) to fulfill their goals could be enhanced by the establishment of agreements between relevant institutions which, having agreed to a mechanism for the representation and operation of these committees, would commit themselves to adopt the decisions made by them following the pre-established operative mechanism.

The initiative for **initiating the integrated coastal zone management process** at the department level could be taken either by the *Intendencia Municipal de San José* (municipal government) or by the *MVOTMA* through *DINAMA*, but the coordination of the whole process should be co-led by both of them. Again, modification and complementation of existing legislation at the department level must be proposed by the *Intendencia Municipal* and approved by the *Junta Departamental*.

The integration of the local committees would vary depending on the geographic section of the coast they will operate on and the issues to deal with but the institutions and organizations that should be represented in the committees are basically the same that should be involved in coastal development planning. Ideally, the permanent members of each committee should be as few as possible to facilitate decision making and operation. Representatives from other institutions could be asked to join it as the need arises.

The human resources required to carry out this measure would come mostly from the participating institutions but additional experts in several disciplines will be also necessary. The estimated financial resources required for the implementation of this measure for a 10-year period are US\$ 23.81 million (present value). The annualized value was estimated at US\$ 3.08 million. The present and annualized values of this measure for a 50-year life cycle, which would be a more appropriate one for its implementation, are smaller. In both cases, the largest investments were assumed to take place during the first ten years. Costs could be substantially reduced by extending the disbursements of funds over a longer period, that is, by distributing expenses of specific climate change adaptation actions according to the time frame when it is expected to occur. The development of an integrated funding scheme, resulting from an inter-

institutional cooperation between national and international funding agencies, would probably be the best strategy to secure the funding for this measure which embraces a wide variety of actions. Potential sources of funding are contributions from the participating institutions, particularly the *MVOTMA*, the *Oficina de Planeamiento y Presupuesto* (Planning and Budget Office), and the *Intendencia Municipal de San José*, international funding agencies such as the Global Environment Fund, the Inter-American Development Bank, the Organization of American States, and agencies concerned with climate change adaptation, as well as the private sector for research and development actions of their own interest.

The following are some of the necessary steps for the implementation of the coastal development planning component:

- Conduct a field survey of an at least 10 km width coastal strip. Process and analyze data. Enter information into a GIS. Produce a zonation with desirable development for the coastal zone, including urban, tourism, industrial, productive, and other development. Review existing legislation applicable to the issues under consideration.
- Determine criteria to guide sectoral development on the coastal zone. Determine areas where setbacks need to be enforced, and areas where the construction of non removable structures may be discouraged by other policy options such as increasing taxes on beachfront buildings. Determine desirable size for land divisions (fractionizations).
- Produce sectoral development policies for the coastal zone, jointly with relevant national and departmental authorities.
- Identify natural areas to protect and design policy for their use and management.
- Analyze possible compensation systems to be applied to affected owners of land, where appropriate.
- Develop comprehensive coastal development plan. Determine costs and benefits of the overall plan.
- Hold 4 or 5 workshops with participation from decision makers, technical experts, and stakeholders to discussed proposed development plan and related issues. If necessary, adjust coastal development plan.
- Implement sectoral development policies.
- Develop legislation at the department level to enforce the coastal development plan.
- Communicate and disseminate coastal development plan, applicable legislation, and encourage the public to assist in ensuring compliance with the plan.

- Implement coastal development plan. Implement compensation policy, as required.
- Create a permanent surveillance mechanism.

In addition to the above, the main steps required to initiate the integrated coastal zone management process are:

- Design general guidelines for the integrated management of the coastal zone of San José.
- Define proposed integration, competences, and operation of Local Committees for Coastal Affairs (LCCA) and Local Sub-Committees with a surveillance role (LSCS).
- Sign agreements between relevant competent institutions, committing themselves to adopt the decisions arrived at by the Committees.
- Create 3 to 4 “integrated” LCCA to address priority issues, needs and concerns related to the coastal zone. Create 3 to 4 LSCS for control and surveillance. Determine the competences and commitments of committees.
- Create mechanisms to allow for public participation in the ICZM process.
- Have committees develop annual plans including actions to address climate change and other issues of present concern.
- Hold participatory workshops with stakeholders to discuss annual plans.
- Implement annual ICZM plans.
- Initiate permanent surveillance by the LSCS.
- Regularly disseminate and communicate the objectives and results achieved by the ICZM process, and encourage public participation in monitoring compliance with plans.
- Three years after implementation, evaluate performance of the LCCA and LSCS, success in achieving actual integration while operating efficiently, and results obtained.
- If the results of the evaluation are satisfactory, develop legal framework for ICZM.

Outreach activities are an essential part of these processes. Public input and involvement, which are key to the success of the measure, are by definition incorporated to the management and development scheme. Also, several workshops with stakeholders have been planned and a permanent dissemination and communication mechanism was conceived. Consultation with national and departmental competent authorities is a

critical step in the implementation of the above processes, and would provide support for this measure at the decision making level. The communication of the coastal development and management plans to the environmental commissions of the Parliament is recommended to build political support at the government level.

The monitoring, evaluation and adjustment of measure involve the following activities: a surveillance mechanism to regularly monitor compliance with, enforcement and effectiveness of the plans; public input to suggest adjustments; a complete assessment of the plans every eight years; and a complete field survey for research purposes every ten years.

Expected impacts

Economic impacts

The overall impacts of this measure on the economy must be positive in the medium and long term, even if negative in the short term, because such is the rationale of sustainable development. It may be anticipated that the implementation of this measure will lead to a re-distribution of the income between some economic sectors. Costs and benefits are difficult to estimate for two main reasons: first, the value of natural resources is required for a comprehensive evaluation and this information is not available in the country; secondly, the policies to be developed for each sector and precise actions to be applied must be known to accurately determine the costs and benefits of the measure. With regard to the economic benefits under climate change, available estimates of value at risk from sea level rise are under-estimated as they do not include the direct and indirect costs of losing coastal resources of high value for the country's economy and for its population.

Of the specific actions recommended to anticipate climate change, the enforcement of setbacks is probably the one with highest economic and social costs if expropriation of all land and property within the setback is the mechanism employed to ensure enforcement and reduce vulnerability to sea level rise. However, alternative mechanisms may be developed to reduce these costs, such as: expropriating selectively the most vulnerable sections of the coast, expropriating only empty pieces of land and houses with more immediate risk; not expropriating empty pieces of land but developing regulations to prevent the construction of non removable houses on them, or not expropriating at all but allowing existing or new houses to remain on the setback only for a certain period of time defined in agreement with forecasts of sea level rise.

Social impacts

Important benefits for the society would result from this measure. By seeking to achieve sustainability of coastal development, it would also contribute to maintain or increase social welfare of present and future generations. Specific actions are included in the measure to preserve natural areas for recreation, enhance coastal aesthetics, and certainly to prevent vulnerability to climate change from increasing thus reducing risk of losing human lives and property.

In achieving largely beneficial goals, some potentially negative social impacts could arise. Certain restrictions on coastal resource uses may be imposed, some land and property might be expropriated forcing some coastal inhabitants to resettle. In turn, resettlement would affect preferences of people for living on the sea front and roots of people for their own houses. Affected owners might receive worse pieces of land in exchange of their sea front property. This potentially negative impacts would not only disappear but become gradually positive as the risk of losing sea front property increases.

The following additional social impacts or expected to result from the implementation of the integrated coastal zone management process, if successfully initiated: it would provide a mechanism for joint actions of the different sectors and for a rapid attention to present problems that affect coastal inhabitants, it would enable social participation in conflict solving and decision making which would in turn contribute to generate public confidence, and it would serve as demonstration to the community of the benefits of joint efforts. A negative aspect of it is that it may slow down the decision making process and implementation of actions during the initial years.

Environmental impacts

Major environmental impacts of this measure are that it is intended to ensure sustainability of coastal resources, to protect natural areas, to preserve the beauty of coastal landscapes, reduce pressure on the coastline, and preserve biodiversity. Most importantly, it would allow the coastline to naturally adapt to climate change. A potentially negative effect on the environment is that it would cause urbanization of some presently non urbanized areas, but this is just a result from transferring the impacts of urbanization from one place to another.

Additional environmental impacts resulting from the implementation of an integrated coastal zone management process are: it would enable to achieve pre-identified environmental goals, rapidly identify present environmental issues once the mechanism is effectively operating, it creates capacity to deal with present and future issues thus allowing to anticipate climate change and avoid other negative effects on the environment. Again, it may slow down the decision making process and implementation of actions during the initial years.

4. Track the impacts of climate change on the Uruguayan coastline

Justification

The main physical effects of global change on the coastal zone are believed to be changes on wind and precipitation patterns (including increasing climate variability) and hydrological regimes, as well as accelerated sea level rise. These changes will in turn produce modifications on the wave climate, on the permanence of high sea levels, alterations to the hydro-sedimentological regime of water bodies, and also changes in the salinity patterns and salt water intrusion. The final expression of those modifications will be given by the way in which the coastline reacts to the new patterns of the variables and processes responsible for its configuration. On the coastal zone, the potential impacts of sea level rise are mainly related to erosion and inundation.

Despite the fact that the Uruguayan coast has several uses of major economic and social importance for the country, such as urban settlements, coastal tourism, navigation, fishing, which are either seated at or closely related to its coastal zone, there is little scientific understanding about the behavior of several environmental variables which are responsible for shaping the coastline and are essential for the successful development of coastal activities.

Monitoring the evolution of the main variables that shape the coastline and also the response of the coastline itself to those forcing variables will help to build capacity to predict potential changes in the coastline, to plan options to adapt to climate change, and also to assist decision making related to coastal management and development.

Description

This measure is aimed at putting in place a system to regularly monitor and analyze the evolution of the main environmental variables and/or processes that will affect the behavior of the Uruguayan coastline under climate change.

In order to track the impacts of climate change on the Uruguayan coastline, it is essential to understand the behavior of key variables or features of the coast, such as wind patterns, sea levels, wave climate, main fresh water flows that discharge on the coast, sediment loads of the main fresh water flows that discharge on the coast, dynamics of beach profiles, and plant position of the coastline.

This measure entails the establishment of a working group responsible for tracking the impacts of climate change on the Uruguayan coastline, and monitoring and analyzing the evolution of the above-mentioned variables and features of the coastal zone.

Available information in the country on water levels, wind direction and intensity, and some data on fresh water flows is deemed to be satisfactory. However, additional information is required to determine wave climate, beach profiles and granulometry, shoreline position, sediment load of fresh water flows, and complement data on major freshwater flows that empty into the sea.

Four representative coastal sites have been selected at sea for monitoring waves through the installation of wave recording buoys. Twelve representative sampling stations have been identified along the Uruguayan coastline for beach profiling and granulometry. The evolution of the coastline would be tracked through aerial photography. Data for the remaining variables would be obtained from the relevant institutions. The specialized working group would be responsible for processing and analyzing the data, and generating specific outputs tailored to the needs of the country and of the international climate change research centers.

Implementation

The strategy recommended to implement this measure is to create a specialized working team to undertake the task of tracking the impacts of climate change on the coastline, by processing existing information recorded by several different national institutions and interpreting this and new information which is not being regularly collected in the country. This working team should operate under one of the national institutions.

The *CNCG*, which has the necessary facilities and equipment to develop the computerized data base and to house the working team, could coordinate the implementation of this measure. The participation of the *DINAMA* through one or more of the following units: *Unidad de Cambio Climático* (Climate Change Unit), *División de Ecosistemas Costeros* (Coastal Ecosystem Division), and *División de Evaluación de Impacto Ambiental* (Environmental Impact Assessment Division), is also deemed necessary. *DINAMA* could undertake the responsibility of monitoring some of the variables which are not being recorded at all in the country.

The main organizations which already produce or keep data required to fulfill the goals of this measure are: the *Dirección Nacional de Hidrografía* (National Hydrography Office) of the *Ministerio de Transporte y Obras Públicas* (Ministry of Transportation and Public Works); the *Servicio de Oceanografía, Hidrografía y Meteorología de la Armada* (Oceanographic, Hydrographic and Meteorological Service of the Army) of the *Ministerio de Defensa Nacional* (Ministry of National Defense); and the *Dirección Nacional de Meteorología* (National Meteorology Office) of the same Ministry.

The human resources required to carry out this measure are the regular staff from the participating institutions plus additional experts to integrate the specialized working team. The estimated financial resources required for the implementation of this measure for a 10-year period are US\$ 1.78 million (present value). The annualized value was estimated at US\$ 0.23 million. Funding for the initial implementation of this measure should not be difficult to obtain, given its wide application to diverse uses such as coastal management and development planning, climate change research, and construction of coastal infrastructure. However, the sustainability of the measure in the future should be ensured since the outputs to be produced require regular and long series of data. Potential sources of funding for the implementation of this measure include national and international sources, municipal governments of some of the coastal departments, and private sources.

The following are some of the necessary steps for the implementation of this measure:

- Ensure availability of funding and facilities with the equipment and infrastructure required to process and analyze data, use models, and communicate results.
- Establish a working group responsible for tracking the impacts of climate change on the Uruguayan coastline.
- Establish cooperative agreements with the institutions that produce information (winds, water levels, freshwater flows).

- Train staff on techniques to monitor climate change impacts on the coastal zone.
- Acquire equipment required to measure some of the variables (wave recording buoys).
- Obtain aerial photographs of the entire coastal zone (scale 1:10.000). Conduct surveys for beach profiling and granulometry, and record waves. Obtain complementary information from institutions. Process and interpret data.
- Periodically communicate and disseminate results.
- Periodically evaluate the measure.

Obtaining support does not appear as a major constraint for the implementation of this measure as awareness of climate change and coastal issues is increasing over time. The population itself is starting to verify changes in climate and its negative effect on some productive activities, such as agriculture. The implementation of the other adaptation measures included herein would contribute to build greater support.

An evaluation of the performance of the measure would be conducted every three years. The longer the measure is sustained the larger feed back it would itself produce to adjust working methodologies.

Expected impacts

Economic Impacts

Except for the funding required to implement and sustain the measure, only positive economic impacts can be expected to result from it. Access to information and enhanced knowledge on the behavior of the coastline and its forcing variables will be of great benefit not only for the country in general but also for the economic sectors that depend on the coastal resources.

Social impacts

Increasing the understanding of the effects of climate change allows the government, economic sectors, and individuals to anticipate climate change and develop adequate response options. This measure generates useful information as well for a wide range of other uses and activities. It may be also expected to produce benefits for the international community for it should be able to contribute valuable information for climate change monitoring at the global level.

Environmental Impacts

A better understanding of the behavior of environmental variables will enable a faster implementation of measures to preserve the environment.

5. Disseminate information on climate change and its potential impacts, with particular emphasis on adaptation and mitigation options

Justification

The successful implementation and adoption of this action plan in Uruguay and the adaptation measures recommended herein is closely related to the degree of awareness by the general public, the private sector, and relevant governmental and non-governmental organizations of climate change issues, their potential impacts, the benefits of adaptation measures, and the respective role of each actor in helping to implement the Plan. But of all the above actors, the opinion and support of the general public is critical to ensure implementation since it is the one that will be more directly affected by the impacts of climate change and by the benefits or disadvantages, if any, of the proposed adaptation measures.

Description

This cross-sectoral measure is aimed at increasing the awareness and understanding of climate change issues, as well as build support for response measures, at different levels and sectors of society. The conduct of an outreach program and promotion campaign is proposed. The dissemination of these issues will be accompanied by information on their potential impacts and, most importantly, on the possible adaptation and mitigation measures that may be adopted to face climate change. It is also intended to encourage a higher participation and involvement of all strata of the population in all subjects dealing with climate change.

It should be stressed that the aim of the outreach program would not be to insist on the dangers of climate change in a threatening way but to provide them with information (in a clear and concise manner) about the existence of climate changes, their potential negative and positive impacts, the possible actions that may be taken to help prevent or slow down climate change, and the adaptation measures that should be adopted to anticipate climate change and to make the best use of its possible benefits.

This measure has the advantage of addressing both the problems and possible solutions to climate change issues. Both components have been integrated into a single information strategy since it is believed that disseminating present and future problems without showing possible solutions would cause a negative effect on the public rather than produce any benefit.

A specific objective of this measure will be to promote the adoption of the agriculture and coastal resource adaptation measures selected for inclusion in this action plan. The adoption of mitigation measures to help reduce the atmospheric accumulation of greenhouse gases will be promoted as well. Such measures may either reduce greenhouse gas emissions (abatement) or increase terrestrial storage of carbon (sequestration).

The outreach strategy would be targeted to the audiences that are most essential to reach, including:

- *The general public.* The general public is characterized by a diverse collection of groups, opinions and interests. Attempts will be made to reach all interest groups. One important sub-group to target are teachers and professors. They can be highly effective leaders in educating the younger on climate change issues. Local environmental activists and community-based organizations are also to be involved in the outreach plan. Other specific population groups include workers, women, elderly, etc.
- *The scientific community.* It is essential to promote a better understanding of these matters among the scientific community given the multidisciplinary nature of climate change issues and solutions.
- *Local and national governments.* Local and national policymakers are key audiences to be approached since they make important decisions regarding the country's mitigation and adaptation options.
- *Renewable energy and energy efficiency business community.* They are a key group to focus an information campaign on climate change because they stand to benefit the most from aggressive climate change policy.
- *Other key stakeholders.* It includes different interest groups like industries, small and large businesses, investors, insurance companies, etc.

Components of the proposed outreach strategy include the following:

- Mass campaigns conducted through the media that has been identified as the most influential. This includes the development of radio and television announcements, information fliers and brochures, newspaper articles, audio-visual materials, etc.
- Development of supporting educational materials to be incorporated into school and university curricula.
- Design and setup of a WEB site dealing with climate change issues in Uruguay.
- Workshops and conferences with participation from local, regional, and international climate change experts.
- Public meetings, including local community and stakeholder meetings, on climate change issues.

Implementation

The implementation of this measure would be co-lead by the *CNCG* and *DINAMA* through its *Unidad de Cambio Climático* (Climate Change Unit). Cooperating organizations include member organizations of the *CNCG*, the *Red Uruguaya de ONGs Ambientalistas* (Uruguayan Network of Environmental NGOs) and other NGOs, private sector, etc.

DINAMA, as well as various environmental groups, are currently carrying out programs for the diffusion of information in the areas of environmental and natural resources. The proposed climate change outreach strategy would coordinate activities in order to have this topic included as part of those programs.

The creation of an outreach working team appears to be the best option to ensure a successful implementation of this measure. The proposed team would be conformed by two part-time climate change experts, plus a communication expert, to be responsible for the dissemination campaign, and administrative staff. Experts from the cooperating institutions are expected to participate in outreach activities as requested and according to their area of expertise. International and regional climate change experts will be made available to take part in workshops and conferences.

The funding required to ensure the implementation of this measure during a 10-year period has been estimated at US\$ 683000. Some of the potential sources of funding for this measure are the own resources of the leading institutions, international agencies concerned with climate change issues, and the private sector. To ensure funding sources

for the implementation of this measure could be a critical step at the start of the dissemination process. However, as this is an iterative problem, as outreach progress, easiness for fund identification and obtainment could improve substantially.

The implementation of this measure would include the following steps and activities:

- Secure necessary funding.
- Hold initial workshop at the national level to launch the outreach initiative and set up general guidelines for the development of the strategy.
- Review outreach objectives.
- Identify target audiences.
- Outline key messages to be delivered to the targeted audiences.
- Develop dissemination materials.
- Engage partners to deliver key messages.
- Identify appropriate media to deliver the messages.
- Identify key events to launch the outreach strategy.
- Identify communication marketing firm to carry out the campaign.
- Carry out mass media dissemination campaign.
- Design, setup, and update of a WEB site dealing with climate change issues in Uruguay.
- Hold workshops, seminars, and conferences with participation from local, regional, and international experts.
- Hold public meetings on climate change issues.
- Hold workshops at the national level on year 4 and 8 to make any necessary adjustments.
- Periodically evaluate performance of the campaign based on public opinion surveys to be conducted every two years.

The dissemination campaign will be evaluated every two years, based on public opinion surveys to be conducted in order to determine whether the degree of awareness about climate change issues has increased as a result of the implementation of the measure or not.

Expected impacts

Economic impacts

The potential economic impacts of the implementation of this measure are closely related to the economic advantages derived from the application of adaptation and mitigation measures. Improving citizens' awareness and knowledge of climate change issues is essential to enable them to take informed decisions.

Environmental impacts

Substantial environmental benefits are expected from a better understanding of climate change, its potential negative and positive impacts, the possible actions that may be taken to help prevent or slow down the process, and the adaptation measures that should be adopted to anticipate climate change and to make the best use of its possible benefits. Changes of attitude and behavior of people with respect to climate change is expected to result in a better environmental management.

Social impacts

The proposed outreach measure would result in an increased awareness and understanding of climate change issues at different levels and sectors of society. This would in turn contribute to build support for response measures.

Acronyms

The following is a list of the acronyms used in this document.

CNCG *Comisión Nacional sobre el Cambio Global* (National Committee on Global Change)

DIEA *Dirección de Estadísticas Agropecuarias* (Agricultural Statistics Office)

DINAMA *Dirección Nacional de Medio Ambiente* (National Environment Office)

DINOT *Dirección Nacional de Ordenamiento Territorial* (National Land Management Office)

DSA *División de Suelos y Aguas* (Soils and Water Division)

GHG Greenhouse Gas

GIS Geographic Information System

ICZM Integrated Coastal Zone Management

INIA *Instituto Nacional de Investigación Agropecuaria* (National Agricultural Research Institute)

IPA *Instituto Plan Agropecuario* (Agricultural Plan Institute)

LCCA Local Committee for Coastal Affairs

LSCS Local Sub-Committee for Surveillance

MGAP *Ministerio de Ganadería, Agricultura y Pesca* (Ministry of Livestock, Agriculture, and Fisheries)

MVOTMA *Ministerio de Vivienda, Ordenamiento Territorial y Medio Ambiente* (Ministry of Housing, Land Management, and Environment)

NGO Nongovernmental Organization

PRENADER *Programa de Manejo de Recursos Naturales y Desarrollo del Riego*
(Program for the Management of Natural Resources and the Development
of Irrigation)

UNFCCC United Nations Framework Convention on Climate Change

USCSP United States Country Studies Program