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The Rural Sector and Natural Resources

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Abbreviations and Acronyms

A,O&M	Administration, Operation and Maintenance
AUSID	*Asociación Uruguaya de Productores pro Siembra Directa*
BROU	*Banco de la República Oriental del Uruguay*
BSE	Bovine Spongiform Encephalopathy
CBD	Convention on Biological Diversity
CCD	Convention to Combat Desertification
CNUMAD	United Nations Conference on the Environment and Development
COTAMA	*Comité Técnica Asesora de Protección del Medio Ambiente*
DF	*Dirección Forestal* (of MGAP)
DGRNR	*Dirección Nacional de Recursos Naturales Renovables (of MGAP)*
DINAMA	*Dirección Nacional del Medio Ambiente (of MVOTMA)*
DNH	*Dirección Nacional de Hidrografía*
DSA	*Dirección de Suelos y Aguas* (of MGAP)
EIA	Environmental Impact Assessment
FMD	Foot and Mouth Disease
GATT	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHGs	Green-house Gases
HACCP	Hazard Analysis and Critical Control Point
IFAD	International Fund for Agricultural Development
IMF	International Monetary Fund
INE	*Instituto Nacional de Estadística*
INIA	*Instituto Nacional de Investigación Agropecuaria*
ISO	International Standards Organization
LATU	*Laboratorio Tecnológico del Uruguay*
MGAP	*Ministerio de Ganadería, Agricultura y Pesca*
MVOTMA	*Ministerio de Vivienda, Ordenamiento Territorial y Medio Ambiente*
MTOP	*Ministerio de Transporte y Obras Públicas*
NBS	National Biodiversity Strategy
OIE	*Office International des Epizooties*
OPYPA	*Oficina de Programación y Política Agropecuaria* (of MGAP)
OSE	*Obras Sanitarias del Estado*
PRENADER	Natural Resources Management and Irrigation Development Project
UNDP	United Nations Development Program
UNFCCC	United Nations Framework Convention on Climate Change
UNIT	*Instituto Uruguayo de Normas Técnicas*
USDA	United States Department of Agriculture
USLE	Universal Soil Loss Equation

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URUGUAY

THE RURAL SECTOR AND NATURAL RESOURCES

VOLUME I: MAIN REPORT

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This report was prepared by a team led by Michael Carroll (LCSES) and comprised of Edgardo Floto (FAO/CP), Alvaro Soler, Steven Oliver, and Luiz Gabriel Azevedo (LCSES), Gonzalo Castro (ENV), and David Rosenblatt (DEC). Logistical and technology-related support was provided by Jeannette Ramirez and Janice Molina (LCSES). Background Technical Papers were contributed by several Uruguayan experts, including Guillermo Cardellino, Alfredo Altamirano, Walter Baethgen, Carolina Sanz, and Alfonso Graña. Valuable comments were provided by Laura Tlaiye, Sector Leader, LCC7, and by peer reviewers Abel Mejía (LCSFW) and Christian Pieri (RDV). Special thanks are due to Diego Payssé, PRENADER Project Director, for sharing his extensive knowledge on the Uruguayan rural sector with the team.

VOLUME II: ANNEXES

URUGUAY

THE RURAL SECTOR AND NATURAL RESOURCES

EXECUTIVE SUMMARY

i. The government of Uruguay and the World Bank have collaborated for more than fifty years in the development of the agricultural sector. Most of this effort was directed towards the productive aspects of agriculture, but during the past decade a broader approach has been adopted to the rural areas; in particular, emphasis has gradually been increased on environmental issues and on the achievement of long-term sustainable production systems, mainly through improved natural resources management. Agriculture remains an important sector of Uruguay's economy and the rural sector faces a series of challenges. The main purposes of these Policy Notes are: (a) to analyze the current status of the country's natural resources; (b) to examine the issues that face the government in its continued efforts to improve the well-being of the rural population; and (c) to establish a framework to enhance the sectoral dialogue between the government and the Bank. The main long-term recommendations and specific short-term actions proposed are summarized in Matrix 1 at the end of this Summary.

ii. The agricultural sector was the engine of economic growth responsible for Uruguay's early prosperity. In addition to building the infrastructure which supported economic development in general, it was also the foundation, in the early 20th century, of an all-embracing welfare state that closely paralleled those of the industrialized countries of Europe and which has had marked long-term implications for the whole political economy of the country.

iii. The inward orientation of economic development policy which took hold in Uruguay at mid-century caused an abrupt change and created a serious bias against agriculture and its comparative advantage that greatly constrained its growth. This bias was only dismantled in the late 1970s and 1980s, at which point the agricultural sector responded strongly. As a result, the 1990s was probably the most dynamic decade for the sector since the very earliest part of the century. Its growth closely paralleled that of the economy as a whole between 1988-1998, albeit with greater volatility, but, under the influence of adverse weather conditions and with several external shocks, output has declined significantly in the past three years.

iv. Although agriculture represents less than 10 percent of the Gross Domestic Product (GDP) of Uruguay, the combination of agriculture and agro-industry makes up fully 23 percent of GDP. Even this figure belies the combined importance of these two sectors to the economy as a whole; over half of their output is exported, and in 2000 represented 73 percent of Uruguay's total export earnings. Moreover, these sectors are far from static; between 1988-1998 their export earnings grew from US$700 million to US$1.85 billion, and the composition of exports was significantly diversified.

v. The experience of shocks is nothing new to the agricultural sector. Severe drought is a frequent occurrence in Uruguay, the loss of its status as "foot and mouth

disease-free without vaccination" has returned Uruguay to the condition which prevailed throughout its entire history until the 1990s, and for the main agricultural products international prices are in a declining trend in real terms. What is remarkable is the resilience of the sector, and the fact that the growth achieved during the 1990s was not at the expense of the natural resource base; quite the contrary, in fact, because the available evidence demonstrates that a reduction in the cultivated area, the adoption of conservation-oriented cultivation methods, and the reduction in the grazing load (resulting from the halving of the national sheep flock) have all contributed to reduce erosion significantly on both crop land and pastures alike.

vi. The 1990s saw many changes in the rural sector, most of them stimulated by the changes in the pattern of production as a result of the liberalization of the economy and, in some sub-sectors, the implementation of strategically-targeted and modest levels of incentives. For example, stimulated by two serious and long-lasting droughts since 1988, farmers are increasingly aware of the benefits of supplemental irrigation. Irrigated rice production has grown to the point at which Uruguay is one of the largest exporting countries. Fodder conservation, almost non-existent twenty-five years ago because of the structure of the costs of production, is now a common activity on dairy farms and is of increasing importance in beef production. As the most visible example, and as a direct result of policy introduced in the late 1980s, Uruguay has accumulated an area of commercial forestry sufficient in size to allow the establishment of industrial processing at an internationally-competitive scale.

vii. The agricultural sector remains vulnerable both to external shocks (particularly weather-related events and the vicissitudes of foreign markets) and domestic factors (such as the recent outbreak of foot and mouth disease). While the government's ability to ameliorate the impacts of these shocks is limited, particularly in the short term, the likely increasing importance of international trade calls for a long-term approach to agricultural and agro-industrial development. As for domestic factors, the government should aim at sustaining the structural reforms that removed the anti-agricultural bias in the past and address other economy-wide issues affecting agriculture's competitiveness. In addition, and since the geographical frontier was reached long ago, Uruguay should integrate the sustainability of its healthy natural resource base into a productivity-based rural development strategy.

viii. The opening of the economy has meant that the impact of lower international prices has been absorbed by producers. Some of these lower prices are the result of market forces, often reflecting improved productivity in other countries, but frequently they are the result of policies that promote unfair competition, particularly on the part of the industrialized countries and in spite of the achievements of the Uruguay Round of GATT. These challenges must be met, since together with the Mercosur countries and Bolivia, Uruguay forms part of one of the few regions in the world where food production can be increased significantly. The government must do all in its power to nurture the growth of entrepreneurship in agriculture, agro-industry and export marketing, and to encourage foreign investment which is an important vector of improved technology (as has been seen, for example, in Uruguay in the cases of beef, forestry, dairy and malting barley).

ix. As for the socio-economic dimensions of the rural economy, Uruguay has the least-skewed distribution of income in Latin America, and sustained economic growth (which should be "pro-poor" in the sense that it creates remunerative employment) is the key element of any poverty alleviation strategy. Education and employment are the two most important factors in reducing poverty. Although relatively small in number, the rural poor[1] in Uruguay (particularly those living in small and medium-sized towns) are highly dependent on wage labor and, given the high levels of literacy that exist in Uruguay, future efforts must be oriented towards improving secondary and technical education. Although the development strategy for non-farm rural employment should by no means be confined to agro-industry, nonetheless there will be a powerful demand-side pull from export markets for agricultural products with value-added through processing.

x. The growth of the agricultural sector during the 1990s was based on productivity-raising investment in which a large proportion of producers incurred significant levels of indebtedness; the resulting high level of debt service is a problem for many producers, particularly at times of cyclically lower prices. There is a continuing need to improve profitability by improving farm management and absorbing technical knowledge alongside physical investments, but there is also a pressing need to improve efficiency and lower costs in related sectors (for example, in the financial sector, where borrowing costs are very high). In fact, the most important "exogenous" factor in improving the competitiveness of agricultural production will be the maintenance of sustained progress in the whole of the government's reform agenda. The costs of certain non-traded inputs can be lowered by improving efficiency in their production.

xi. Uruguay is well endowed with natural resources for agricultural production, although its cultivable soils represent only a relatively small part of its total land area. Over the past 30 years, much has changed in the way producers utilize and manage natural resources. For agriculture to continue its role of supporting economic development, it must increase even more its outward orientation, paying ever-increasing attention to the demands of world markets and emphasizing diversification (of both production and markets) and an increase in value-added. The future does not lie in the production of "commodities" or in an emphasis on an increase in volume *per se*, but rather an increase in production based on: (a) specialization, quality improvement and processing; and (b) the exploitation of Uruguay's particular advantages, such as its counter-season relationship with the northern hemisphere (the basis for a large part of Chile's export trade, for example) and its capacity for natural, organic and "green" agriculture. As a significant net agricultural exporter, Uruguay must exploit as much as possible its existing and new areas of comparative advantage and engage in a continuous effort to maintain and improve its competitive position in individual lines of production.

xii. The increase in agricultural production must come from increased productivity, precisely because the geographical frontier was reached long ago. For long-term sustainability, it is essential that such intensification (or "vertical" increases in output) must not prejudice the natural resource base that supports it. There are encouraging signs

[1] About 130,000 people living in small- and medium-sized urban centers, and 57,000 dispersed in rural areas.

that the erosion and degradation of soils provoked by inappropriate agricultural policy established half a century ago have been significantly reduced over the past 20-30 years. The reduction in the total cropped area has largely eliminated the cultivation of the marginal and vulnerable soils, and has been accompanied by the adoption of rotations (including planted pastures) and agricultural practices (such as minimum and zero tillage) that significantly reduce erosion. Similarly, a reduction in the size of the national sheep flock (from 26 to 12 million) has removed most of the threat to natural pastures from over-grazing.

xiii. Although land degradation has been reduced over the past quarter century, many of the activities that make up the current production systems present new environmental challenges that need to be addressed within a context of sustainable development. A lack of profitability at the farm level could provoke an inappropriate and eventually detrimental use of natural resources, to the extent that producers are forced to lower their planning horizon and place emphasis on the achievement of immediate and short-term solutions to cash flow shortages. Uruguay must, therefore, develop strategies and mechanisms to exploit fully the attributes of its natural resources, such as its "natural" pastures and the potential for organic farming, in the pursuit of market opportunities presented by ever-more-aware and demanding consumers.

xiv. In contrast to many other Latin American countries, there is little causal relationship between rural poverty and the degradation of natural resources, although a significant number of poor farmers do, in fact, live in areas with poor and degraded soils. The dispersed rural poor require a strategy to reduce poverty that emphasizes: (a) enhanced income generation from farming itself, which requires an improvement in the ability of small farmers to manage natural resources; (b) the development of small "cottage" industry (agro-related and others); and (c) off-farm employment.

xv. Significant changes have taken place in the way producers utilize and manage water resources in Uruguay. Reduced crop pressure on land and livestock pressure on natural pastures has been accompanied by the dramatic expansion of irrigated agriculture (partially supported by the Bank-financed Natural Resources Management and Irrigation Development Project - Loan 3697-UY). In addition to the role of irrigation in ameliorating the effects of two serious and long-lasting droughts during the past fourteen years, the impact that supplementary irrigation has under average climatic conditions is rapidly becoming appreciated by a large number of farmers. As pressure grows on available water resources, the concomitant need for an improved institutional and regulatory framework and an integrated strategy for water resource management will be of increasing importance. Improved efficiency of water use will require a broad range of initiatives, from the proper management of livestock-related effluents through investment in irrigation technology and improved water quality to the establishment of water markets, conservation-oriented policy instruments, and more systematic groundwater monitoring systems.

xvi. In tandem with an agricultural use of natural resources that emphasizes natural products and the general "wholesomeness" of production systems, biodiversity conservation and the maintenance of healthy eco-systems offer additional opportunities

for the rural economy. The conservation of biodiversity requires the establishment of a system of protected areas, complemented by a framework of incentives to private landowners to promote land-use practices that exploit the synergy between conservation and new opportunities for rural income generation. The geographic configuration of protected areas must maintain the mosaic nature of Uruguay's natural habitats and promote the restoration of biological corridors.

xvii. The adoption of modern technologies in production and processing will be a key determinant of agricultural development. The opportunities presented by biotechnology, and particularly by genetic engineering, must be carefully scrutinized and the undoubted advantages, in terms of productivity enhancement and pest and disease control, must be weighed against the disadvantages in terms of undermining Uruguay's potential as a clean, natural and uncontaminated environment in the eyes of consumers in sophisticated world markets. The use of lifetime tracing systems (*trazabilidad*) in livestock production will soon become an essential requirement for continued access to demanding export markets, particularly in the light of the continuing threat from BSE[2] and fears about genetic engineering, as will the adoption of advanced food safety measures (such as the HACCP system[3]).

xviii. There are several areas where "best practice" can be applied from the international arena in such subjects as: the use of market instruments for environmental protection (including carbon credits, and other measures to reduce the emission of green-house gases); the application of contamination fees in such sub-sectors as dairy production and forest-products processing, which have the potential to generate important negative externalities; and the application of modernized water rights, with the concomitant use of water-use fees and water markets.

xix. In summary, although the agricultural sector has a demonstrated capacity to further innovate by adopting technology and diversifying both production and markets, there is a growing recognition that the need to expand production and to increase productivity must be compatible with the protection and conservation of the natural resources on which it is based. In addition, it must be recognized that the issues and challenges of the rural areas go beyond the ability of agriculture alone to solve. A large part of the public sector's role in promoting development of the rural areas is to provide a supportive framework of public goods, while encouraging the private sector to identify and exploit the opportunities made available by world markets. There is also an important role for government in using public expenditure, both in support of infrastructure and in the application of specific incentives to achieve a demonstration effect in selected sub-sectors; the achievements in irrigation development and commercial forestry over the past fifteen years are good examples to expand and replicate.

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[2] Bovine Spongiform Encephalopathy or "mad cow" disease.
[3] Hazard Analysis and Critical Control Point

xx. Important issues, such as water resources management, environmental degradation, biodiversity conservation, the exodus of rural population, non-farm rural employment and rural poverty must be dealt with in an integrated manner. In an environment of domestic macro- and micro-economic uncertainty, exacerbated by the difficulties being experienced in the Argentine economy, the short-term prospects of the Uruguayan economy are challenged by the need for comprehensive fiscal, financial and regulatory reforms which are needed to strengthen investment and economic recovery. Future Bank assistance to the rural sector in Uruguay must take a comprehensive view of the problems affecting its future development, while supporting the promotion of mechanisms that would contribute to sustain the positive trend developed during the 1990s while addressing the impact of the regional financial crisis on the rural economy.

xxi. In these Policy Notes, Chapter I presents an overview of the recent evolution of macro-economic variables in the Uruguayan economy, including a discussion of the main characteristics of rural poverty and its evolution during the 1990s. Chapter II presents the main characteristics of the country's natural resources base. Chapter III discusses the main uses of natural resources in the rural sector (including their evolution, main constraints and development potential) and deals with the institutional and legal framework for natural resources management and conservation. Finally, Chapter IV presents a summary of the main conclusions and recommendations. In addition, a number of key subjects have been treated in more depth in detailed annexes.

Matrix 1
Summary of Main Long-Term Recommendations and Specific Short-Term Actions

Area/Responsibility	Recommendation/Action
Macro policy Central Government	Strengthen and expand structural reforms being carried out, including the financial and transport sectors, in order to improve the competitiveness of the agricultural sector (as well as the other productive sectors).
Macro policy MEF	Continue commitment to long-term agenda of nurturing entrepreneurship in production, processing and marketing, and encouraging foreign direct investment *via* an open economy.
Macro policy Central Government	Encourage the expanded use of public-private sector partnerships (as exists in agricultural research) as a means to bolster public sector expenditure in support of rural development while continuing to encourage private sector support to the development of infrastructure/services (e.g., ports, railways).
Macro policy MEF/MGAP	Evaluate tax pressure on the agricultural sector and its impact on competitiveness, as well as the implementation of the eventual corrective measures, as part of the next round of government policy reforms.

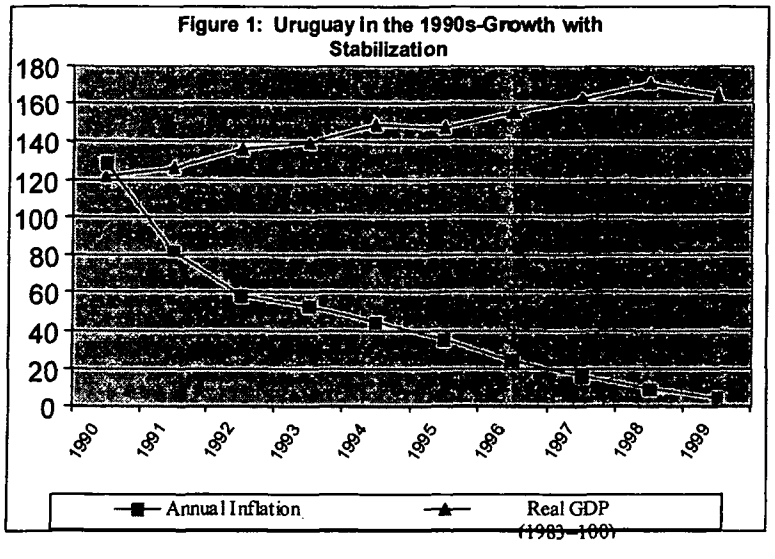
Macro policy MEF/MEC	Procure sustained "pro-poor" economic growth as the main tool in the poverty reduction strategy, to maintain and improve the distribution of income. Prioritize secondary education and technical training in rural areas.
Sector-wide MGAP	Support the continued growth of the agricultural sector, which (by definition) must come from productivity growth and must be export-oriented, encouraging adoption of technology, both through physical investment in machinery and infrastructure and through the up-take of knowledge. ▪ Implement programs to support capitalization and adoption of environmentally-friendly technologies. ▪ Implement training/education programs to complement physical investment with knowledge investment geared toward achieving higher efficiency.
Sector-wide MGAP/MRREE/Public-Private partnerships in research, marketing, quality promotion & certification	Pay increasing attention to existing and emerging patterns of comparative and competitive advantage, following the demands of foreign markets dictating both patterns of production and the opportunities for value-added *via* processing. Promote and support better integration of the different production/processing /marketing chains.
Natural Resources MGAP/MVOTMA/ MTOP/MIE/ Municipalities/Public-Private utilities	Support mechanisms to sustain the positive trend in agricultural productivity, taking precautions about area-specific soil degradation, as well as contamination of water resources (both ground-water and surface flows) that could occur from the intensification of livestock and crop production, in order not to reverse the progress achieved in the reduction of negative impacts of agricultural production on natural resources over the past 25 years. ▪ Support continuation of good soil management practices by modernizing technical standards and enforcement. ▪ Place attention on localized erosion-prone areas, and implement integrated watershed management projects using the Santa Lucia experience.
Natural Resources: Water and Soils MGAP/MVOTMA/ MTOP/MIE	Undertake a comprehensive review and the implementation of revisions to both institutional and legal frameworks for water resources management, to clarify agencies' roles, develop strategies and a policy framework, as part of the development of a reform agenda leading to the modernization of the sub-sector. ▪ Rationalize the legal and institutional framework for water resources management, by improving the regulations on existing laws, and preparing and adopting an integrated strategy for both soil and water resources management. ▪ Identify activities in the present production systems that could present new environmental challenges in a context of sustainable development.
Natural Resources: Biodiversity MGAP/MVOTMA/ MTU	Enhance the consistency between the conservation of biodiversity and the maintenance of healthy eco-systems, with continued agricultural development and increased productivity. ▪ Establish a system of protected areas and a framework of incentives for private land-owners to promote land-use practices that take advantage of the synergy between conservation and new opportunities for rural income generation.

CHAPTER I. THE RURAL SECTOR IN THE ECONOMY

MACROECONOMIC PERSPECTIVES

1. The economic and social landscape of Uruguay was formed by the dramatic rise and decline of the country's performance during the twentieth century. As early as the 1880s, Uruguay had become distinguished for its prosperity, based mainly on the export of livestock products. In the 1920s, it was a pioneer in the provision of social benefits, with universal access to education, health, and retirement benefits. Economic performance started to deteriorate after the 1930s as the agricultural sector was increasingly taxed to support the development of an inefficient manufacturing sector. In the mid-1950s, the country entered a period of prolonged stagnation when the limited growth potential of the protected industrial sector became exhausted. The ensuing long-term poor economic performance contributed to a military take-over of the government in 1973 that lasted for 12 years.

2. The military government initiated reforms that enhanced the role of market forces, and between 1973-1981 an average 3.7 percent annual growth rate of GDP was achieved. However, by the early 1990s the strategy of exchange rate-based stabilization, which was not supported by fiscal and monetary restraint, resulted in a significantly over-valued currency and the debt crisis that took hold in 1982 plunged the severely-indebted country into a deep recession. A new civilian government in 1985 confronted numerous challenges but by 1989 the economy was again stagnant, the public sector deficit exceeded 7 percent of GDP, and the annual inflation rate approached 100 percent. In 1990, a new administration concentrated on restoring stability. It advanced in financial sector reforms and trade liberalization (including the participation of Uruguay in Mercosur), as well as modernizing and reducing the size of the state. Annual GDP growth, which had averaged less than 1.0 percent during the late 1980s, increased to 4.4 percent from 1990 to 1994, bolstered by strong demand from Argentina and Brazil.



3. Progress with the reduction of inflation in the early 1990s was more modest. Reductions in the fiscal deficit helped inflation decline slowly from 129 percent in 1990 to 53 percent by the end of 1993, but deeper reductions in inflation proved difficult to achieve because of traditional and entrenched wage indexation and difficulties in sterilizing high levels of capital inflows. A crawling peg exchange rate regime was in place throughout the 1990s and the exchange rate was allowed to fluctuate within a narrow band as the domestic currency was devalued at a pre-announced rate. Although inflation could have been further contained by lowering the rate of currency depreciation, the government (in agreement with the IMF) opted to forego this option, wary of a further appreciation of the real exchange rate with its adverse consequences for exporting sectors.

4. More significantly, in the early 1990s, the administration failed in its attempts to accelerate structural reforms. Its program to begin to privatize public enterprises was rejected by voters through a plebiscite in 1992, and attempts to initiate reform of the central government were reversed by the legislature. When a new administration took over in 1995, its first priority was to reduce the fiscal deficit that had reached 2.8 percent of GDP in 1994, despite that year's strong economic growth (of 7.1 percent). Although GDP declined by 1.3 percent in 1995, the government reduced the fiscal deficit to 1.6 percent of GDP *via* limited nominal public-sector wage increases in an inflationary environment, investment cuts and increases in public utility tariffs. During the recession, inflation was reduced only moderately, from 44 percent in 1994 to 35 percent in 1995.

5. The period 1996-1998 was characterized by strong growth, a sharp improvement in price stability and the consolidation of the improved fiscal performance. Annual GDP growth averaged 5.1 percent over this period, the annual rate of inflation fell to 8.6 percent by the end of 1998, and the fiscal deficit (including costs associated with social security and other reforms) declined to 0.8 percent of GDP. Following the 1995 recession, however, unemployment remained between 10-12 percent over the 1996-98 period, and growth in GDP resulted in little improvement in social indicators.

6. Uruguay entered a difficult recession again in 1999, triggered largely by the economic recession in Argentina, the devaluation in Brazil, and the continued decline in international commodity prices, providing clear evidence of the dependence on regional trade and export of commodities. In addition, in the second half of 1999 the drought significantly affected agricultural and livestock production and the overall economic situation was complicated further by rising international petroleum prices. As a result, real GDP fell by 2.8 percent in 1999; the fiscal deficit deteriorated to 3.8 percent of GDP, and unemployment ended the year at 11.4 percent. Inflation, however, was further reduced to 4.2 percent by the end of the year.

7. An incipient recovery in the first quarter of 2000 was thwarted, as external factors and additional weather problems continued to plague economic growth. In late 2000 and early 2001, an outbreak of foot-and-mouth disease resulted in another strong negative shock to the economy (see Box 2 on page 11). The Brazilian currency began to depreciate sharply again in the first half of 2001, causing a shock to demand from this traditional trading partner. The result of all these negative circumstances was a further

decline in real GDP during 2001, estimated at 3.1 percent. Unemployment varied between 15-16 percent throughout 2001.

8. The exchange rate in recent years has been used to guide the path to lower inflation, and this process has been supported by IMF programs. In June 2001, the government decided to increase the 7.5 percent annual nominal devaluation rate to 15 percent. In addition, the width of the target band was doubled, from three to six percentage points. While the slower crawl already had given Uruguay some competitive advantage, in particular, relative to Argentina, the continuing depreciation of the Brazilian currency and strength of the US dollar motivated this policy change. Early in 2002, the Argentine financial crisis prompted further adjustments and both the annual nominal devaluation rate and the width of the target band were doubled again (to 30 percent and 12 percent, respectively). Prudent monetary policy has been used to support the exchange rate system. A step-wise devaluation could be problematic in the context of Uruguay's highly dollarized banking system (about 85 percent of deposits are either denominated in dollars or indexed to the dollar). The acceleration of the crawling band creates pressures on the banking system; however, the pressures are more gradual and can be managed through other means.

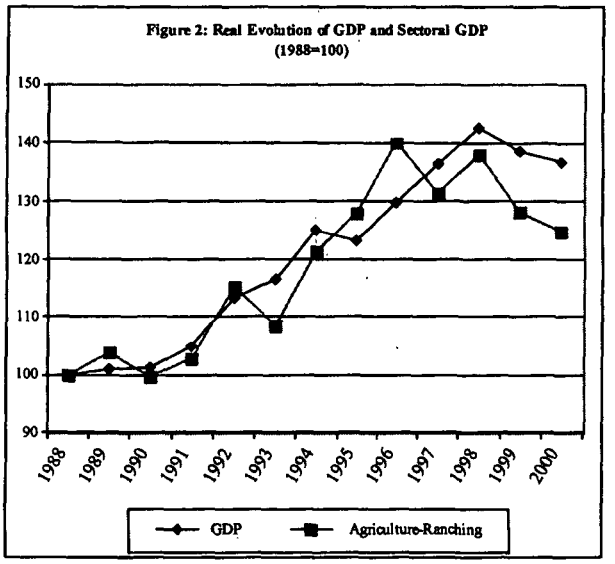
9. The volatility of short-term capital flows (mostly owned by Argentine nationals) reduces the degrees of freedom the makes the exchange rate policy and creates risks to the banking system, as the government-led rescue operations for two major commercial banks in early 2002 indicates. In an environment of domestic micro-economic uncertainty and difficulties the Argentine economy, the short-term prospects of the Uruguayan economy are challenged by the need for comprehensive fiscal, financial and regulatory reforms which are needed to strengthen investment and economic recovery.

THE NATURAL RESOURCE INTENSIVE SECTORS

10. Crop production, livestock and forestry[4] are the three most natural resource intensive activities in Uruguay, which together represented between 7-9 percent of GDP during most of the last decade. However, if industrial production and services directly associated with these activities are included, the sectors' combined share of GDP is closer to 20-25 percent[5]. During the early 1990s, the agricultural sector grew slightly faster than overall GDP. It peaked, however, in 1996 and several years of adverse weather conditions along with other external shocks have caused both greater volatility and declines in production.

[4] In this report, the agricultural sector is broadly defined to include these three sub-sectors.
[5] Picerno, *et al*, 2000. This estimate is based on an input-output matrix assembled for 1993.

11. Given the declining prices of many commodities, the agricultural sector has led the recent recession, in contrast to the 1995 downturn when natural resource sectors buffered the declines suffered in tourism and other sectors of the economy (Figure 2). With additional problems for beef exports, created by the spillover of the 2001 foot and mouth disease outbreak, the prospects for 2002 continue to be unfavorable, given the increased share of beef exports (up to 50 percent[6]) which foot and mouth disease-free markets had absorbed in the recent past. It is expected that the positive effect of improved access to international markets, as the situation continues to be stable from an epidemiological point of view, will be counteracted by lower export prices due to increased competition from other regional exporters, such as Brazil and Argentina.



12. As there are no new "frontier" land areas to bring into production, the strong growth in the early to mid-1990s was due mainly to a more intensive application of capital to the existing natural resource base, in response to increased external demand. Over half of the sector's output is either directly exported or processed and exported. Before the reduction of export revenues in 2001 caused by the foot and mouth disease outbreak, out of total exports of US$2.2 billion, US$1.6 billion were either agricultural or industrial products of agricultural origin. Recent trends in the performance of the most important products, as well as their future prospects and main limitations, are summarized in a matrix appended to Chapter IV (Main Conclusions and Recommendations). The liberalization of the trade regime and the removal of most sector-specific policy distortions provoked a structural shift, particularly in crop production. Comparative advantage now largely determines production decisions, where the producers must respond not only to long-term secular declines in real prices (which are the result of increased productivity world-wide) but also to frequent unfair competition. As a significant net agricultural exporter, Uruguay must exploit as much as possible its existing and new areas of comparative advantage, and engage in a continuous effort to maintain and improve its competitive position in individual lines of production.

[6] Lema, J. "*La Aftosa y sus Implicancias en el Comercio Cárnico*". Anuario OPYPA 2000.

Box 1

The Foot and Mouth Disease Emergency

Until the early 1990s, the presence of Foot and Mouth Disease (FMD) in Uruguay was a significant constraint to the export marketing of beef. It was eradicated by a campaign of vaccination, and for ten years Uruguay remained free of FMD, at first "with vaccination" and later, from May 1996, "without vaccination", the coveted status awarded by the world authority, the OIE [1]. This allowed Uruguay to begin to penetrate highly-prized markets in Europe, North America and Asia with beneficial impacts on the development of the livestock sector. By 2000, these markets were absorbing 50 percent of Uruguay's beef exports and were worth close to US$200 million per year, leading to more stable prices to producers and to increased output and efficiency in the production and marketing chain.

FMD broke out in October 2000 in the north of Uruguay, where it was confined and eradicated through a policy of slaughtering both infected animals and those located nearby. However, in late April 2001, FMD broke out again, this time in the south of the country close to Argentina and rapidly spread to the whole country. The impact of the outbreak has been devastating for the economy of Uruguay in general and the livestock sector in particular; it resulted in a loss of over US$140 million in beef export revenues, as well as the related multiplier effects on employment in agriculture and meat-packing, and on transport. It was quickly realized that a policy based exclusively on slaughter would not contain the disease, leaving immediate vaccination of the entire national herd as the only viable solution.

In order to assist Uruguay in containing the epidemic and gradually returning to its disease-free status, the Bank prepared with the government the FMD Emergency Recovery Project with an estimated cost of US$24.0 million. A loan to support it, for US$18.5 million, was approved in September 2001. The three-year project provides technical and financial support to the government in three areas: (a) the vaccination of the entire national herd, with compensation to those farmers whose animals were slaughtered at the outbreak of the epidemic; (b) the strengthening of monitoring and surveillance capability, to confine the area and number of stock affected in any future outbreak; and (c) the identification of alternative markets in the short term and the restoration of Uruguay's access to premium markets in the long term.

The first vaccination campaign was carried out in May 2001, and subsequent vaccinations are continuing as scheduled. The status of project implementation is satisfactory. There have been no new outbreaks of FMD since August 2001, and Uruguay is on course to re-establish its disease-free status and to develop sustainable mechanisms to minimize the probability of new outbreaks.

[1] The Paris-based *Office International des Epizooties* of the World Organization for Animal Health

Sectoral Composition

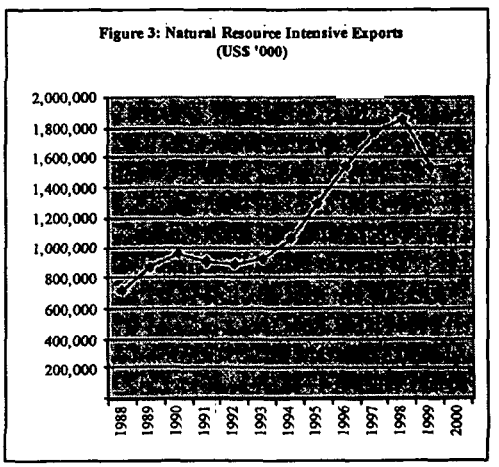
13. The share of nominal GDP of the main natural resource intensive sectors (which apart from agriculture include fishing and mines/quarries) has declined over the last decade as relative prices shifted against tradable primary sector goods – at least during the early 1990s. Since 1998, real growth of these sectors has been less than that of the

economy as a whole. Within these sectors, fishing has lost part of its share, with quarrying/mining taking over a larger share of nominal GDP.

14. The fall in relative prices was particularly pronounced in the early 1990s; however, there is another shift downward that appears to have started in late 1998. While some of the evolution of relative prices above can be attributed to economy-wide issues, like the real appreciation of the currency, clearly there are sector specific factors, international commodity price trends, and domestic supply shocks that have played a role as well. It is likely that the general "agri-business" share of GDP suffered a decline similar to that of the core primary sector during the latter part of the 1990s.

Exports of Natural Resource Intensive Products

15. Natural resource intensive exports[7] performed well between 1988-1998, increasing by over 160 percent from about US$700 million to US$1.85 billion. The drop to just over US$1.5 billion (7 percent of GDP) in 2000 was caused by demand-side factors (e.g., the decline in dollar incomes of key trading partners, like Brazil and Argentina) and supply-side shocks, principally from poor weather conditions. The composition of these exports changed over the period. In particular, the share of skins/leather exports dropped from nearly 30 percent in 1988 to between 14-18 percent during the latter part of the 1990s. Plant/vegetable products had somewhat volatile shares. Animal products held their share during most of the period. The large export growth sectors (albeit starting from a very small base) were forestry and paper products, which grew from a combined US$16 million in exports in 1988 to US$122 million in 2000.



16. The destinations of exports changed substantially over the period. In some of the more industrialized sub-sectors, like processed food and paper/cellulose, there was a rise in importance of Mercosur trading partners during the mid-to-late 1990s. In the case of processed food/drinks, in the late 1980s destinations like the United States, Europe (in particular, the United Kingdom), Japan and Mexico were important. By the late 1990s, Mercosur destinations became much more prominent, with Paraguay alone accounting for 42 percent of purchases in 1999. Paper/cellulose was a relatively new but rapidly growing export during the 1990s; Argentina was the main destination for these exports, but Brazil began to claim an important share during the late 1990s. For wood/forestry products, the Scandinavian countries were predominant in the late 1980s as the industry was getting started, but by the mid- to late-1990s other European destinations became

[7] Natural resource intensive exports are defined as exports of the following nomenclature categories from Uruguayan trade data: (I) Animal products; (II) Plants/Vegetable Products; (III) Oils/Greases/Waxes; (IV) Processed Food/Beverages; (V) Minerals; (VIII) Skins and Leather Products; (IX) Wood/Forestry Goods; (X) Paper/Cellulose Products; and (XIV) Precious Stones/Pearls.

more important (particularly Italy and Spain). Another development was the shift in skins/leather exports away from European destinations and towards Asia. In the animal product category, Israel continues to play an important role, but Brazil remains the predominant single destination.

17. Consequently, as far as the main component of Uruguayan exports (i.e., animal products) is concerned, the Argentine economic crisis did not have a major effect from the view-point of the market for these products, but could have a potential negative impact on export prices as the Argentine producers are now able to offer beef at nearly 50 percent of the Uruguayan price. This potential impact has not materialized yet, however, because of the financial difficulties faced by Argentine beef exporters and the reluctance to export of those without financial difficulties, because of uncertainty regarding the rate of exchange at which their export returns will be converted into pesos. Under these circumstances, the short- to medium-term external threat to the Uruguayan beef sector is more likely to come from the long-term declining trend of international beef prices than from the Argentine exporters. In this respect, the Uruguayan government and livestock producers should continue their efforts to open other market niches for beef exports, such as ecological beef or environmentally-friendly beef, which pay higher prices and would thus improve the profitability of the sector.

Labor and Capital Use

18. During the 1990s, between 6-9 percent of employment in the urban centers of the interior has been in the agricultural, fishing and mining-quarrying sectors. In addition, between 0.5-2.5 percent of employment in Montevideo was attributed to these sectors. The national employment survey does not cover rural areas, which by definition have a much higher concentration of employment in the natural resource intensive sectors[8]. Despite this, agricultural and agro-industrial activities continue to bear a large portion of all wage payments generated within the economy. It has been estimated that whereas only 7 percent of total wages and salaries paid by the tertiary sector is linked to agricultural production, that amount climbs to 58 percent for the industrial sector and 100 percent for the agricultural sector. It is estimated that 22.3 percent of the total wages and salaries paid within the economy are closely linked to agricultural and agro-industrial activities, a figure very similar to the sectors' contribution to GDP[9]. Most importantly, given the types of jobs involved, this share of the total amount of wages and salaries paid supports a comparatively larger share of the total number of jobs in the economy; this is of great significance to the less well-off and less skilled segments of the population and labor force, which are highly dependent on wage labor for their survival.

19. In recent years, unemployment in the natural resource intensive sectors has been higher than in the economy as a whole (Table 1), largely because output in these sectors has fallen more than the overall economy during the current recession.

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[8] Aproximately 220,000 adults (persons over 15 years of age) live in the rural areas.

[9] Picerno, A., Antía, F. and Sáder, M. "*Estimación de la Incidencia del Sector "Agronegocios" en la Economía Uruguaya*". Anuario OPYPA 2000.

Table 1: Unemployment Rate*, Urban Interior

Year	Overall	Natural Resources Intensive Sectors
1993	6.0	5.8
1994	6.9	6.4
1995	7.6	8.0
1996	8.9	9.1
1997	8.8	8.7
1998	8.1	8.0
1999	8.7	10.4
2000	10.5	13.9

Source: INE
* Data are from a sectoral breakdown table. These overall rates do not necessarily correspond with general unemployment rates for the urban interior, as presented in other INE tables.

20. Much of the increase in agricultural production during the 1990s was fueled by important investments. This was particularly true for beef production[10] [11], which witnessed marked improvement in productivity indicators as investments and technology adoption grew in response to improved price and market expectations by producers and packers.

21. To finance these investments, the agricultural sector has borrowed from the domestic banking system at increasing levels over the period. In 1997, 1998 and 1999, total indebtedness of the sector as a percentage of sectoral GDP was 57 percent, 67 percent and 85 percent, respectively[12].

22. This borrowing has carried very high costs, even in dollar-denominated loans, despite the fact that Uruguay enjoys one of the lowest levels of country risk in the region with the government borrowing internationally at 250 to 300 basis points over US bond equivalents. Although interest rates for foreign currency denominated loans have decreased since the banking system crisis of the early 1980s, there is substantial room for improvement, particularly due to the fact that a major factor explaining these high costs is the inefficiency of the banking system mostly related to overstaffing. Given the impact that borrowing costs have on the agricultural sector's competitiveness, this should be one of the key areas of the government's future reform agenda. The increased indebtedness of the agricultural sector can be explained to some extent by the fact that it has had access to loans from the *Banco de la República Oriental del Uruguay* (BROU), often at lower costs than similar finance available from private banks.

[10] Ilundain, M. and Lema, J. "*Evolución de la Ganadería de Carne Vacuna en el Uruguay en la Década de los 90*". Anuario OPYPA 2001.
[11] Picerno, A. "*Informe sobre Resultados de la Encuesta Pecuaria*". Anuario OPYPA 1997.
[12] Picerno, A. 1999.

Tax Burden

23. The agricultural sector is taxed *via* a number of direct and indirect taxes. The tax burden on the sector, as a share of sectoral GDP, declined from 9.5 percent in 1999 to 7.8 percent in 2000 because of tax relief enacted by the government. However, this decline merely restores the tax burden to the level experienced during 1996 (7.9 percent)[13]. Nevertheless, as with the case of borrowing costs, an evaluation of the tax pressure on the agricultural sector and its impact on competitiveness, as well as the implementation of the eventual corrective measures, should be a priority in the next round of government policy reforms.

THE SOCIO-ECONOMIC DIMENSIONS OF THE RURAL SECTOR

The Evolution of Rural Poverty

24. Uruguay is highly urbanized, and over 80 percent of the 3.3 million inhabitants live in urban areas. Of the urbanized population, close to 40 percent live in Montevideo, 40 percent in urban areas in the interior of the country, and just under 20 percent in rural areas[14]. Uruguay has a per capita income of almost US$6,200 and enjoys, for Latin American standards, a relatively equitable income distribution with social indicators close to those of industrialized countries.

25. At the beginning of the 1990s, income poverty affected 25.5 percent of the urban population (headcount measure). Following a steady decline in the earlier part of the decade, poverty stood at just over 20 percent of total population by 1994. The 1995 economic crisis, however, reversed this trend and the country ended the decade with poverty levels similar to those of 1991. Large urban centers other than Montevideo actually showed a worse level of poverty in 1998 than in 1991. Although no figures are available, it is safe to assume that, given the economic crisis that affected the country again in 1999 and 2000, the situation of the urban poor will have deteriorated even further towards the end of the 1990s, making it a lost decade from the view-point of poverty alleviation.

26. In Uruguay, it is clear that urban poverty is a more important problem than rural poverty both in relative and absolute terms. This is true even within rural areas, where some 130,000 people living in small- and medium-sized urban centers are classified as "income poor" or "income indigent", as opposed to 57,000 among the dispersed rural population. Most of the population defined as rural actually lives in small towns and have the characteristics of urban dwellers in most respects. Therefore, the data of the

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[13] "*Evolución de la Presión Fiscal en el Agro*" Tambler, A. Anuario OPYPA 2000 This analysis presents the legal, theoretical tax pressure on the sector, but it is not an economic analysis of the actual incidence of taxation in practice.

[14] As from 1998, the definition of the rural population includes dispersed rural population and people living in small urban centres with less than 5,000 inhabitants; the previous definition included people living in small centres of less than 900 inhabitants. Consequently, the estimate of the size of the rural population will be higher than in previous studies.

Survey on Rural Households[15] to a certain degree over-estimate the extent of rural poverty. These numbers show that income poverty is found predominantly in the small urban centers and not in the dispersed rural areas, an important determining factor for the definition of poverty alleviation strategy.

27. In the rural areas, by the end of 1999 overall poverty was lower than in the urban areas, particularly among the dispersed rural population where only 19.5 percent was living in poverty. Poverty levels for the medium-sized urban centers were similar to those of the large urban centers (around 25 percent), while the small-sized urban centers presented the worst poverty levels, with 28.2 percent of the population living below the poverty line. People living below the indigence line represented about 6 percent of total rural population. By contrast, in Montevideo and the other large urban centers it has been estimated that a very small proportion of the urban population (2.3 percent) falls below the indigence line (World Bank, 2000).

28. Although Uruguay is one of the countries with the lowest inequality in income distribution in Latin America, there are signs that this is changing. The Gini coefficient remained almost unchanged between 1990 (41.18) and 1994 (41.63) but increased by approximately 2 points (which is statistically significant) to 43.4 in 1998. While still low by Latin American standards, there was a clear acceleration in the rate of increase of income inequality in the second half of the decade[16].

29. In the rural areas, according to data available for 1999, income inequality was slightly lower than in the large urban centers, with the small urban centers presenting the lowest inequality (39.42). Income inequality among the dispersed rural population and in the medium-sized urban centers was 40.16 and 40.76, respectively, which leads to the conclusion that, with the exception of Montevideo, the country showed rather similar levels of income inequality at the end of last decade.

30. The dispersed rural population presents the largest deficits in unsatisfied basic needs, even though some of these identified deficits might respond more to cultural factors than to objective difficulties in obtaining basic goods and services. These deficits cannot be explained entirely by income constraints, as some are present not only among the poor but also among the better-off segments of rural society.

Main Income Sources of the Rural Poor

31. Income originating in the agricultural and livestock sector accounts, on average, for more than 48 percent of total income of the dispersed rural population, compared to a mere 14.5 percent in the small- and medium-sized urban centers. For the two poorest quintiles of the dispersed rural population, income from agricultural and livestock activities represent more than 54 percent of total income. For the poorest quintile living

[15] "*Estudio sobre el Empleo, los Ingresos y las Condiciones de Vida de los Hogares Rurales*". OPYPA-MGAP (2000).

[16] The Gini coefficient for Uruguay still compares favourably with the coefficients of other countries in the Region: 53 in Argentina (1996), 59 in Brazil (1996), 57 in Chile (1996), and 49 in Mexico (1996).

in the small- and medium-sized urban centers, this source of income represents close to 28 percent of total income, but for the richest quintile this drops to less than 9 percent.

32. Off-farm income, on the other hand, is almost as important as agricultural income for the dispersed rural population and accounts for about 50 percent of total income on average; this increases from 41 percent among the poorest to about 54 percent among the richest segment of this sector of the population. The relative importance of this source of income becomes greater as income increases, indicating that off-farm income is an important part of the household strategy to improve their level of income.

Activities Targeted to the Rural Poor

33. In 2001, the Government received a US$14 million loan from the International Fund for Agricultural Development (IFAD) to implement a 6-year project designed to reduce rural poverty. The main objective of the project is to raise the income of rural poor households, improving their living conditions and strengthening the institutional framework, in order to provide efficient and permanent mechanisms to fight rural poverty.

34. The project focuses on four main areas of activity through the implementation of specific strategies intended: (a) to develop a decentralized and sustainable institutional framework to assist the rural poor; (b) to provide productive and marketing assistance; (c) to render a gender sensitive social targeting mechanism; furnish credit and improve access to regular financial services; and (c) to promote improved linkages and coordination between activities of different projects and programs under implementation serving the rural sector.

35. The geographical coverage of the project is nationwide, although once a Rural Poverty Map (currently under preparation) becomes available it is expected to focus activities and to give priority to actions in areas with larger concentrations of rural households under the poverty line. The project is targeted to approximately 43,000 potential beneficiary families among landless, marginal (mainly subsistence) producers or potentially commercial small producers. It is expected that 10,000 of those families will be benefited, including 3,600 with activities targeted for women. The project will provide technical assistance, credit and seed capital to groups or single beneficiaries to raise agricultural productivity, improve access to formal credit and production/marketing chains, and to develop rural, manufacturing or services micro-enterprises. The program has no explicit focus on improved natural resources management.

CHAPTER II. THE NATURAL RESOURCES BASE

TOPOGRAPHY

36. Uruguay is characterized by a large, gently sloping basalt watershed in the north and a sedimentary basin and some extensive fluvial plains in the north-east. The south is predominantly on pre-Cambrian crystalline rocks, with the coastal basins filled with recent sediments, grading into the extensive recent sediments of the west that run along the Uruguay River.

37. The topography is generally gentle, with a mean altitude of 140 meters above sea level (masl). Most of the country, however, is located below 200 masl, with the exception of the two hilly regions in the north and the south-east which occupy about 10 percent of the country and have an altitude of more than 300 masl. Consequently, in most parts of the country slopes are usually slight, generally between 2 and 6 percent, while in a few relatively small areas the slopes can exceed 10 percent.

CLIMATE

38. The mean annual temperature ranges from 16°C in the south to 20°C in the north-east. Mean temperatures in January range from 22°C in the south-east to 27°C in the north-west. During the coldest month (July), temperatures range from 11°C in the south to 14°C in the north. The first frosts may be expected from early June in the center of the country to early July in the south-west . The last frosts are expected around the middle of August along the south coast and at the beginning of September in the interior.

39. The mean annual rainfall ranges from between 1000 mm in the south to over 1300 mm in the north. Rainfall occurs in every month of the year, but both annual and monthly amounts are highly variable, showing 20-30 percent deviations around the mean values. At the eight meteorological stations[17], the mean rainfall in any month is not less than 61 mm.

40. Rainfall is frequently of high intensity, with a low ratio of infiltration to run-off. The annual average run-off is estimated at 300 mm (30 percent of the total rainfall), and summer run-off is less than 0.15 liters per second per square kilometer (l/s/km²). The country has abundant surface water resources equally distributed within the territory due to the dynamic of hydrological cycle components. A significant portion of the available water is non-regulated and, consequently, water availability decreases accordingly in the summer time.

[17] Melo, Treinta y Tres, Rocha, Artigas, Salto, Paysandú, Colonia and Montevideo.

Table 2: Mean Monthly Precipitation and Variability

Month	Rainfall (mm) *			
	Average	Standard Deviation	Maximum	Minimum
January	72.1	38.9	193.4	8.1
February	72.9	54.3	186.7	0.1
March	80.0	52.0	244.4	4.8
April	105.3	65.5	280.6	13.5
May	111.5	69.3	401.3	23.7
June	102.1	68.8	275.1	9.7
July	93.4	59.3	229.6	22.5
August	115.1	81.3	299.2	30.1
September	122.2	83.5	441.6	29.6
October	84.6	61.2	239.7	8.5
November	81.7	57.7	198.3	3.7
December	69.8	44.7	157.3	0.0

* Measured at INIA La Estanzuela, 1965-2000.
Source: R. Romero (INIA) 2001

41. Annual actual evapo-transpiration ranges from around 1000 mm in the north-west to 850 mm across the center to less than 750 mm in the extreme south-east, with maximum and minimum values during summer and winter, respectively, but with low variation between years.

42. As in the majority of natural systems, there exists an uneven balance between the distribution of rainfall and seasonal variation of potential evapo-transpiration, resulting in frequent water deficits in soils during mid-spring and summer and water excess in winter. Extreme events also occur periodically, and two serious droughts have occurred during the last fourteen years (in 1988/89 and 1999/00), although their impact differed widely within the country.

WATER RESOURCES

43. In terms of its water resources, Uruguay is a fairly rich country with an average per capita availability in excess of 35,000 m^3. However, a large portion of the water resources originates in neighboring countries. In addition, Uruguay is at the receiving end of environmental degradation and water quality problems that originate in neighboring countries (primarily in Brazil), indicating that issues related to trans-boundary water resources management are of significant importance to Uruguay.

44. As a result of the country's physical characteristics, water resources are spread throughout the territory in a relatively homogenous way, and under average rainfall conditions there is no region where widespread or severe water scarcity is systematically felt. Water conflicts are restricted to specific areas and have been aggravated only in the recent past.

45. With respect to water quality and environmental externalities, a number of issues are observed in Uruguay. Poor management of solid waste in the dairy sector is a problem that has received attention from the Bank-supported PRENADER project[18] (see Box 2). Although only a relatively small number of sub-projects dealing with the problem have been implemented in the Santa Lucia watershed (approximately 60 ponds and 10 septic chambers), the results achieved in this area suggest a substantial demand for the expansion of this technology. Other issues related to water quality include the limited scope for monitoring and enforcement programs for effluent discharges, with noticeable deficiencies in the information system caused primarily by an institutional vacuum and deficient coordination between *Dirección Nacional de Hidrografía* (DNH) and the *Dirección Nacional del Medio Ambiente* (DINAMA). Non-point source contamination from agriculture is an issue of growing concern which needs to be evaluated and quantified.

46. An estimate of the contributions of surface and ground water in the coverage of the country's total consumptive demands is summarized in Table 3:

Table 3: Estimate of Contribution from Surface and Ground Water Supplies

Water Source	Annual Volume	
	million m^3	%
Surface Water Direct Intake	1,050	28.7
Surface Water Reservoirs	2,470	67.5
Ground Water	140	3.8
Total	3,660	100.0

47. Problems with water quality are confined to specific areas. In superficial water flows, problems may be found in waterways located close to urban and suburban areas as well as waterways located in dairy producing basins. These waterways receive effluents from industrial, rural and domestic activities, resulting mostly in organic-based contamination. However, high levels of metals have been detected in the water in certain areas, which could harm crops and soils if it were used for irrigation. Other source of concern related to superficial waters is the eutrophication of water bodies, resulting in significant growth of algae.

48. With respect to ground water, the main problems are associated to: (a) salinity in aquifers enclosed on geological formations with high salt contents (natural cause); and (b) high nitrate and coliforms levels in wells located in areas of rural (mostly dairy) as well as domestic activities.

49. From the point of view of agricultural uses (mainly irrigation), water quality does not constitute a major problem. Irrigation in Uruguay covers 247,000 ha and is mainly supplementary; even if water with salinity problems is used, normal rainfall is enough to wash the soil and dilute salt concentration in the root zone. However, the existence of

[18] Natural Resources Management and Irrigation Development Project, Loan 3697-UR

wells with salinity problems in areas of intensive fruit and horticultural production should constitute a warning about the possibility of more intense contamination of both the soil and the crops if proper water management techniques are not utilized. This is mostly relevant in the case of very sensitive crops grown in greenhouses. A study carried out by PRENADER[19] highlights the need to monitor continuously the salt content in water and to train technicians and producers in proper irrigation management techniques when problem water sources are involved.

SOILS AND LAND CAPABILITY

50. The territory of Uruguay covers 17.5 million ha, of which 16.1 million ha (91.4 percent of the total) are considered suitable for agricultural production[20]. Pastures make up about 90 percent of this usable area, and about 91 percent of the pasture area is under natural pasture[21]. The soils of Uruguay have been extensively studied; they are predominantly superficial, with a generalized deficiency of phosphorus and high clay content. There are 3.2 million ha net (4.0 million ha gross) with cropping potential (that is, of USDA[22] Soil Classes I to III).

51. Although there are 3.2 million ha of arable soils, only about 1.6 million ha of these soils can be cropped in any one year because of the need to include pastures in the land-use rotation: (a) to maintain an adequate level of organic matter content to preserve soil structure; and (b) and to achieve a balance between permeability, moisture retention and resistance to erosion. The area of the *Litoral,* bordering the Uruguay River and the Río de la Plata, has 52 percent of the arable land potentially cultivable in any given year (and 72 percent of land of Soil Classes I and II) and represents 80 percent of the land actually cropped in any given year.

52. Soils of the northern and eastern regions of the country have water-holding capacities of less than 150 mm throughout the *solum* depth, while the soils of the center, south and west generally hold from 150 to over 200 mm. In many places, low water-holding capacity is linked to soils often of less than 50 cms in depth and lying over impermeable sub-soil materials.

53. The distribution of land capability by different types of use, derived from consideration of combinations of soil conditions and climatic factors, are indicated in Table 4.

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[19] Zamalvide, J.P. "*Calidad de Agua para Riego en Sistemas Horti-frutícolas*". 2001

[20] Broadly defined to include crop production, pastures and forestry.

[21] Although a proportion of it has been improved through investments, particularly over the past forty years, aimed at increasing its carrying capacity.

[22] United States Department of Agriculture Soils Classification

Table 4: Potential Land Use

Region / Department	Land Area (gross '000 ha)		Cultivable Soils (net '000 ha)		
	Total	Under Production	Total	Potential Annual Use [23]	
				Crops	Cultivated Pasture
I: Artigas	1,193	1,160	156	75	81
Salto	1,416	1,318	209	103	106
II: Paysandú	1,392	1,345	259	135	123
Río Negro	928	947	328	184	144
Soriano	901	834	422	240	182
Colonia	611	571	221	123	98
San José	499	446	132	77	55
Flores	514	497	149	86	63
III: Durazno	1,164	1,093	222	117	105
Florida	1,042	1,022	209	100	109
IV: Rivera	937	884	115	46	69
Tacuarembó	1,544	1,473	198	96	101
Cerro Largo	1,365	1,342	232	115	117
V: Treinta y Tres	953	858	8	3	5
Rocha	1,055	934	102	34	68
VI: Lavalleja	1,002	930	116	46	71
Maldonado	479	396	60	23	37
VII: Canelones	454	353	64	34	30
Other	173	16	-.-	-.-	-.-
Total	17,622	16,420	3,202	1,637	1,564

Source: adapted from The Agricultural Sector Review (1988): derived from Hunting Technical Services/OPYPA (1976) and the Crop Sector Review (1982).

54. Nearly 50 percent of the country is classified as primarily suitable for crop and livestock production, with a further 8 percent that could be added to this group of soils, although agricultural capability in the latter soils is restricted to rice.

Table 5: Land Distribution by Main Soil Capability

Soil Capability	Area (million ha)	Percent
Mainly for crops	3.5	20.2
Crops with pasture	3.1	17.9
Pasture with crops	1.9	11.0
Mainly pasture	7.1	41.0
Pasture rice	1.4	8.1
Forestry and natural reserves	0.3	1.7
Sub-total	17.3	100.0
Other (unsuitable for agricultural use)	0.3	
TOTAL	17.6	

Source: Durán (1991)

[23] Based on rotations of: 4 years crops/2 years pasture in Class I and II land, 3 years crops/2 years pasture on Class IIA land, and 2 years crops/2 years pasture on Class III land.

ECOLOGICAL CHARACTERISTICS AND BIODIVERSITY

55. Uruguay is located in the confluence of two major phyto-geographic domains: the Amazonian and the Chaco. Because of its comparatively small size, relatively regular topography, and absence of major geographical accidents, Uruguay tends to be uniform from a biological perspective when compared with other countries in the Neo-tropical region.

56. Broadly speaking, and under natural conditions, the country's habitats are dominated by permanent, periodically-inundated grasslands, interspersed with a mosaic of other habitats, especially marshes, spiny woodland (*espina*), gallery forest, and in some cases large bodies of standing water (*esteros*). The relative importance of these habitats and the clear dominance of the grassland (*pradera*) ecosystem are shown in Table 6.

Table 6: Principal Natural Habitats and Land Use in Uruguay

Habitat Type	Area (million ha)	Percent
Savanna, currently rangelands	14.00	79.4
Natural Forest	0.60	3.5
Wetlands and other Aquatic Ecosystems	1.14	6.5
Permanent Agriculture	0.92	5.2
Urban and Infrastructure	0.30	1.7
Plantation Forests	0.40	2.2
Other	0.26	1.4
Total	17.62	100.0

57. Most of the country belongs to the "Uruguayan Savanna" eco-region, which also extends to parts of Argentina and Brazil. Because this eco-region is one of the few "savanna" eco-systems in the world, it is important from a global representation view-point, even if its biodiversity, when measured in terms of species richness, may not be as high as that found in other eco-regions. The other eco-regions represented in the country include the Humid Chaco and the Brazilian Atlantic Coast *Restingas*.

58. The specific habitats present in Uruguay do not occur in isolation from each other but are interspersed, with a series of localized geographic features which include rocks, hills, small ravines and a highly-branched hydrological network; it is this "mosaic" pattern that defines the uniqueness and importance of the eco-region from a biodiversity perspective and, under natural conditions, allows it to maintain its species diversity. The following are the main eco-systems present in the country:

- Savanna – which includes a heterogeneous herbaceous community (2000 species, of which 400 are *graminidae*), whose diversity is determined by the relative complexity of the soils. There are also various legumes with importance from a range management perspective, as well as shrubs.

- Native Forests – which includes various distinct types, among them gallery forests (along rivers and other water courses), ravine forests (which appear in patches and benefit from specific micro-climate conditions), "*bosque Serrano*," palm forests (including the important and endemic "*Butia*" association covering 70,000 ha), "*monte de parque*," "*algarrobal*," and litoral spiny forests ("*monte espinoso del litoral*").

- Wetlands – which are primarily located in the south-east , especially in the Laguna Merín watershed and the coast of Rocha.

- Coastal Ecosystems - which are productive and have an important associated wildlife. They occur along the two main coasts of the country, the River Plate coast (460 km) and the Atlantic coast (220 km).

59. There are about 1,200 species of vertebrates in Uruguay, including 580 species of fish, 41 species of amphibians, 62 species of reptiles, 434 species of birds, and 111 species of mammals. Of the 111 mammal species historically present, four have already become extinct and five are threatened with extinction. Uruguay contains remnants of the original "Argentine Mesopotamian Grasslands" which include three restricted-range plant species (the entire genus *Sporophila*), one of which is in critical condition, another endangered, and the third near-threatened. From a botanical perspective, Uruguay has over 2,500 species of which the great majority is herbaceous species or shrubs corresponding to the dominant savanna ecosystems[24].

[24] More comprehensive descriptions of the country from a biological perspective can be found in: "*Estudio Ambiental Nacional*" and "*Propuesta de Estrategia Nacional para la Conservación y Uso Sostenible de la Diversidad Biologica del Uruguay*".

CHAPTER III. THE UTILIZATION OF NATURAL RESOURCES

LAND USE

60. **Crop Production**: The area under annual crops suffered a marked reduction during the 1990s as a result of the increased openness of the economy and the decline on international prices. From 1.08 million ha in the crop year 1976/7, the area under annual crops (the eight principal grains and oilseeds) fell to 0.82 million ha in 1996/7 and to 0.49 million in 2000/1. Significant investments in processing facilities have accompanied the exploitation of comparative advantage in malting barley and rice, which are important export crops, whereas food and feed grains as well as oilseeds have all declined over time.

Table 7: Area under Annual Crops ('000 ha)

Crop	1976/7	1986/7	1996/7	2000/1
Malting Barley	40.0	50.8	146.1	88.6
Maize	158.5	94.4	61.3	34.3
Oats (for grain)	65.5	48.1	67.1	40.0
Rice	56.8	79.4	155.5	153.7
Sorghum	106.7	30.6	38.8	22.9
Wheat	543.5	187.8	250.3	123.0
Soybeans	10.0	32.1	7.6	5.1
Sunflower	102.3	67.1	96.8	24.6
Total	1,083.3	590.3	823.5	492.2

61. **Livestock Production**: The productivity of pastures in Uruguay has long been a polemical subject, and heroic efforts have been made for more than half a century to improve pasture composition and yields. The nutritive value of natural pastures is restricted by, among other things, the scarce presence of legumes, and the growth of pastures is very cyclical, with peaks in production in spring and fall and troughs in summer and winter. Efforts to improve the productivity of pastures have been based on improving the natural pastures on the superficial soils (*mejoramiento extensivo*) and planting pastures on arable land (*pastura convencional*). Over time, the former has become reduced in importance and the latter has increased. In addition to these methods, annual forage crops are also planted.

62. There have been significant changes in the composition of the area of pastures dedicated to livestock production. The area of pasture with improvements increased from 10.2 percent of the total in 1981 to 16.2 percent in 2000. Of the total pasture area with improvements, planted pastures rose from 35.3 percent in 1981 to 52.2 percent in 2000, whereas improved natural pastures fell from 51.0 percent to 29.6 percent of the total. In the improved natural pastures category, seeded natural pastures increased in importance

up to 1999 (when it reached 657,000 ha, in part as a result of the success of the legume Lotus *Rincón*, while the area receiving fertilizer decreased.

Table 8: Evolution of the Area of Natural and Improved Pastures ('000 ha)

Type of pasture	1981	%	1990	%	2000	%
Area with improvements						
- Planted pastures	557	3.6	704	4.6	1,196	8.4
- Seeded natural pastures	538	3.5	359	2.3	487	3.4
- Fertilized natural pastures	263	1.7	155	1.0	191	1.3
- Annual forage crops	214	1.4	283	1.8	418	2.9
Sub-total	1,572	10.2	1,501	9.7	2,292	16.2
Natural pasture and crop residues	13,775	89.8	13,918	90.3	11,845	83.8
Total	15,347	100.0	15,419	100.0	14,137	100.0

63. One of the most significant changes introduced over the past twenty years has been the generalized use of forage conservation to smooth out the irregular production cycle of both natural and planted pastures. The cattle population has remained remarkably stable over the last twenty five years.

64. By contrast, the sheep population has fluctuated enormously, and the most recent data show that by 2000 the total number of sheep had fallen to a little more than half the peak population reached in 1991.

Table 9: Cattle and Sheep Population ('000 head)

Year	Sheep	Cattle	Ratio
1976	15,647	10,385	1.5/1.0
1986	23,336	9,300	2.5/1.0
1991	25,611	9,001	2.8/1.0
1996	19,702	10,651	1.8/1.0
2000	13,032	10,379	1.3/1.0

65. Cattle and sheep are raised almost entirely in association, their complementary forms of grazing maximizing the use of natural and improved pastures. However, poor pasture management can easily lead to over-grazing, particularly in the extensive areas of superficial soils and on establishments that practice little or no forage conservation. This is greatly exacerbated during the dry summers and especially during the periods of extreme drought occasionally experienced. When stocking rates are high, farmers have no room for maneuver when climatic conditions reduce the available food supply and are faced with the stark choice between the survival of stock and the well-being of pastures. There is considerable evidence that the pressure placed on pastures by the exceptionally high sheep population in the late 1980s and early 1990s caused long-term damage and provoked erosion in some areas. The population was close to its peak during the first

(1/1988-5/1989) of the two serious droughts to castigate Uruguay in the past twelve years, although it had fallen significantly by the time of the second (9/1999-5/2000).

66. **Forestry**: Stimulated by the current Forestry Law of 1988 (the *Ley Forestal* 15.939), there has been a very significant expansion in the area of planted forest. Between 1975-1980, only 13,883 ha were planted (under the aegis of the earlier *Ley Forestal* 13.723 of 1968), and in the period 1981-1990 some 31,074 ha were planted, mainly in the latter years. Between 1991-2000, however, 488,587 ha of forest were planted. Of the total area of 533,544 ha, approximately 70 percent is planted with eucalyptus *spp.* and 25 percent is planted with pines. Planting continues at the rate of more than 60,000 ha per year.

67. The development of forestry is based on the designation of "priority areas" which target those regions of the country with conditions suitable for forestry that are at the same time marginal for other activities. The policy of incentives provided by the government applied only in the priority areas, and thus there has been a concentration of the newly-developed forest plantations in those areas. Although commercial forests cover only a small part of the country, in certain areas they are now a dominating feature of the landscape, with an influence that extends from their impact on groundwater to the safety implications of the enormous transport requirements of a product that is destined mainly for export.

68. The issue of the environmental sustainability of commercial forestry concerns its impact on water supply, soils and biodiversity, as well as a set of less tangible but important issues including the alteration of the landscape. These issues are currently the subject of a study by the *Dirección Forestal* (DF) financed through PRENADER, which will be supplemented in the future by a series of experimental analyses in a range of catchment areas throughout Uruguay in order to examine the impacts of different tree species on different soils. Based on preliminary work financed by PRENADER, the DF is in the process of preparing a Code of Forestry Practice.

69. Given that the cumulative area of planted forest will shortly reach the critical mass of raw material supply necessary to allow industrial processing on an economically-feasible scale, from pulp and cellulose to sawn-timber products, it can be expected that the relevant investments will be made following the expressions of interest being received from foreign and multi-national companies. Pioneer investments have already been made or are in progress involving some of the largest firms in the world. These investments must be carefully scrutinized, and their environmental implications carefully assessed, to ensure that the very significant pollution potential of these industries is avoided.

70. **Native Forest**: Uruguay has some 700,000 ha of native forest or woodland which form associations of species characteristic of different parts of the Uruguayan landscape and co-existing with the areas of natural pasture that predominate. These ecosystems are highly fragmented and have been subject to much anthropic deterioration which, in many cases, has left them as secondary (or worse) stands of woodland. Technical information that would support the recovery and sustainable management of this resource is

incomplete. Of the total, only 300,000 ha are officially registered (which brings tax exemptions) and only 120,000 ha of this has an approved management plan. The remaining 400,000 ha is not subject to any official control. The managed woodland produces 40,000 cubic meters of firewood per year. The Forest Law of 1987 protects this resource in its entirety and gives the DF the responsibility to manage it. The National Forest Inventory, whose preparation emphasized the commercial planted forest, also included the definition of native forest in the cartography and data base.

Soil Erosion

71. Most of the serious erosion that affects Uruguay was the result of inadequate cultural practices used in intensive agricultural production in the period before and after the Second World War. In many cases, the investments reportedly required to bring these areas back into agricultural production would be not be financially feasible. During this period, erosion in parts of the *Litoral* and in the more marginal, transitional areas between the *Litoral* and the areas of poor, shallow soils was the direct result of bringing inappropriate areas into production, spurred by artificially high prices generated by protection.

72. More recently, the trend is towards the adoption of sustainable production systems. By the latter half of the twentieth century, most Uruguayan farmers were adopting appropriate crop/pasture rotations in their winter crop cultivation, which explains the relatively low soil degradation in the country. As a result, according to different evaluations (Table 10), soil erosion in Uruguay appears to be stabilized with about 30 percent of soils subject to light to moderate erosion which represents mainly a potential problem.

Table 10: Percentage of total land area affected by soil erosion in Uruguay

Source:	Level of soil erosion:				
	Nil	Light	Moderate	Severe	Extreme
Cayssals *et al.*, 1978, quoted in Durán (1991)	69.9	21.2	6.8	2.0	-
National Map of Human-induced Erosion, 2001	67.7	21.6	9.4	0.6	0.12

73. The main cause of erosion is rainfall, which can be of high intensity (reaching 50 mm per hour on occasions). With a marked Mediterranean-type climate and large variability of rainfall during the year compared to potential evapo-transpiration, there are excesses of water in the winter and deficits in the summer. Soils, in general, have poor infiltration because of their heavy texture and high clay content, and the degradation of soil structure through deficiencies in management has worsened the problem. Estimates are that some 30 percent of the territory has been affected in the past to some degree by erosion; inappropriate agricultural practices (including over-grazing, over-cultivation, inappropriate cultivation and rotations) have contributed to degradation and erosion.

Land Use and the Impact of Production Systems

74. Soil conservation is a function of its use in accordance with its aptitude and the adoption of cultivation practices which allow different forms of management to achieve sustainable production. In Uruguay, basic tenets of conservation have frequently been violated by the demands of the production systems used.

75. For a long period, soil conservation measures were virtually unheard of in Uruguay; in fact, many practices almost seemed designed to provoke erosion. Excessive plowing and seed-bed preparation, cultivation of natural drainage channels, mono-cropping, etc. have provoked the reduction of the organic material content of soils, their compaction and loss of structure, and even, in extreme cases, to the complete destruction of the "A" horizon, leading to the most visible forms of erosion.

76. Until the 1970s, the construction of terraces was the central element of soil conservation policy but in practice there was little adoption of them by farmers. From the late 1970s, conservation policy allied to credit from BROU emphasized contour cultivation, but the restricted absorption of intense rainfall dictated by the physical composition of most soils and cultivation practices limited its usefulness. Together with the rotation of crops with pastures, contour cultivation remained the most common method of soil conservation until the advent of minimum tillage and direct drilling practices.

77. Although contour cultivation and associated measures helped to reduce soil erosion, a large problem remained. Those aspects of degradation of the physical properties of soil that result in reduced rainfall infiltration and an increased vulnerability to erosion also reduce its production potential. Thus, any "mechanical" measures for conserving soil must be complemented by proper management practices (e.g., rotations, green manure crops, zero or minimum tillage) if proper results are to be achieved.

78. Current trends toward the use of minimum tillage or direct planting practices, while overcoming many of the problems of traditional cultivation practices and the conservation methods designed to counter-balance them, must also observe certain fundamental principles, such as respect for natural drainage lines and conducting soil preparation operations following the contour or with carefully-controlled slopes. Information from INIA and AUSID indicates that some 26 percent of the area under cropping, equivalent to approximately 95,000 ha in 2000, uses systems of direct drilling and this can be expected to increase. However, direct drilling should not be thought of as excluding other good management practices. It is also evident that certain degraded land requires an intermediate phase of conventional cultivation to correct problems of micro-leveling, soil compaction, removal of erosion channels and weed control. With PRENADER support, a pilot project was implemented to garner experience in micro-catchment area-based integrated management of natural resources (see Box 2).

Box 2

A win-win experience in micro-catchment-based natural resources management.

As an integral part of the PRENADER program, a pilot project for the sustainable management of natural resources in the catchment area of the Santa Lucía river has been implemented. The area, covering 13,000 km^2 where more than 80% of the economic activity of the country takes place, is the largest catchment that is wholly contained within the territory of Uruguay and the source of drinking water for more than 60 percent of the population of Uruguay. The project strategy focused on the integrated management of natural resources (soil, water, and natural vegetation) in the whole area, the most intensively farmed catchment area in Uruguay. There, the use of traditional soil management technology provoked serious problems of soil erosion, and heavy concentration of dairy farming has caused contamination problems of both superficial water-courses and the underlying aquifer.

Implementation started in 1995, targeting 410 small producers in four representative micro-catchment areas covering some 29,000 ha, with average farm holdings of 71 ha. The integrated management approach required group work by farmers in addition to that carried out within each individual farm, inducing the creation of 17 farmers' groups with a total of 377 members. With technical assistance provided by the project, farm management plans (*Planes de Manejo Predial, PMP*) were prepared with each farmer, designed to introduce soil conservation, fertility maintenance, and pollution control techniques tailored to the specific characteristics of each farm. The technical assistance, along with the on-farm investment and farmer training provided were key attributes of the interventions promoted. The pilot project financed activities during two crop years. Particularly successful have been the adaptation and installation of 62 specially-designed septic ponds and chambers aimed at trapping solids and cleaning-up effluents generated in dairy farms. The project also established, in 13 of the groups, a fund based on farmers' contribution and matching grants to finance the acquisition of conservation tillage equipment for collective use.

The adoption rates of the wide range of resource conservation practices and interventions promoted far exceeded in many cases what was actually funded by the pilot project, and farmers in many instances expressed that they intended to continue with the practices beyond the period of support, indicating the perceived financial returns of such activities.

79. During the past two decades, rain-fed crop production has decreased and the area of planted pasture and forestry has increased, thereby reducing overall the potential problem of soil erosion and degradation. The concomitant evolution from mono-cropping towards crop and pasture rotations has brought clear advantages of soil conservation, increased organic matter content and improved structure. Conventional tillage with emphasis on soil movement has slowly been replaced by minimum (vertical) tillage and, more recently, direct drilling. The rice area has increased significantly and has expanded into areas where the risks of erosion are significantly higher; the transfer of technology and the monitoring of the up-take of appropriate conservation measures are important in these areas. Vegetable and fruit production have increased their productivity and diminished the area cultivated, using irrigation and improved cultivation methods. As a result, marginal land has been transferred to other uses, particularly pastures, reducing the overall erosion risk.

80. In extensive livestock production systems, improved grazing management allied to the reduction in stocking rates (consequent on the reduction in the national sheep flock) has reduced pressure on the natural pastures and reduced soil degradation and erosion. Dairy production systems have intensified land use, and the production of summer and winter forage and of silage crops have increased the potential for erosion and degradation; although these crops are frequently cultivated in rotation with pastures, improvement in soil structure is frequently placed second to the need to feed animals, and serious problems of soil compaction from trampling occur.

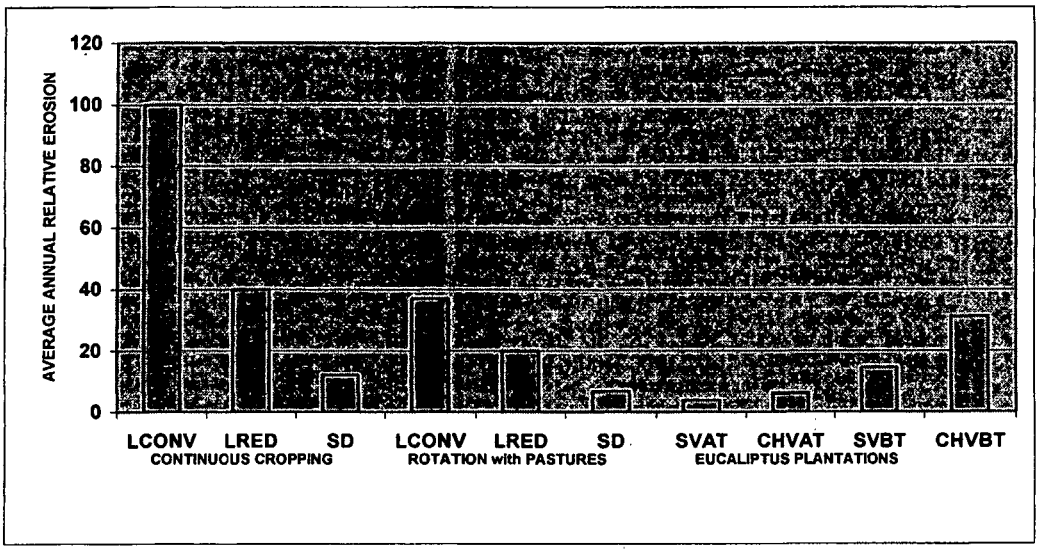
81. Recent field measurements and modeling works demonstrate the dramatic impact of improved soil and crop management techniques. In order to examine the problem of soil degradation over time, a detailed analysis of the evolution of the carbon content of agricultural soils in Uruguay has been carried out using the Century model[25], calibrated using the results of long-term experiments and cross-checked with results generated by individual producers. The model closely simulates the effect of the inclusion of pastures in the rotation and the cultivation methods commonly employed in Uruguay.

82. Based on a stratification of three basic soil types and on the hypothesis of three levels of prior use of the soils in cropping, a series of simulations was carried out covering the period 1975-2000. Assumptions made for the simulations included :(a) that most of the area under cropping between 1975-2000 had had between 10 – 20 years of continuous cropping use prior to 1975; (b) that prior to 1975, 100 percent of the cropped area had had no rotation with pastures and had been cultivated with the then-conventional (i.e., soil-turning) techniques; and (c) that by the year 2000, 100 percent of the cultivated area included pastures in the rotation, and cultivation techniques had advanced to the point at which two-thirds was minimum tillage and one-third was zero tillage. These technical parameters were considered to have evolved at a constant rate between 1980 and 2000. A series of sensitivity analyses was made with respect to variations in the compositions of soil types and differing histories of prior agricultural use for any given

[25] Baethgen, W., García Préchac, F., and Clérici, C. "*Estimación de la Evolución del Contenido de Carbono de los Suelos Agrícolas de Uruguay*".

area. Finally, in each simulation account was taken of soil loss through erosion, using the Universal Soil Loss Equation (USLE).

Figure 4: Rate of soil erosion losses (t/ha/yr) for different alternatives of soil management.



LCONV: conventional tillage; LRED: reduced tillage; SD: direct drilling; SVAT: high technology on soil with no prior use; CHVAT: high technology on soil with intense prior use; SVBT: low technology on soil with no prior use; CHVBT: low technology on soil with intense prior use

83. Previous research had indicated that the major part of soil erosion and degradation in Uruguay had occurred prior to 1980. Simulation *via* the model indicated that the point of departure in 1975 was as follows:

Table 11: Loss of organic matter of soils *cf.* their pristine state (as a %):

Amount of prior agricultural use	Heavy soils (43% clay, 32% silt)	Medium soils (34% clay, 27% silt)	Light soils (12% clay, 10% silt)
10 years	43	51	67
20 years	58	68	82

84. From the analysis of the period 1975-2000, two distinct phases were identified; the first, from 1975-1990, indicates a gradual slowing-down and eventual halt to the rate of loss of the levels of organic matter from soils, and the second, from 1990-2000, indicates a gradual recuperation of these levels. This improvement was accompanied by a reduction in the level of soil erosion.

85. The recuperation in levels of organic matter and the reduction in soil erosion were the direct result of: (a) the observed increase in pastures in the rotation; and (b) the reduction in soil-moving cultivation methods and the increase in minimum and zero-tillage practices. Soil erosion has been reduced on a per ha basis and, at the national level, this impact has been greatly magnified by the reduction in the cultivated area.

WATER RESOURCES

86. Favorable climatic conditions have meant that the development of irrigated agriculture, traditionally the main consumer of water in many countries, is relatively recent. Consequently, problems of water quality, conflicting demands for water from different sectors of the economy, and general water management problems are relatively new issues which both the public and the private sector are only just beginning to address. Nonetheless, despite its comfortable water balance, Uruguay already faces challenges related to localized water scarcity and water user conflicts, some of which are related to the quality of water resources. Over the past few years, Uruguay has faced two drought cycles (1988/89 and 1999/00) which had serious consequences for agriculture and other water use sectors (e.g., hydroelectric generation). Site-specific conflicts, such as water competition in the Río Negro basin between irrigation and hydro power, have emerged and point towards increased challenges for the future.

Water Uses and Management

87. The analysis of water resources use and management by sectors shows that priority actions could be undertaken in parallel with the implementation of the necessary reforms to achieve more efficient management. The reform path would involve the establishment of a national water resources policy and a national water resources management system, initially targeted at reducing legal and institutional obstacles. This process would require steps ranging from the establishment and validation of a country water resources strategy to the development of a national water resources plan.

88. With respect to water uses, the sectors with expressive consumptive water use include primarily: (a) irrigation; (b) water supply and sanitation; (c) livestock production; and (d) industrial water uses.

Table 12: Main Water User Sectors

Water Use	Annual Volume (million m^3)			%
	Surface water	Groundwater	Total	
Human (WSS)	375	35	410	11.2
Industrial	40	40	80	2.2
Irrigation [26]	2,910	30	2,940	80.3
Livestock	195	35	230	6.3
Total	3,520	140	3,660	100

[26] Rice is the main crop produced under irrigation, accounting for approximately 95 percent (2.8 billion m^3) of the total irrigation water used in Uruguay.

Main Rural Consumptive Use of Water

89. Irrigation is the main water use sector accounting for approximately 80% of total consumptive use. During the 1998-99 crop year, an estimated area of 245,000 ha was under irrigation, accounting for a water demand of about 3 billion m^3.

90. Irrigation, which is mostly supplementary in Uruguay, has grown considerably in importance, partly as a consequence of the PRENADER project which has incorporated some 34,800 ha of irrigated agriculture since 1993. More importantly, however, PRENADER has supported the diversification in irrigation practices with projects for the production of high-value crops (e.g., fruits and vegetables, and grapes) and the introduction of new, water-efficient irrigation technology.

91. Although detailed information on irrigation water use efficiency is not available, PRENADER has contributed to important improvements in irrigation efficiency among its beneficiaries; however, there is still a long way to go to improve overall water use and water management. The significant increase in irrigation water withdrawal and storage capacity (Figures 5, 6, & 7) has not been compared with the proportional increases in environmental externalities and respective direct benefits for the poor rural population. A comprehensive evaluation of the irrigation sector is necessary for the development of an irrigation strategy involving both supply and demand issues, as well as environmental externalities.

Figure 5: Reservoirs for Irrigation

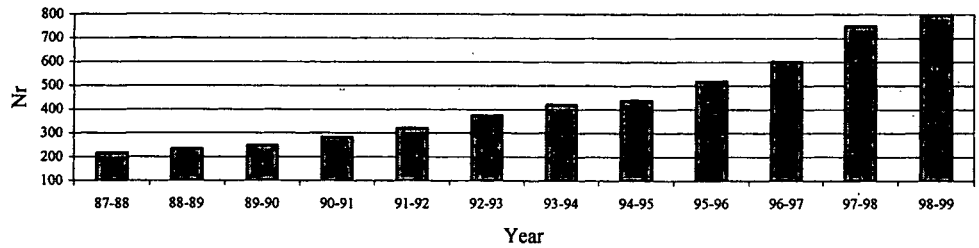


Figure 6: Water Withdrawal for Irrigation

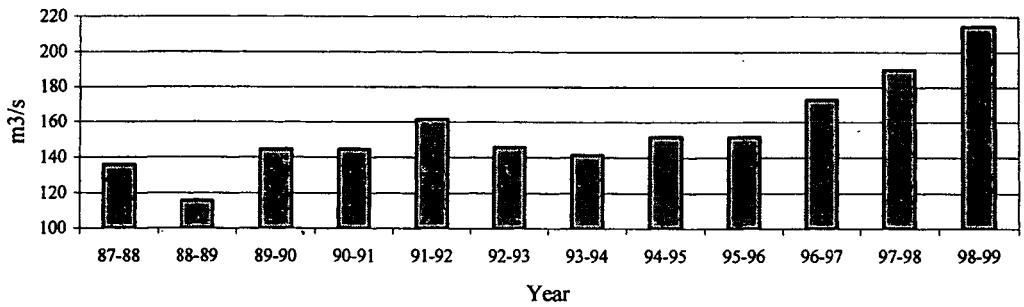
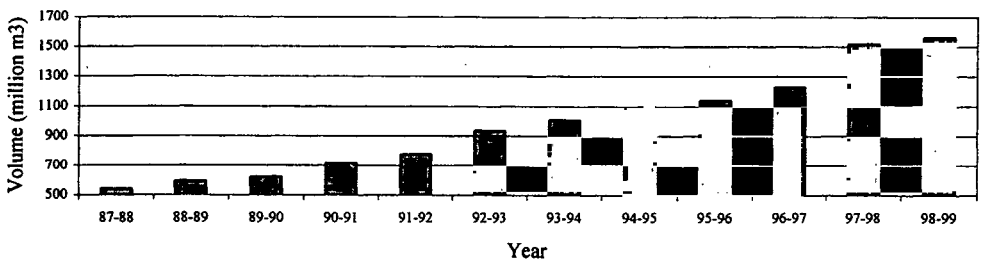


Figure 7: Storage Capacity for Irrigation



92. Much remains to be done with respect to the efficiency of irrigation systems which, in Uruguay, do not include flow measurement devices; farmers pay quotas based on the irrigated area and not by volumetric measurement of water use. This is a major disincentive for conserving water. Rice, the main irrigated crop[27], has an average water consumption of 15, 000 m^3/ha under current flood irrigation practices. This value can be reduced to about 7,000 m^3/ha through the implementation of more efficient water distribution and management systems. However, the current incentive structure is such that farmers have no reason for investing in the conversion of their irrigation systems.

[27] The average gross annual yield, estimated over the past 10 years, is 5,838 kg/ha, corresponding to approximately 116.8 bags of rice per hectare.

93. Investments costs for irrigation systems vary from US$150/ha for pumping systems to US$800/ha for gravity systems. Irrigation operational costs vary between US$75-80/ha. Those farmers that do not have water pay 20 bags of rice per ha (or approximately US$170/ha, equivalent to US$0.011/m³). This indicates that cost recovery mechanisms currently in place for irrigation do offer a full range of incentives necessary to significantly improve the efficiency of irrigation water use.

94. Beef cattle raising and the dairy sector are important activities that together correspond to a significant part of the overall consumptive use[28] of water. One of the most important issues relates to the waste that is generated, mostly by the dairy sector, which in general is poorly managed and contributes to environmental degradation (specifically, the contamination of water supplies). The PRENADER project has pioneered efforts to curb this problem by providing financing for the construction of specially-designed septic chambers aimed at trapping solids and cleaning up effluents generated in dairy farms. The success of the program has spun off similar efforts by other agencies, but the magnitude of the problem and the limited amount of resources available have resulted in a large unsatisfied demand. The development of a consistent strategy to expanding this pilot program to other areas of the country can bring about significant benefits by improving and protecting the quality of water supplies.

95. Similarly, despite sustained growth in the amount of infrastructure available to provide good quality water to livestock, such as the number of wells and reservoirs available on farms (Table 3), there is still unsatisfied demand. Most of the recent growth in the number of wells was destined to irrigation purposes, whereas reservoirs were mostly built to support irrigated agriculture in crop-pasture rotations. The continued need for this type of infrastructure as an essential element in sustainable (as well as environmentally- and technically-improved livestock production systems) was demonstrated by the number of wells demanded under the PRENADER Emergency Program of 1998. In response to the 1998 drought, the emergency program was set up to finance wells to provide water for cattle in small dairy and medium-sized livestock production units. Throughout 1998, the program financed approximately 700 wells at a cost of US$2.4 million.

Table 13: Water-related infrastructure available for agricultural production

Type of infrastructure	1980	1990	2000
Reservoirs/Small dams	49,452	56,683	80,528
Wells	n.a.	50,493	59,383
Windmills	19,681	21,348	17,643
Water tanks	8,000	8,704	9,717

[28] A cow drinks between 60 and 80 liters of water per day. In the dairy sector, an additional 5 to 10 liters per head are used in the production system. Estimates presented by farmers indicate that in the dairy sector each cow generates between 15-20 liters per day of liquid effluents.

Primary Irrigation Areas

96. The main irrigation areas in Uruguay are the eastern, northern and southern regions. Variations among regions reflect different natural resource availability (mainly soils and water), enterprise combination by farmers, and existing infrastructure.

Table 14: Irrigated area by main regions and crops (ha)

Region	Crop			Total
	Rice	Horticulture & fruits	Other	
East	140,000	-	2,300	142,300
North	60,000	4,400	3,000	67,400
South	-	19,600	1,500	21,100
West	3,500	3,000	5,000	11,500
Center	3,500	-	1,200	4,700
Total	207,000	27,000	13,000	247,000

97. The Eastern Region comprises part of the Departments of Cerro Largo, Treinta y Tres, Rocha and Lavalleja, covering almost 12 percent of the territory. It is the country's most important irrigated area, and rice is the major irrigated crop, currently planted on 140,000 ha. There are enough areas of suitable soils for cultivating rice that could allow for a significant expansion of the cropped area. Based on a rotation of two years of rice with four years of pasture, more than 30,000 ha should be available for rice area expansion.

98. There has been no irrigation development in crops other than rice in the region, mainly because soils are not suitable and farmers have not been interested in diversifying. The few exceptions are several irrigation experiences with corn, soybeans and cultivated pastures, taking advantage of the infrastructure for irrigating rice crops. However, because of control strategies for several aggressive weed species (e.g., red rice and *capin*), it is likely that the corn and sorghum area will increase in the coming years.

99. The two main constraints that limit the expansion of the rice area are: (a) the lack of water available at a short distance that would permit irrigation development at reasonably low costs; and (b) land owners' lack of interest in growing rice by themselves or renting land to sharecroppers in areas where water availability is not a limiting factor, (especially when the rice:beef cattle price relationship is unfavorable to the crop). Improved water and soil management practices would also allow greater irrigation water efficiency, which in turn would make more water available for further development of irrigated agriculture. Cultivated pasture irrigation areas could also be increased, taking into account that the rotation systems recommended include two years of rice followed by four years of planted pastures.

100. The Northern Region includes part of the Departments of Artigas, Salto, Tacuarembó and Rivera and covers almost 25% of the territory. The availability of

natural resources in the region indicates a good potential for the expansion of irrigated land. Fallow soils free of aggressive weeds and adequate conditions for the construction of small- and medium-scale dams make the region attractive for irrigation, not only of rice but also of corn and sorghum/pasture rotations. The current area planted with rice is around 60,000 ha. Because of current international rice market constraints, the planted area has decreased; existing irrigation infrastructure is under-utilized and production diversification would be an option for maintaining farm incomes. This constitutes an opportunity for irrigation development of other crops such as corn and sorghum, that can be used for animal feed in intensive beef cattle production systems that include pasture grazing and grain supplementation.

101. The development of citrus and horticultural crop irrigation will continue, with the process of incorporating irrigation mainly on farms already under production and rarely through the establishment of new farms. There are enough natural resources available for a significant increase in the irrigated area of citrus and horticultural crops, but market constraints, lack of adequate infrastructure for production and commerce, farmers' lack of information and inadequate production structure (farm size and tenure) conspire against the potential for developing new, intensively- irrigated farming areas.

102. Citrus production takes place on sandy soils in the Departments of Salto and Paysandú, in the Uruguay River basin. The area of citrus under irrigation has increased over the past ten years to nearly 4,500 ha net (6,000 ha gross area). External market demand for high quality fruit caused farmers to invest in irrigation systems. New irrigation investment projects are generally individual projects. Drip and micro-sprinkler methods are widely used. Wells in area of the Salto aquifer and small dams are the most common water sources.

103. While the area dedicated to sugar cane has fallen from nearly 10,000 ha to fewer than 3,000 ha over the past decade, because of regional market integration agreements that made the sector lose competitiveness, the area destined for horticultural crops is steady. Horticultural crops for early markets are mainly cultivated in the north-west of this Region (in Salto and Bella Unión). Irrigation is based on privately-owned wells and water conveyance and application systems, and drip irrigation is replacing the common furrow method. The main source of water is the Salto aquifer.

104. The Southern Region, which includes the Departments of Colonia, San José, Canelones and Montevideo, has the country's best soils and has been used for many years for grain, horticultural and deciduous fruit production. Deciduous fruits and horticultural crops are the main irrigated products. Fruit production takes place mostly on small farms (there are more than 1,600 farms with an average area each of 5 ha of deciduous fruit).

105. As a result of farmers' interest in improving the quality and increasing the output and productivity of marketable products to achieve lower unit production costs, improve competitiveness in domestic markets and expand export possibilities, the proportion of the total deciduous fruit area under irrigation has increased significantly in the past decade, from 11 to 30 percent; over the same period, the irrigated horticultural area has expanded from 14 to 55 percent of the total cultivated area.

106. Groundwater is the major water source (more than 50 percent of the irrigated area). The remaining area is irrigated from small streams and reservoirs. Water shortage and reduced farm investment capacity are the principal constraints for irrigation development. Groundwater reserves to sustain a significant increase in irrigation are restricted to the *Raigón* and *Cretácico* aquifers. However, the latter has some localized salinity problems. There is increasing competition for water extraction among farmers in some localized aquifers and there are risks of over-exploitation. Costs for developing wells from other aquifers in the area are quite restrictive. Therefore, it seems that irrigation development could be more efficiently sustained by collective irrigation systems using water reservoirs and conveyance and delivery facilities.

Environment and Irrigation

107. The impact of irrigation on the environment is related to drainage, salinization, soil degradation, erosion, agro-chemical contamination and competition over water for other uses.

108. The excess water frequently occurring during the irrigation season makes it necessary to take detailed drainage design into consideration in irrigation projects. It is common to see that inadequate drainage systems, mainly at a regional scale, cause flooding of agricultural lands and roads. Poor water management on farms is a consequence of unsound land systemization and irrigation design.

109. There are no significant effects of irrigation on water resources and soil salinization. Given its saline and sodium contents, groundwater is generally classified as suitable for irrigation, with medium to low risk of soil salinization and alkalinization. The use of water with some saline content does not constitute a constraint for irrigation development because rainfall (more than 1,000 mm/year) leaches salts to soil horizons where there are no root activities. Problems might be serious in the case of greenhouses (where rainfall, obviously, does not occur) if water used is only marginally suitable and adequate management techniques are not adopted.

110. Efficient irrigation development requires the use of sound soil and crop management techniques. New irrigation projects must include a soil and water management plan but, although PRENADER has done it, enforcement of this requirement is otherwise difficult when no public financing is involved for project implementation. PRENADER has financed irrigation projects for small farmers who mainly grow horticultural crops, and in some cases they have reduced their cropped area just so that they can irrigate. Thus, it has had a positive impact on land management by reducing crop area, leaving the soils that are more eroded or susceptible to erosion for pastures.

111. Irrigation development tends to increase the use of agro-chemicals because of the need to achieve high yields to justify the investments made. In the case of rice, the main irrigated crop in Uruguay, the use of agro-chemicals (such as pesticides) is quite low. The exceptions are herbicides, which are widely utilized.

112. The main results from a study on the issue indicate that no significant chemical concentrations affecting the environment can be found. However, some values found in streams that receive effluents from rice fields, although below critical level, constitute a warning that some farmers are possibly not applying agro-chemicals correctly. Additionally, work has been carried out to evaluate pesticide contamination in certain aquifers (Arroyo Sacra, Raigón and Salto). Although no chemical contamination has been found, data is still insufficient and further studies must be conducted to prevent the possible alteration of aquifer and other water supplies.

113. Irrigation development has not given rise to inter-sectoral conflicts except during the intense droughts that occurred twice over the past twelve years. Average water runoff is over 300 mm per ha , which implies that with adequate control flow structures enough water would be available for all purposes. However, it is not possible to regulate all runoff produced within the country except by means of large dams which are not always physically and economically feasible.

114. In the case of groundwater, competition is more complex and better knowledge of the dynamics and management of water sources would reduce future conflicts. Moreover, a better institutional and legal framework would operate positively to encourage better groundwater use and conservation.

LAND USE PATTERNS AND THEIR ENVIRONMENTAL EFFECTS

Biodiversity

115. Livestock production (primarily cattle and sheep) has been the main pillar of the rural economy for several hundred years. From the beginning, livestock production was based on the use of natural pastures, at first extensive but gradually with increasing intensity, including enclosure with fencing in the 19th century and significant attempts to improve its grazing capacity in the latter half of the 20th century with investments in fertilizer, exotic pasture species, drinking water storage and electric fencing. The original savanna ecosystem with associated forests (a product of rich soils and a temperate climate) has thus been heavily altered and, with it, the natural features of the landscape have changed substantially.

116. This alteration has had effects at two levels:

- Localized effects, which include a change in the composition of species (primarily grasses) both from the invasion of exotic species (such as introduced grasses) and from the selective effects of grazing (which favors certain species over others, and thus alters the natural competitive forces). In addition, grazing causes soil compaction which also distorts the ecological forces present before widespread grazing.

- Ecological effects, which are larger-scale changes resulting from the alteration (due to range management practices) of flooding patterns, fire cycles, and natural succession cycles, which in turn create a savanna ecosystem different from its original natural condition, with the consequent change in species composition and dominance patterns.

117. Another major alteration of natural habitats (directly or indirectly associated with range management practices) has been the heavy loss of native forests, with the consequent loss of biodiversity habitats, biological corridors, and ecosystem services. Fortunately, both main habitat types (savanna and native forests) are fairly resilient and, unlike many tropical habitats, they can be the subject of restoration efforts that can be cost-effective and feasible in time.

118. Erosion has also altered natural habitats. Some 30 percent of all agricultural land has suffered from some form of erosion. Nevertheless, soil erosion seems to strongly depend on the appearance of periodic heavy rain episodes (associated with *El Niño* Southern Oscillation events), with the resulting damage being heavily correlated with the type of land use present, which is minimal under permanent forest.

119. Wetland loss and degradation has also occurred to a substantial degree because of a variety of factors, including the early expansion of rice cultivation which both replaced the habitats and degraded them through the application of fertilizers and pesticides. This effect has been particularly important in the east (*Bañados del Este*).

120. Finally, invasion by exotic species (both animals and plants) has also caused significant impacts. For example, since the 1960s the growth of the livestock sector has been based in part on the improvement of natural pastures *via* the introduction of improved grasses and legumes and the use of fertilizers, with the consequent ecological impacts already discussed. Fortunately, from a biodiversity perspective, of the 16 million ha that are appropriate for livestock and agriculture, 91 percent is still under natural pastures.

Green-House Gases and Carbon Sequestration[29]

121. Research has shown that a reduction in atmospheric carbon dioxide content can be achieved by large-scale applications of certain land use practices, including: reduced tillage, use of legume-enriched pastures (e.g., with clover, alfalfa) in rotation with annual crops, improved strategies to enhance fertilizer use, increased efficiency in the use of animal feed and the return of animal wastes, and the establishment of forests and grasslands in former croplands and degraded soils. Increasing the sequestered carbon content of soils provides benefits to farmers in terms of an improvement in fertility, water-holding capacity and structure of soils, as well as a reduction in erosion.

[29] Carbon fixed by plants can remain in the form of wood for several years, and/or return to the soil as plant residues increasing the organic matter content of the soil.

122. There are clear opportunities to accelerate soil recovery rates through the adoption of integrated management practices, including the use of no-till agriculture and the inclusion of productive pastures. However, a more serious problem is presented by methane (CH_4) and nitrous oxide (N_2O), two significant green-house gases with high global warming potential (21 times and 310 times, respectively, the warming potential of CO_2). These gases are generated in significant amounts, mostly from livestock production but also by other farming practices, and, consequently, significant improvements in animal and land husbandry would have to be extended to the majority of the rural area to make Uruguay a significant contributor in combating global warming. Since the high rates of emission of both gases are the result of inefficiencies in the production system, a reduction would lead to better financial results for the farmers (higher nitrogen-use efficiency, and more efficient conversion of animal feed).

123. Uruguay offers the potential for increased carbon sequestration through increased establishment of forest as well as land use changes (mainly improved pastures and no-till agriculture). Recent research conducted in Uruguay has reached two important conclusions regarding global warming. First, methane is the most important emitted green-house gas, because of the large ruminant population in Uruguay (more than 10 million head of cattle). Second, there is a huge potential to mitigate the green-house gas effect; studies indicate that the amounts of carbon being sequestered in the forestry sector and through land use changes are greater than the equivalent emissions from the energy generating and industrial sectors of Uruguay. Improving the natural pastures with introduced species and fertilizer application results in animal diets of higher quality, providing the potential for more efficient livestock production systems, including increased weaning rates and lower age at slaughter. These improvements contribute to a lower level of methane emission per unit of output.

THE INSTITUTIONAL AND LEGAL FRAMEWORKS FOR NATURAL RESOURCE MANAGEMENT AND CONSERVATION

124. Since 1935, when a law on fauna protection and hunting was introduced, Uruguay has developed a comprehensive regulatory and legal framework related to land and natural resources management. The obligation to protect the environment as a national asset is included in the Constitution, and a full *corpus* of laws dealing with natural resources has been developed[30]. In addition, Uruguay is a signatory of several international agreements concerning the environment[31].

125. The existing legal framework encompasses all aspects of natural resources management, but there is a need to address some weaknesses which stem from the

[30] Including water use and water management (Law 14.859 of 1978), water and soil conservation (Law 15.239 of 1990), irrigation (Law 16.858 of 1997), protection of the environment (Law 16.170 of 1990 and Law 16.466 of 1994), and rural properties (Law 16.233 of 1991).

[31] Including the Convention on Biological Diversity (CBD), the Convention to Combat Desertification (CCD), the Convention on Wetlands of International Importance (Ramsar), and the UN Framework Convention on Climate Change (UNFCCC).

overlap of certain regulations; for example, soil and water conservation issues are dealt with from different perspectives in at least three laws, and there is a lack of consistency among different legal texts. There is also an overlap of responsibilities among institutions, the most striking case being that of water resources management in which four ministries are involved. One option being explored by the government would address these weaknesses through a process of decentralized responsibilities and local implementation, with customized regulations to fit local physical and socio-economic circumstances.

126. Since the creation of the Ministry of the Environment (*Ministerio de Vivienda, Ordenamiento Territorial y Medio Ambiente*, MVOTMA) in 1990, environmental issues have been given both institutional and political importance. MVOTMA is responsible for implementing national environmental policy, and it assigned general roles for environmental protection to its executing unit, the *Dirección Nacional de Medio Ambiente* (DINAMA).

127. Experience of more than decade has shown that the creation of MVOTMA has not been sufficient for the achievement of the proper management of natural resources, and that the environmental roles of different institutions remain scattered and overlapping. There is a conflictive relationship between MVOTMA and other agencies, especially with MGAP. In effect, MGAP has certain functions considered by MVOTMA as critical for environmental management, such as the protection of flora and fauna, irrigation for agricultural purposes, forestry and soil conservation.

128. In water management, the *Ministerio de Transporte y Obras Públicas* (MTOP), MGAP, OSE, municipal *Intendencias* and MVOTMA all overlap. In an attempt to rationalize this, MVOTMA formed the Technical Advisory Commission for Environmental Protection (COTAMA) as a consultation and advisory agency, with delegates from both the public and the private sector.

129. Experience has also shown that, in addition to the normal problems faced by the introduction of new legislation and its regulation, there has been uneven success in the use of different types of instruments available for natural resource management. Here the distinction is drawn between instruments with direct state intervention in their application (e.g., authorizations, permits and prohibitions) and those based on indirect interventions (e.g., credit, taxes and exemptions) or on the provision of information.

130. The former predominate, basically in the form of permits and prohibitions associated with controls by the state and sanctions (fines) for offenders. These instruments have proved difficult to implement, and control has been both costly to implement and easy to evade. Indirect interventions have included tax exemptions granted for native forest conservation, which have been applied successfully, and the imposition of conditions by BROU for granting credit for crops that had relative success in the 1980s but currently lack much importance. Several information instruments are available, including public hearings (for example, as a prerequisite for the authorization of hydraulic works) or Irrigation Advisory Boards (concerning the regulation of water use for irrigation), but these have had limited use.

131. The legal basis for water resources management is established in the Water Code of 1978. There are certain gaps, in terms of inadequate or missing regulations, and conflicts with other laws dealing with the environment and natural resources. Different regulations are not harmonized, and fragmented management exacerbated by institutional disputes frequently leads to deficient implementation. A systematic and comprehensive review of the legal framework is necessary to prepare a modernization agenda for water resources management. The Water Code does not represent a comprehensive legal base of regulations for the management and use of water, and focuses primarily on the issue of water ownership. Complementary, specific and more detailed regulation (e.g., for irrigation) exists. The legal base of the Water Code and other legislation constitutes an adequate legal framework for water resource management.

132. The *Dirección Nacional de Hidrografía* (DNH)[32] is responsible for water resources management. It has a long history of service and a relatively small group of qualified staff, but in recent years it has been plagued by a shortage of funds (especially in its operational budget) and of staff. The role of DNH as the main agency in water resources management is clear, but fragmented management and conflicting institutional disputes within the government and between water users' sectors is a major challenge for improving water resources management. There is only a limited exchange of information among relevant agencies, and collaboration is insufficient.

133. The lack of clarity in the roles of agencies is exacerbated by the lack of a national strategy and policy framework for water resources management. As a result, the water policy and institutional gaps conspire against the modernization of water resources management in Uruguay, and the development of a reform agenda would require a comprehensive review and the implementation of revisions to both institutional and legal frameworks.

134. Water quantity and quality were integrated into the Water Code (of 1978) but they are dealt with by two Ministries, with very little sharing of information between the institutions. The development of a coherent strategy for water quality management is overdue, and is one of the most pressing needs in the preparation of the water management strategy.

135. The use of ground water in Uruguay is limited, representing less than 4% of the country's total water supply. Despite its current limited use of them, Uruguay has some important aquifers (e.g., Guaraní) which need to be properly managed and protected.

Standards of Water Use for Agricultural Purposes

136. The Irrigation Law of 1997 filled a legal void left by the Water Code, and is implemented *via* a regulation that involves three ministries. This is unwieldy but, given

[32] The DNH has three major mandates: (a) the administration, operation and maintenance (A,O&M) of public infrastructure; (b) the maintenance and operation of the hydrologic network and information system; and (c) the issuance of water rights (which started in 1980).

the difficulties in passing new legislation in Uruguay, it would be preferable to work within this law by improving the regulation to foster improved coordination among responsible agencies. The Water Code was greatly improved in 1980 but further revisions are necessary, mainly with respect to water allocation to non-agricultural uses. The Water Code needs a regulation, and there is also a need for the establishment of norms related to irrigation techniques.

Soil Management and Conservation

137. Soil conservation is directly related to land use, cultivation practices and water management. The MGAP is the main institution involved (through the preparation and issuance of technical norms). As in the case of water resources, the legal framework lacks management focus. The Water and Soil Conservation Law provides most of the necessary instruments to achieve its objectives but could be improved through improvements to the regulation. As an example of the need for change, a soil and water management plan is not currently required when proposing a new dam or reservoir.

138. The regulatory decree concerning soil resources dates from 1990 and must be changed because the institutional structure has changed. An up-date to provide better enforcement and control of the norms is being analyzed; in its current draft form this would be a great improvement, but it could benefit further from input from third parties with experience in modern soil and water management techniques in other regions.

139. The regulation establishes that farmers, whatever their tenure status, should apply agricultural techniques in accordance with established technical standards. The regulation states the technical criteria that should be applied for the purpose of achieving a more rational use of sustainable resources and yields. It also establishes that the DGRNR is responsible for producing, promoting and disseminating among producers the technical standards. These technical standards need to be revised in the light of the new technologies and technical knowledge now available (e.g., minimum tillage and direct drilling), whose application makes it possible to reduce considerably the risks of erosion.

Environmental Management and Conservation

140. With the passage of Law N° 16.466 (concerning Environmental Impact Assessment - EIA), Uruguay complied with provisions of the United Nations Conference on the Environment and Development (CNUMAD, 1992) Rio de Janeiro Declaration, which established that States should adopt the EIA with respect to any proposed activity that may produce a considerable negative effect on the environment. MVOTMA has the role of qualified authority at the national level.

141. Until the approval of Law N° 17.234 (Creation of a National System of Protected Natural Areas), Uruguay lacked a specific standard for the protection of natural areas linked in a national system. The law creates this system, or "instrument to implement national environmental protection policies and plans," made up of areas classified and incorporated at the proposal of MVOTMA, which should also reconsider those areas already declared as protected, based on an inventory to be made by DINAMA. Although

the law designates MVOTMA as coordinator, the administration of the protected areas themselves could be the responsibility of other public or private agencies or individuals. Since this is a "framework" law its scope will depend on its regulation. The law has received sharp criticism from the AEA, the Faculty of Agronomy, MGAP and the productive sectors. The DGRNR is currently collaborating with MVOTMA in the preparation of a regulation.

142. The Environmental Protection Law N° 17.282 gives MVOTMA the principal role in management and coordination with other agencies of issues related to environmental protection. MVOTMA has already assumed some duties assigned to it, such as the integrated coordination of environmental management.

143. The certification and labeling of agricultural products obtained or prepared in accordance with environmentally-adequate standards and processes is an important component of current environmental management. Uruguay lacks its own system of environmental certification and labeling. Uruguay's certifying institutions (LATU and UNIT) apply international standards, usually those generated by the International Standard Organization (ISO). Uruguay ratified the Convention on Biological Diversity (CBD) on May 11, 1993 through Law 16.408. Uruguay also prepared its National Biodiversity Strategy (NBS) and officially approved it on December 29, 1999. It contains the principal recommendations and instruments for the implementation of the CBD, and is the result of a participatory process.

International Commitments

144. The Ramsar Convention[33] was ratified by Uruguay in 1984, and the wetlands of the *Laguna Merín,* an area of 435,000 ha, was included in the list of Wetlands of International Importance. The DGRNR is the administrative authority for the Convention and is responsible for implementing and applying the treaty, acting as the focal point for communications and coordination.

145. The Kyoto Protocol, which contains a series of provisions related to carbon sequestration due to changes in soil use, was endorsed by Law N° 16517 in 1994. The issue is of potential importance to Uruguay, because carbon sequestration resulting from human activities is directly related to changes in soil use and forestry (for example, the use of zero tillage that contributes towards reducing soil erosion and at the same time traps carbon) may be used for the purpose of certified emission reduction.

The Scope for Improvement

146. From the view-point of agricultural production, Uruguay is well endowed with natural resources, although its cultivable soils represent only a relatively small part of its total land area. At the same time, from the view-point of the conservation of natural resources, the Uruguayan Savanna eco-region is one of the few savanna ecosystems in the world and has an importance in terms of global representation that goes beyond its biodiversity measured in terms of species richness. Fortunately, its ecological

[33] Ramsar Convention on Wetlands of International Importance

characteristics and the resilience (and restoration potential) of its ecosystems provide many areas of synergy between productive use and the maintenance of eco-systems and biodiversity.

147. In the past 20-30 years, much has changed in the way producers utilize and manage natural resources. There are encouraging signs that the erosion and degradation of soils, provoked by inappropriate agricultural policy established half a century ago, have been significantly reduced over this period. The available evidence shows that: (a) the reduction in the cropped area; (b) the adoption of soil conservation-oriented cultivation methods (such as minimum and zero tillage) and improved rotations (including planted pastures); and (c) the reduction in the grazing load (resulting from the halving of the national sheep flock) have largely eliminated the cultivation of the marginal and vulnerable soils and have contributed to reduce erosion significantly on both crop land and pastures. However, many aspects of current, new production systems that have been introduced present their own environmental challenges that need to be addressed in a context of sustainable development.

148. Significant changes have also taken place in the way producers utilize and manage water resources in Uruguay. Reduced crop pressure on land and livestock pressure on natural pastures has been accompanied by the expansion of irrigated agriculture. In addition to the role of irrigation in ameliorating the effects of two serious and long-lasting droughts during the past fourteen years, the impact that supplementary irrigation has under average climatic conditions is rapidly becoming appreciated by a large number of farmers. As pressure grows on available water resources, the concomitant need for: (a) an improved institutional and regulatory framework; and (b) an integrated strategy for water resource management will be of increasing importance. Improved efficiency of water use will require a broad range of initiatives, from the proper management of livestock-related effluents through investment in irrigation technology and improved water quality, to the establishment of water markets.

149. In tandem with an agricultural use of natural resources that emphasizes natural products and the general "wholesomeness" of production systems, biodiversity conservation and the maintenance of healthy eco-systems offer additional opportunities for the rural economy. The conservation of biodiversity requires the establishment of a system of protected areas, complemented by a framework of incentives to private land-owners to promote land-use practices that exploit the synergy between conservation and new opportunities for rural income generation. The geographic configuration of protected areas must maintain the mosaic nature of Uruguay's natural habitats and promote the restoration of biological corridors.

150. There is a clear role for the agricultural sector to help reduce the emission of green-house gases by introducing agronomic practices that increase the removal of carbon dioxide from the atmosphere. Uruguay offers the potential for increased carbon sequestration through increased establishment of forest as well as land use changes (mainly improved pastures and no-till agriculture). The carbon sequestration potential of different land use practices needs to be evaluated fully under the specific conditions of Uruguay, which will allow the definition of a strategy to promote carbon sequestration.

151. The serious problems presented by methane and nitrous oxide mean that significant improvements in animal and land husbandry would have to be made over a large part of the rural area to make Uruguay a significant contributor in combating global warming. The high rates of emission of both gases are the result of inefficiencies in the production systems, and a reduction in emissions would lead to better financial results for farmers. Recent research conclusions in Uruguay indicate that methane is the most important emitted green-house gas, because of the large ruminant population and that there is significant potential to mitigate the green-house gas effect; the amounts of carbon being sequestered in the forestry sector and through land use changes are greater than the equivalent emissions from the energy generating and industrial sectors of Uruguay. Improving the natural pastures with introduced species and fertilizer application would result in animal diets of higher quality, providing the potential for more efficient livestock production systems, including increased weaning rates and lower age at slaughter. These improvements contribute to a lower level of methane emission per unit of output.

152. There are several areas where "best practice" can be applied from the international arena in such subjects as: the use of market instruments for environmental protection (including carbon credits, and other measures to reduce the emission of green-house gases); the application of contamination fees in such sub-sectors as dairy production and forest-products processing, which generate important negative externalities; and the application of modernized water rights, with the concomitant use of water use fees and water markets.

153. For agriculture to continue its role of supporting economic development, it must increase its outward orientation, emphasizing diversification (of both production and markets) and an increase in value-added. The increase in agricultural output must come from increased productivity, precisely because the geographical frontier was reached long ago. For long-term sustainability, it is essential that such intensification must not prejudice the natural resource base that supports it.

Matrix 2

Recent Trends and Issues in Main Sub-sectors and Products

Status	Prospects	Limitations	NR Issues
LIVESTOCK PRODUCTION Beef cattle: ▫ Production showed increasing trends throughout the 1990s with respect to productivity, quality and numbers of stock.	▫ Although there is technology available to sustain this trend, as increased productivity at lower unit costs is the only option available to confront decreasing prices in foreign markets, the recurrence of Foot and Mouth Disease was a severe setback for the sub-sector. ▫ Markets must be recovered, the adoption of technology must be accelerated, and more integration must be achieved in the production, processing and marketing chain.	▫ Sanitary status; otherwise, there are no insurmountable limitations. ▫ The low volume of production and international market share require increased integration and marketing skills.	▫ Adequate stocking ratios and herd management are critical to ensure pasture coverage and thus reduce the risk of sol erosion. ▫ Methane emissions may turn into a significant problem. The issue needs further study and analysis.
Dairy: ▫ Production has shown a continued increasing trend for over 15 years, based on the adoption of technology. ▫ It is the most "advanced" livestock production sub-sector because of the amount of technology adopted (and being used).	▫ Good from the point of view of production. Profits are reasonable as well as marketing, although growth is constrained because of limited markets and products. There should be more focus on quality.	▫ A limited range of products and by-products is being sold, and the number of markets is insufficient. Research & development is needed. ▫ There is a need to emphasize quality from production to marketing.	▫ Need to address problems with effluents.
Sheep: ▫ Production of wool declined markedly as wool prices fell dramatically in the 1990s. However, this provoked the need for adoption of improved management techniques, to increase productivity, and focused attention on options such as increased lamb production for export which had been traditionally overlooked.	▫ Good in the short term for those with technology to access the opportunities in lamb production. However, not all producers can adopt the necessary technology.	▫ There is a need to develop technology to overcome sanitary problems that can severely limit production.	▫ Caution should be adopted concerning the use of marginal natural resources (i.e., natural pastures) during upward wool price cycles, when overstocking tends to occur

Status	Prospects	Limitations	NR Issues
CROP PRODUCTION Rice: ▫ The increasing trend seen in area planted and output during the 1990s came to a halt in 1999 because of sharply lower international prices.	▫ Clear role in crop-livestock rotations, contributing to overall financial performance of livestock farms, as well as the establishment of improved pastures. ▫ Prices are low, which is having the effect of driving some share-croppers out of rice growing; share-croppers were a strong driving force behind the growth experienced during the 1990s.	▫ A dependence on livestock production for diversification and growth, utilizing feed grains corn and sorghum) as well as pastures. ▫ Structural, related to the problem of sharecroppers. ▫ Need to refine technology in order to decrease loses and improve the structure of costs of production.	▫ There is a need to control growth of the planted area in marginal areas. This was controlled by PRENADER, but will not be if privately financed. ▫ There is room for growth in output based on modest increases in the planted area and significant increases in yields, mainly related to improved irrigation technologies and water management. ▫ Need to develop technologies to solve environmental problems posed by rice hulls.
Malting Barley: ▫ Production increased in 2000/2001 as a result of better expectations and prospects for marketing and financing of the crop. ▫ Strong vertical integration in the production and processing chain; the processing sector is active in financing production inputs and guaranteeing marketing.	▫ The long term export outlook is good beyond short term market fluctuations. ▫ Important crop for small and medium producers, but the number of producers involved is limited.	▫ The crop is very susceptible to poor weather conditions and phyto-sanitary problems; both uncontrollable. ▫ Not enough competition ▫ Lack of adequate risk management instruments.	▫ Continued development and adoption of zero-tillage technologies and the resulting adjustments to the crop and livestock production system, would translate into increased production efficiency and better environmental sustainability of the production system.
Wheat: ▫ A continued downward trend in planted area resulting from low prices.	▫ The reduced competitiveness of the crop will require a stricter selection of cropped areas, longer rotations and the adoption of technology to achieve lower unit costs, or will limit the area planted only to the most suitable soils.	▫ The lack of an integrated chain of production/ processing has a negative impact on external competitiveness. ▫ The resurgence of certain diseases conspires against achievement of better competitiveness through improved productivity and lower unit production costs. ▫ The lack of adequate risk management instruments.	▫ The development of zero-tillage technologies could contribute to an expanded niche of the crop in diversified production systems.

Status	Prospects	Limitations	NR Issues
Oilseeds: ▫ Sunflower is the most important oilseed crop, with an increasing trend in the planted area resulting from better prices. ▫ Soybeans are staging a comeback, but high production costs and high use of insecticides are a threat to this trend.		▫ Only two companies are involved in the production/marketing chain, and the lack of integration results in marketing constraints. ▫ High production costs in soybeans, and high use of insecticides represent limiting factors to expansion.	▫ The use of transgenic lines that tolerate glyco-phosphate chemical weed control allows soybean producers to use no-till techniques. ▫ Need to develop no till technology for other crops and maximize efficiency of soybeans rotations on soil fertility.
Feed Grains (corn, sorghum) and hay: ▫ There is a slowly increasing trend in production driven by the growing demand from the livestock sector.	▫ Fair if competitiveness is improved, given that these crops aren't produced in enough quantities to supply growing demands from livestock production.	▫ Problems associated to the costs of production, and need to improve production management in order to increase competitiveness.	▫ Need to improve irrigation management. ▫ Irrigation technologies for fodder production must be validated and disseminated
Horticulture and fruit/grape production: ▫ Production systems were updated during the last decade (better varieties, use of irrigation, post-harvest management and crop handling). ▫ Efforts have been concentrated on improving competitiveness in the domestic market, based on quality. ▫ Wine production has increased in volume and improved in quality in the past decade, with the introduction of new varieties and the use of irrigation.	▫ Exports are mostly destined to the regional market and are driven by occasional excess production.	▫ No outward looking orientation. ▫ Requires further improvement of production systems (varieties, irrigation, post-harvest technologies) to sustain increasing competitiveness in foreign markets.	▫ The use of agricultural chemicals needs to be rationalized ▫ Careful monitoring of potential salinization problems in intensive horticulture systems.

Status	Prospects	Limitations	NR Issues
Citrus: ▫ The sector grew steadily during the 1990s, improving both productivity and quality in order to respond to market demands and to remain competitive. ▫ The sector is important in terms of the amount of labor it absorbs, but consolidation came at the expense of the small-and medium-sized producers, whose numbers have been reduced because of their lack of resources to become exporters.	▫ There are good prospects in the main European markets, but decreased windows of opportunity to access other northern-hemisphere markets and increased competition from new exporters and from other types of fruits.	▫ There is an over-reliance on European markets. ▫ Unorganized supply ▫ There is very little product differentiation ▫ There is insufficient know-how to optimize the quality at delivery of products exported.	▫ There is a pressing need to look into issues related to pesticide use.
FORESTRY ▫ Continued grow. ▫ Still a sizeable area of soils unsuitable for agriculture available to develop.	▫ Declining prices and higher volumes of production should lead to greater diversification.	▫ Little product diversification ▫ Further upgrading and development of supporting infrastructure, including roads and port facilities needed.	▫ Effect of forestry development on water tables and aquifers still not fully documented.

CHAPTER IV. MAIN CONCLUSIONS AND RECOMMENDATIONS

OVERALL ECONOMIC DEVELOPMENT PROSPECTS

154. From a macroeconomic perspective, Uruguay's comparative advantage continues to lie in a variety of agricultural and livestock activities for export, as well as in industrial goods closely linked to these sectors. In the early 1990s, these sectors experienced fast growth based on productivity gains that were the result of investment facilitated by the lowering of external tariffs and other barriers.

155. While investment during the 1990s resulted in productivity gains that position these sectors well in export markets, the agricultural sector remains vulnerable both to external shocks (particularly weather-related events and the vicissitudes of foreign markets) and domestic shocks (such as the recent outbreak of foot and mouth disease). In addition, producers incurred high levels of indebtedness to finance investment, and debt service has become burdensome during the recent lean years.

156. The real appreciation of the currency, while facilitating the purchase of imported capital goods, also led to an increase in the relative price of non-traded inputs, in particular labor and transport services, with the consequent negative effect on profitability in the sector's main activities. Nevertheless, it seems that many agro-livestock export activities remained competitive (even before the exchange rate regime became more flexible starting in 2001), since some establishments have succeeded in raising productivity sufficiently to compensate for the deterioration in relative prices facing the sector. The challenge will be to generalize these productivity gains to all producers in order to maintain the country's comparative advantages in these sectors in a sustainable manner. With respect to this, the Bank's assistance has gradually been increased on environmental issues and on the achievement of long-term sustainable production systems, mainly through improved natural resources management.

157. The government must do all in its power to nurture the growth of entrepreneurship in agriculture, agro-industry and export marketing. For agriculture to continue its role of supporting economic development, it must increase even more its outward orientation, paying ever-increasing attention to the demands of world markets and emphasizing diversification based on specialization, quality improvement and processing.

158. Thus, there is a continuing need to improve profitability by improving farm management and absorbing technical knowledge alongside physical investments, but there is also a pressing need to improve efficiency and lower costs in related sectors. At the macro level, perhaps the most important factor to improve the competitiveness of the sector will be the sustained progress in the government's economic reform agenda. Non-traded input costs can be lowered by improving the efficiency of their production through deregulation. Borrowing costs are affected by the efficiency of the banking system. Labor costs – even if not an intensive factor for the primary sector – affect the sector through service costs (e.g., banking and government services) as well as in downstream

processing activities. The legal and administrative structure the structure of water resource and land management both affect the efficiency of production in the sector.

RURAL POVERTY

159. Given the country's high level of urbanization, rural poverty is not as important as urban poverty in Uruguay. The rural poor, particularly those living in small- and medium-sized urban centers, are highly dependent on wage labor for their survival, and creating employment opportunities becomes central to poverty alleviation. The case of Uruguay ratifies once more the importance of sustained economic growth as the key element of any poverty alleviation strategy. Economic growth *per se* is not enough to reduce poverty; it has to be a "pro-poor" growth, providing remunerative employment opportunities and accompanied by improved income distribution.

160. Education and employment are the two factors that have most influence on poverty and, consequently, need special attention in a poverty alleviation strategy. Given the prevailing very high literacy rates and generalized school attendance, even among the rural poor, future efforts should be directed to improve access of the rural poor to secondary and technical education, thus leaving them in a better position to benefit from the employment opportunities created by economic growth.

161. Poverty rates followed closely the evolution of unemployment rates during the 1990s. Given the relative importance of wages as a means of escaping income poverty for the rural poor living in the small- and medium-sized urban centers, increased employment opportunities, particularly in the non-agricultural sector, are central to any program to reduce poverty. However, with the loss of competitiveness of manufacturing industry and the decline of its relative importance in the economy, special incentives would have to be devised in order to encourage private investors to develop new, modern and competitive industries in the interior of the country.

162. For the dispersed rural poor, on the other hand, a two-pronged approach is warranted. The survival strategy of these poor includes both on-farm and off-farm activities. The experience of PRENADER indicates that to enhance the income-generating potential of poor farmers living in areas with poor and deteriorated soils, it is necessary to improve small farmers' ability to manage their natural resources properly. The pilot project in the Santa Lucía watershed provides valuable experience on the means to implement soil and water conservation programs among poor farmers through a participatory approach. There is a good basis, not only from a technical perspective but also from the socio-economic, environmental, and institutional perspectives, for the design and promotion of sustainable production systems among small farmers in other areas of the country[34].

163. The development of off-farm income-generating opportunities should also be an integral part of the strategy to escape poverty for the rural poor in dispersed rural areas. This would involve both the development of small household industries as well as the

[34] See discussion in "*Evaluación del Programa Piloto de Manejo Sostenible de Recursos Naturales en Microcuencas dentro de la Cuenca del Río Santa Lucía*" PRENADER (2000).

search for employment opportunities in the non-agricultural rural sector. Therefore, the government's rural poverty alleviation strategy should complement the actions supported by the IFAD-financed project by promoting the development of employment and the above-described types of industries, for which the two main constraints (the limited or non-existent access to capital, and the lack of technical support) would have to be addressed.

ISSUES AND OPPORTUNITIES IN NATURAL RESOURCE MANAGEMENT

164. In Uruguay, although soil erosion and land degradation are more a potential risk than an actual problem, many aspects of current, new production systems that have been introduced present their own environmental challenges that need to be addressed in a context of sustainable development. In a country where 80 percent of the land is under pastures, soil erosion and degradation are a localized phenomenon that affects mainly the areas around Montevideo and the west and south-west coastal regions of the *Uruguay* river and the *Río de la Plata*. These are the areas where most of the winter crops are still produced under traditional cultural practices and production systems. However, even in these areas the situation has been improving during the last two decades with the introduction of crop-pasture rotations and the adoption of minimum and zero-tillage practices. The latter covers at present over 25 percent of the land under crops. There is a need to sustain the positive trend of the 1990s, during which output, productivity and competitiveness increased and the degradation of natural resources was reduced.

165. Because of the decline in grazing pressure on pastures, there has been a natural regeneration of the grass base of pastures, but its long-term sustainability is in question if the profitability of the livestock sector and, therefore, the farmers' capacity to invest in improved pasture management do not increase. Moreover, even though the current institutional and legal framework does not impose any major constraint to improved soil management, the government should work towards better coordination among the various agencies with responsibilities in the area of soils conservation and management and improve their capacity to enforce existing rules and regulations.

166. In the water sector, Uruguay's potential problems appear to be of a medium- and long-term nature. Water resources are still plentiful and, apart from some problems with the hydro-electrical companies during the severe droughts of the late 1980s and 1990s, there are no major inter-sectoral water demand conflicts. However, stimulated by these long-lasting droughts, farmers are expanding the irrigated area, and beef and dairy producers are increasing their demand for water (for livestock, for pasture and forage production, and for cleaning premises). Water supply is essential to improved pasture management and to increased profitability of the beef sector. The challenge is to mix soft – management interventions (improved institutional coordination and more effective application of the current regulatory reform) with the implementation of infrastructure to meet these increasing demands on a sustainable basis.

167. From a long-term perspective, however, and in preparation for a potential increase in the pressure on available water resources, Uruguay should increase the rate of improvement of the institutional and regulatory framework for water resources

management and take steps to implement an integrated water resources management strategy, taking the watershed as the basic management unit. As the country advances towards the establishment of more robust and modern water resources management systems, it will be better equipped to resolve international disputes and conflicts. To improve the efficiency of water use, steps should be taken not only to increase the level of technology of irrigated agriculture and to improve water quality at the field level but also to establish the base for the appropriate operation of water markets and to establish proper management of effluents in intensive livestock production systems.

168. Over the past 25 years, significant changes in land use and management have occurred in Uruguay, with major impacts on the status of natural resources. These changes have created new opportunities for the rural sector to capture national and global benefits of improved natural resources management (including more cost-efficient use and protection of soil and water resources), biodiversity management and conservation, and potential contribution to an improvement in the balance of greenhouse gases through carbon sequestration.

169. Improved management and conservation of biodiversity could be achieved through a combination of an effective System of Protected Areas and the development of conservation efforts outside these areas. A system of protected areas must be established and strengthened although, unlike other Latin American countries, following a model of incentives for the use of privately-owned land, given the land tenure characteristics of Uruguay.

170. The basis for a successful program for the conservation of biodiversity outside the country's protected areas would be the promotion of land-use practices that exploit the synergies between biodiversity conservation and opportunities for rural income generation. Some of these practices of "integrated ecosystem management" may include a combination of various land uses, whose relative emphases will be determined by the local conditions, the feasibility of implementing an incentive framework, the ability for market-based mechanisms to support these land uses, and their relative contribution to conservation.

171. Among others, some opportunities are given by: the maintenance of scenic beauty for rural tourism and recreation; wildlife ranching (an industry that has grown by 500% in the last five years); integrated savanna ecosystem management (including regeneration of natural grasses and other vegetation); the maintenance and regeneration of natural forests; reduced impact grazing; carbon sequestration; silvo-pastoral systems ; diversification of products; provision of shade; the increased ecological value that such systems provide due to the maintenance of natural habitats and the establishment of biological corridors; and sustainable game hunting (currently generating a US$6 million per year, and attracting hunters from both Europe and the USA). These practices can be associated to the production of ecologically-friendly meat for export, and perhaps rely on the independent certification of advanced ecological standards with the resulting gain in competitive edge in international markets.

172. These possibilities would not implemented in isolation from each other. Even though they may be relatively modest from an economic perspective when analyzed individually, they can become a major alternative to inappropriate land-use practices through income diversification and complementarity to traditional practices. From a biodiversity perspective, the key issue is the promotion of a geographic configuration of protected areas that maintains the mosaic nature of Uruguay's original habitats, restoring biological corridors through a diversified rural landscape. Eventually, and with the growing international trends that are favoring the competitiveness of green markets, biodiversity conservation offers major opportunities for the future well-being of Uruguay's rural economy and for the regeneration and maintenance of healthy ecosystems in the country.

OTHER ISSUES

173. Complementing the opportunities and actions recommended in the previous section for improved natural resources management, Uruguay faces a number of additional issues in the future in the areas of trade, biotechnology and bio-safety that the government should consider as part of a forward-looking agenda.

174. The decade of the 1990s demonstrated that the agricultural sector not only has the resilience to respond to the problems caused by exogenous shocks but also has a capacity to innovate, by adopting technology and diversifying both production and markets. It is axiomatic that the motive forces that will drive agricultural development in the future, and which ultimately will determine to a large degree the development of the rural areas, will be export-market oriented. This is nothing new to Uruguay, which has been a significant net agricultural exporter for most of its history. The role of the government should be to support the private sector in identifying and exploiting the opportunities made available by world markets. It should continue to lobby for the liberalization of international trade in agricultural products and for the continued removal of distortions created by the policies of industrialized countries. It will be important for the government and the agricultural sector to continue the efforts to achieve once more the status of "foot and moth disease-free without vaccination"

175. The adoption of technology in production and processing will be a key determinant of agricultural development. The opportunities presented by biotechnology, and particularly by genetic engineering, must be carefully scrutinized and the undoubted advantages, in terms of productivity enhancement and pest and disease control, must be weighed against the disadvantages in terms of undermining Uruguay's potential as a clean, natural and uncontaminated environment in the eyes of ever-more-discriminating consumers in sophisticated world markets. The use of lifetime tracing systems (*trazabilidad*) in livestock production will soon become an essential requirement for continued access to demanding export markets, particularly in the light of the continuing threat from BSE and fears about genetic engineering, as will the adoption of advanced food safety measures (such as the HACCP system).

176. A number of issues have been raised that are important for the rural sector; although it is beyond the scope of this report to deal with them in depth, it will be

important for the government to carry out the structural and policy reforms concerning the basic services required for the sustainable development of the sector. There are also several areas where "best practice" can be applied from the international arena in such subjects as: the use of market instruments for environmental protection (including carbon credits, and other measures to reduce the emission of green-house gases); the application of contamination fees in such sub-sectors as dairy production and forest-products processing which generate important negative externalities; and the application of modernized water rights, with the concomitant use of water use fees and water markets.

OPPORTUNITIES FOR FUTURE BANK ASSISTANCE IN THE RURAL SECTOR

177. As the report has demonstrated, Uruguay does not face any major critical issues with regards to the management of its natural resources. However, a number of areas have been identified where there is a need to develop mechanisms to sustain the trend developed in the 1990s (improved productivity with minimum natural resource degradation) while addressing the negative impact of the Argentina's financial crisis on Uruguay's agricultural trade. In this context, and based on the experience gained through the implementation of the successful PRENADER project, continued Bank support to the sector would constitute a valuable contribution. Although the areas identified should be reassessed to account for the impact of the deteriorating fiscal situation on the sector, in general terms Bank assistance could be targeted at: (a) the need to implement a gradual shift in focus from investments in irrigation towards a knowledge-intensive phase aimed at improving efficiency, management and sustainability of water resources; (b) the promotion and expansion of more integrated strategies providing assistance for farmers to improve overall competitiveness while adopting environmentally-sound practices (replicating the successful "win-win" experience of the pilot program in the Santa Lucia catchment area); (c) mainstreaming biodiversity considerations within the country's predominant ecosystems; (d) improving the regulatory framework and delivery mechanisms of specific public services to the sector; (e) complementing existing programs for rural poverty alleviation through the identification and promotion of off-farm employment opportunities and the establishment of small-scale processing facilities; and (f) generating the groundwork needed to develop specific medium-term strategies, such as specialized export opportunities (i.e., "green markets"), biotechnology in production and processing, and carbon trading.

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