GREEN GROWTH

TOWARDS A STRATEGY FOR URUGUAY

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This report is one of a series of five products generated within the framework of the Green Growth Technical Assistance in Uruguay, of the World Bank:

- Green Growth: Towards a strategy for Uruguay (*Spanish/English*)
- Market Opportunities for Green Upgrading and Innovation. Sustainability demand analysis for the beef, soy, dairy and tourism industries (*Spanish/English*)
- Water quality modeling and update of the action plan for water quality in the Santa Lucia River basin (*Spanish*)
- Natural capital accounts of Uruguay: an initial approach and considerations for institutionalization (*Spanish*)
- Policy instruments for the control of water pollution and GHG emission from agriculture diffuse sources. Review of international experiences and guidelines for their design for nutrient control in the Santa Lucia River basin (Uruguay) (*Spanish*)

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Environment and Natural Resources Global Practice, World Bank

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Acronyms

ANII	National Agency of Research and Innovation
APEJ	Asian-Pacific excluding Japan
BCU	Banco Central del Uruguay
CAGR	Compound Annual Growth Rate
DACC	Development and Adaptation to Climate Change (World Bank Project)
DINAGUA	National Water Directorate
DINAMA	National Directorate of the Environment
DNE	National Directorate of Energy
EU	European Union
FAO	Food & Agriculture Organization of the United Nations
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GHG	Greenhouse Gases
GM	Genetically Modified
GSTC	Global Sustainable Tourism Council
IDB	Inter-American Development Bank
IMEBA	Tax on the Transfer of Agricultural Goods
INAC	National Meat Institute
INIA	National Institute of Agricultural Research
INUMET	Uruguayan Institute of Meteorology

IRAE	Income Tax on Economics Activities
JICA	Japan International Cooperation Agency
MEF	Ministry of Economics and Finance
MGAP	Ministry of Livestock, Agriculture and Fisheries
MIEM	Ministry of Industry, Energy and Mining
MTOP	Ministry of Transport and Public Works
MVOTMA	Ministry of Housing, Land Use Planning and Environment
NDC	Nationally Determined Contributions
Non-GM	Non-genetically modified organisms
OECD	Organization for Economic Co-operation and Development
OPP	Office of Planning and Budget
OSE	National Water Supply and Sanitation Company
REDD+	Reducing Emissions from Deforestation and forest Degradation, plus the sustainable management of forests, and the conservation and enhancement of forest carbon stocks
SNAACC	National Secretariat of Environment, Water and Climate Change
SNIA	National System for Agricultural Information
SNIG	National System of Cattle Information
STI	Sustainable Travel International
UdelaR	University of the Republic
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
URSEA	Regulatory Unit of Water and Energy Services
US	United States of America
VAT	Valued Added Tax

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Executive Summary

Green growth aims to reconcile economic growth and environmental sustainability. Although there are many definitions of green growth, one aspect that is common to all the revised definitions is the possibility of generating new opportunities for growth and inclusion, as well as avoiding the costs of environmental degradation and the irreversible loss of options for future development. Economic growth and environmental sustainability can be perceived as conflicting objectives but this is misleading. A green growth approach to development reconciles these policy objectives by enabling the country to harness its natural capital for growth and by using growth as an incentive to nurture their natural asset base. Green growth is about marrying environmental objectives with productivity objectives, job creation, technology adoption, and higher value added. The transmission channels between *green* and *growth* will, however, vary from one country to the other.

This report provides a roadmap to boost green growth in Uruguay. The purpose of the proposed roadmap is to promote growth and, at the same time, preserve the asset base on which such growth depends. It is based on the findings of a technical assistance financed by the World Bank that took place between August 2016 and March 2018, as well as Uruguay's experience in environmental sustainability policies, the collection of international evidence, with an example of countries like Colombia and Korea, and the World Bank's experience with Uruguay during the last decade. This report is fed and complemented by four other reports, each focused on one of the four key lines of work developed under the technical assistance: (i) Market opportunities for green upgrading and innovation; (ii) Water quality modeling and updating of the action plan for water quality in the Santa Lucia River basin; (iii) Natural capital accounts for Uruguay: an initial approach and considerations for institutionalization; (iv) Policy instruments to control water pollution and the emission of greenhouse gases (GHG) from diffuse sources of agriculture.

This report proposes an operational definition for Uruguay. Natural capital plays a key role in

promoting the country's export-oriented growth model. Uruguay has already engaged in a sustainable growth trajectory for key economic sectors (such as agriculture, tourism, forest management, energy), but needs to define a green growth strategy to tackle emerging environmental challenges. In that sense, green growth can be seen as *a strategic framework and a set of tools to take advantage of natural capital and avoid environmental irreversibilities to sustain inclusive growth*. The technical assistance served as a space to identify information tools and policy options to comprehensively harmonize the objectives of growth and environmental sustainability.

Uruguay is not new to green growth. During the last decade, the country developed the concept of sustainable intensification in agriculture and is implementing an innovative policy of soil protection by enforcing mandatory management plans for the preservation of soils and waters with agricultural purposes and the recovery of eroded soils. Uruguay implemented a monitoring system for phytosanitary products, and also has a traceability program in the production of beef and other agricultural products. The country also developed an irrigation strategy and its corresponding action plan that aims to promote the development of a climate-smart agricultural sector. These examples testify not only to Uruguay's efforts to promote environmental sustainability but also to the need to stimulate economic growth.

However, going forward, the country will be called to tackle some challenges, for which a green growth lens may be important. Soil erosion, phosphorus and nitrogen pollution, pesticide management, and greenhouse gas emissions represent some of the recurring themes in the country's decision-making process. The management of water quality represents a particularly important challenge. In spite of the abundance in the annual average precipitation, Uruguay suffers naturally from an extreme variability of water resources availability throughout the year. This affects not only the production but also the availability of drinking water for human consumption. In the future, the country's ambition to increase its agricultural production along with its small geographical size will require greater efforts in sustainable intensification. A green growth approach allows addressing this type of challenges through a system of data collection, information analysis and decision making that integrates various sectors and seeks to prioritize actions that have tangible short-term benefits and avoid high remediation costs in the future.

In addition to addressing some of these challenges, green growth would also help promote Uruguay's competitiveness in global value chains that offer higher markups for more sustainable products. Focusing on a selected number of value chains, the technical assistance found that there are important growth prospects and attractive price margins in the niches of sustainable beef, non-genetically modified (non-GM) soy, organic milk powder and adventure tourism. In general, the analysis showed that there is strong global demand for the green products analyzed, which is expected to grow between 6 percent (sustainable meat) and 40 percent (adventure tourism) per year over the next five years. It is expected that this demand brings along higher margins compared to conventional products. Greener products can help diversify exports towards niches of higher added value, while favoring investments in capacities and promoting the adoption of new technologies and practices, and contributing to the improvement of the management of the natural resource base of growth sectors.

By factoring in Uruguay's current growth trajectory, this report translates Uruguay's strategic goals into a five-step actionable roadmap to promote green growth. A first step is to identify the possible ways in which green growth policies can boost Uruguay's growth, e.g.

by contributing to more efficient use of natural resources, or by serving as an economic stimulus and create employment.

As a second step, recognize that green growth policies do have environmental benefits, identify the timing and geographic scale of such benefits, and identify the risks of irreversibilities that they can help avert. The water quality modeling tool piloted during the technical assistance represents a highly valuable information tool to evaluate environmental performance of different policy measures and development scenarios in the Santa Lucia River watershed. A third step is to define criteria to prioritize possible green growth policies. As an example, priorities can be set across two dimensions: (i) synergies between different types of benefits (e.g. local / short term); (ii) urgency of action. With priorities set, a fourth step consists of defining the policy instruments that could help achieve environmental objectives while promoting sustained growth and social welfare. The technical assistance identified a number of untapped opportunities for designing economic incentives to control non-point source pollution in agriculture. Finally, a green growth strategy should establish the mechanism for evaluating and adjusting green growth policies.

Continuing along the green growth path will require institutions and political leadership. In this sense, the creation of the National Environmental System, with the National Secretariat of Environment, Water and Climate Change (SNAACC) and the National Cabinet of Environment, along with the long-lasting efforts of key line ministries such as the Ministry of Livestock, Agriculture and Fisheries (MGAP) and the Ministry in charge of the environment (MVOTMA), have been critical milestones in Uruguay's efforts towards sustainable development. As a national green growth strategy takes form, anchoring the vision to a solid institutional framework will be key for the very sustainability of this vision.

Chapter 1

Introduction

Objective and structure of this report

Based on the insights of a World Bank-financed green growth technical assistance, this report provides the elements of a roadmap for implementing green growth in Uruguay. It sets forth the key building blocks and principles to develop a strategy that combines the objectives of sustaining the growth already underway in Uruguay with environmental sustainability that will maintain the asset base on which that growth depends. As the report shows, green growth is of utmost relevance to Uruguay, since the country's successful growth model is rooted in the country's rich asset base. In this context, environmental – or green – policies need not exist exclusively to protect the environment: they can in fact be a driving force for growth and development. The report builds on the findings of the deliverables produced through the technical assistance that was carried out between August 2016 and March 2018; Uruguay's experience on sustainability; international knowledge; and the World Bank's involvement on these topics over the last decade.

The report is structured in three sections, each one answering a key question:

(a) **What** is green growth and what could it potentially mean for Uruguay? Previous experiences have demonstrated that green growth is not defined in the same way by countries as there is no all-encompassing outright definition. Here, a definition of green growth is suggested for Uruguay building on its existing initiatives.

(b) **Why** is green growth relevant for Uruguay? Uruguay has set ambitious goals, which will put more stress on its natural base, for the coming years. At the same time, this technical assistance envisages several opportunities that Uruguay could exploit. This report marries challenges to these potential opportunities.

(c) **How** could Uruguay move forward on implementing green growth? There is not a single recipe for green growth; instead, by factoring in Uruguay's current growth trajectory, this re-

port translates Uruguay's strategic goals into an actionable roadmap.

The green growth technical assistance in a nutshell

Before proceeding, it is useful to provide an overview of the technical assistance efforts provided over the past 20 months. The technical assistance was a joint effort between the World Bank and the Government of Uruguay to identify programs, policies and institutional arrangements to support the country's growth model while promoting the sustainable and efficient use of environmental services and natural resources.

The technical assistance output is composed of five reports, including this document. To achieve the technical assistance's goal, four lines of work were developed to create knowledge, build counterpart capacity, and develop policy dialogue. The outputs of each line of work are summarized here:

- **Market Opportunities for Green Upgrading and Innovation:** by conducting a demand analysis of green international market trends and prices, this line of work identified the low-hanging-fruit for green upgrading in key international value chains. The work focused on beef, dairy, soy and tourism industries.
- **Water Quality Modelling and Updating of the Action Plan for Water Quality in the Santa Lucia River Basin:** this line of work aimed at strengthening local capacities and generating a water quality management tool to support decision-making processes, and at elaborating a roadmap to improve measures for water pollution control. The technical assistance focused on a critical pollution hotspot and important water supply source: the Santa Lucia River watershed. Lessons from this effort can be scaled up to other parts of the country.
- **Natural Capital Accounts for Uruguay: An Initial Approach and Considerations for Institutionalization:** this line of work aimed at strengthening local capacities and generating a tool to enable decision-makers to account for nature's role in the economy and human well-being by integrating monetary variables of national accounts with physical variables of capital accounts natural. Focus was given to the agricultural and forestry sector at the national level and on the quantity and quality of water for the Santa Lucia River basin.
- **Policy Instruments to Control Water Pollution and Green House Gas (GHG) Emissions from Diffuse Sources of Agricultural Activity:** This line of work aimed at generating knowledge about economic instruments to mitigate pollution, in line with other initiatives that analyze this type of instruments that have been developed in the country. Economic instruments have the advantage, compared to other policy instruments such as command-and-control regulations, of promoting efficiency. Focusing on a special type of problem, non-point source pollution[1] in agriculture, the work reviewed the international experience on the application of economic instruments, brought together experts and analyzed options for policy design in Uruguay.

The technical assistance benefitted from a highly collaborative effort between Uruguayan partners and the World Bank. This effort builds on several prior initiatives (Box 1). The Uruguayan partners involved included representatives from the National Secretary of Environment, Water and Climate Change (SNAACC), the Ministry of Economics and Finance (MEF), the Ministry of Livestock, Agriculture and Fisheries (MGAP), the Ministry of Housing, Territorial Planning and the Environment (MVOTMA), and the Office of Planning and Budget (OPP). The project also counted with the collaboration of the

1 In this document, diffuse and non-point sources are used interchangeably.

Box 1. Recent technical assistance support by the World Bank.

The green growth technical assistance builds on a strong set of analytic efforts that took place in recent years. These include, among others, the programmatic approach "Water for Uruguay" and the technical assistance "Low emissions growth options for Uruguay".

Water for Uruguay aimed at informing Government's formulation and design of future policies and investments programs in the rural and urban water use and management domains. It built cross-sectorial intervention in water related sectors on climate change resilience and integrated water resources management and development. The agencies involved included MGAP, DINAMA and DINAGUA of MVOTMA, OSE, the Regulatory Unit of Water and Energy Services (URSEA), and the Uruguayan Institute of Meteorology (INUMET). Cross-linkages between these agencies where created through the implementation of activities, including: the development of an irrigation strategy and the revision support of an irrigation bill to promote Climate-Smart Water Agriculture Management; the development of a dam-safety legal framework; the promotion of industrial pollution control; the piloting of an Integrated Urban Water Management methodology; and the strengthening of institutional capacity to support low emissions growth options.

The objective of the technical assistance on *Low emissions growth options for Uruguay* was to identify opportunities for low-cost reductions in emissions from the agriculture, energy, transport and waste management sectors. The study was specifically tailored to highlight ways in which Uruguay can maintain its growth path, specifically in the agriculture sector, while at the same time reducing the overall emission intensity. This initiative counted on the support of several Uruguayan government counterparts, which included the Climate Change Division of DINAMA, MGAP, Ministry of Transport and Public Works (MTOP) and National Directorate of Energy (DNE) to ensure that the study took into consideration all stakeholders in government and civil society.

academia, the Central Bank of Uruguay (BCU), the National Institute of Statistics (INE) and the national water supply and sanitation company (OSE). The leadership role played by SNAACC as a coordinating entity facilitated interactions among actors and catalyzed results.

The technical assistance strengthened dialogue and collaboration across ministries and between the Government and the non-government stakeholders. For example, the work on market opportunities relied on inputs from counterparts to identify the potential low-hanging fruit that could leverage Uruguay's export performance. The work on water modelling in the Santa Lucia River watershed, fostered the creation of two working groups. One of these dealt with the development of the water modelling tool with the participation of MGAP, SNAACC, and the National Environmental Directorate (DINAMA) and the National Water Directorate (DINAGUA) divisions of MVOTMA. The other one dealt with the creation of the roadmap to update the Action Plan for water protection in the Santa Lucia River watershed and counted with an even broader inter-institutional involvement: MVOTMA (DINAMA and DINAGUA), MGAP, SNAACC, OSE, academia (University of the Republic), MEF and

the National Institute of Agricultural Research (INIA). The work on economic instruments benefitted from a rich discussion on the political feasibility and practicality of implementing certain policy instruments. This discussion saw the participation of academia, international organizations and government officials, namely from MEF, MGAP, MVOTMA, MIEM, OPP, among others. The work on natural capital accounts was realized through the hands-on involvement of staff from SNAACC, MVOTMA, and MGAP. Government experts gathered data and built pilot accounts for agriculture, which includes also forestry, and water.

Chapter 2

What is green growth?

Definitions

Green growth as seen by the OECD. The meeting of the OECD Council of Ministers in June, 2009, issued a Declaration on Green Growth in which the Council recognized that economic recovery and sustainable economic growth are key challenges facing all countries, and that well-targeted policy instruments can be used to encourage green investment to contribute simultaneously to economic recovery in the short-term, and help build a green economy in the long-term. The Declaration also noted that for countries to move towards sustainable low-carbon economies, international co-operation will be crucial in areas such as the development and diffusion of clean technologies, and the development of an international market for environmental goods and services, and called on the OECD to develop a Green Growth Strategy in order to achieve economic recovery and environmentally and socially sustainable economic growth. This strategy, published in 2011 "Towards Green Growth" (OECD, 2011), provides the following definition:

"Green growth means fostering economic growth and development while ensuring that natural assets continue to provide the resources and environmental services on which our well-being relies. To do this it must catalyze investment and innovation which will underpin sustained growth and give rise to new economic opportunities" (OECD, 2011, p.4).

The UN definition. The Rio+20 United Nations Conference on Sustainable Development in 2012 established the Global Green Growth Institute (GGGI) as an international organization dedicated to supporting and promoting strong, inclusive and sustainable economic growth in developing countries and emerging economies. The GGGI has defined Green Growth in the following terms:

"In contrast to conventional development models that rely on the unsustainable depletion and destruction of natural resources, green growth is a coordinated advancement of economic growth,

environmental sustainability, poverty reduction and social inclusion driven by the sustainable development and use of global resources" (United Nations in Republic of Korea, 2012).

The World Bank approach to green growth and practical considerations. In the May 2012 report "Inclusive Green Growth", the World Bank defined Green Growth as "growth that is efficient in its use of natural resources, clean in that it minimizes pollution and environmental impacts, and resilient in that it accounts for natural hazards and the role of environmental management and natural capital in preventing physical disasters. And this growth needs to be inclusive" (World Bank, 2012). In its key messages, the report emphasized that:

- *Greening growth is necessary, efficient, and affordable.* It is critical to achieving sustainable development and mostly amounts to good growth policies: necessary to avoid environmental degradation and natural resources depletion, endangering people's welfare; efficient by improving the efficiency of the processes of investing in and using up of assets; affordable by reducing the cost of clean-up, recovery and inputs needed to generate well-being.
- *Obstacles to greening growth are political and behavioral inertia and a lack of financing instruments*—not always the cost of green policies.
- *Green growth should focus on what needs to be done in the next five to 10 years* to avoid getting locked into unsustainable paths and to generate immediate, local benefits. Green growth reveals opportunities for growth also in the medium and long term.
- *The way forward requires a blend of economics, political science, and social psychology*—smart solutions to tackle political economy constraints, overcome deeply entrenched behaviors and social norms, and develop the needed financing tools.
- *There is no single green growth model.* Green growth strategies will vary across countries, reflecting local contexts and preferences—but all countries, rich and poor, have opportunities to make their growth greener and more inclusive without slowing it.

Common and recurring features. An aspect that is common to all definitions is the idea that green growth is not just about avoiding the negative (environmental) externalities of growth, including locking in unsustainable practices, but also about unveiling opportunities. Economic growth and environmental sustainability can be perceived as conflicting objectives. This is misleading. A green growth approach to development reconciles these policy objectives by enabling the country to harness its natural capital for growth and by using growth as an incentive to nurture their asset base. The appeal of the green growth concept is both strategic and analytical (Bowen & Fankhauser, 2011). From a strategic point of view, green growth allows environmental protection to be cast as a question of opportunity and reward, rather than a costly restraint. From an analytic point of view, green growth is about marrying environmental objectives with productivity objectives, job creation, technology adoption, and higher value added. The transmission channels between *green* and *growth* will, however, vary from one country to the other.

Towards a meaningful definition for Uruguay. Green growth for Uruguay could be seen as *the strategic lens and the set of tools to harness natural capital and avoid environmental irreversibilities to sustain inclusive growth*. Uruguay has already engaged in a sustainable trajectory for growth for key economic sectors, but it needs to define a green growth strategy to tackle emerging challenges. At the same time, adopting a green growth trajectory is not static. Through the technical assistance, green growth has emerged as an overarching framework to think about development. A framework to enable the country to achieve robust growth without locking itself into unsustainable patterns and to constantly readjust its growth strategy to find new opportunities amid

changing threats. Rather than developing a theory of green growth, the technical assistance served as a space to identify practical tools and policy options to reconcile the objectives of growth and environmental sustainability. The result has been to provide decision makers and the society as a whole with an instrument to help sustain adaptively a green growth strategy in Uruguay.

Green growth across the world

The concept of green growth has its origins in the Asia and Pacific Region. At the Fifth Ministerial Conference on Environment and Development held in March 2005 in Seoul, 52 Governments and other stakeholders from Asia and the Pacific agreed to move beyond the sustainable development rhetoric and pursue a path of "green growth". In 2008, partly in response to the global financial crisis, the Republic of Korea adopted *low carbon green growth* as the country's new development vision, which was followed shortly after by the release in 2009 of their National Strategy for Green Growth (Republic of Korea, 2009b) and Five-Year Plan for Green Growth (Republic of Korea, 2009a), which were accompanied by the enactment of a Framework Act on Low Carbon Green Growth. Korea has since been instrumental in promoting the concept more broadly, including through the OECD. Today a large number of countries have taken up the concept and adapted it to their development challenges, and have adopted green growth strategies in one way or another.

Korea

Korea provides an excellent example of a country that has dealt successfully with rapid urbanization and harnessed remarkable economic growth. Korea's urbanization rate increased from less than 30 percent in the early 1960s to 82 percent in 2010 while at the same time incomes (GNI per capita) rose from about US$130 in 1965 to over US$27,600 in 2016.

Korea is also a country actively implementing a green growth paradigm. Policy-makers in Korea sought transformation, not marginal adjustment, of the economy, which relies heavily on energy-intensive industries (which doubled its GHG during the 1990s) and massive energy imports (which account for two-thirds of imports). In pursuing green growth, they are combined three complementary and mutually reinforcing objectives: responding to the economic crisis, reducing the country's energy dependency, and rebalancing the economy toward green sectors over the long term in a search for greater resilience and competitiveness.

Korea's US$31 billion stimulus package, adopted in 2009, was the greenest of any country, with 80 percent of all funds going toward environment-friendly projects. Investments initially targeted infrastructure as a short-term response to the crisis. Projects included the development of renewable energy sources, energy-efficient buildings, and low-carbon vehicles; the expansion of railways; and the management of water and waste. Most of the green investment funded three initiatives: river restoration, expansion of mass transit and railroads, and energy conservation in villages and schools. Together the three initiatives were estimated to create 500,000 jobs.

Korea's motivations for implementing green growth transcend the 2008 global economic crisis. Well before the crisis, the country was rethinking its growth model, which it recognized as unsustainable given the upward trend in energy prices. Faced with high energy prices and rising concerns over climate change, it announced a new long-term energy strategy in August 2008. This strategy aims to reduce energy intensity by 46 percent and increase the share of renewable energy in total primary energy from 2.4 percent in 2007 to 11 percent by 2030.

The government also established mandatory reporting of carbon emissions by all carbon- and energy-intensive industries.

Vietnam

Thirty years of rapid and inclusive economic growth have raised Vietnam's status to that of a lower-middle-income country, creating opportunities for people and businesses. Its GDP growth per capita has averaged 5.5 percent a year since 1990, yielding per capita gross national income (GNI) of US$1,980 in 2015. Growth has been inclusive: incomes have risen across the income distribution, while growth in inequality has declined. Growth has bolstered shared prosperity and achieved strong gains in poverty reduction: the percentage of people living in extreme poverty (US$1.9 per day) stands at less than 3 percent today. Key social indicators have improved substantially: the population is better educated, has a higher life expectancy and a lower maternal mortality ratio than that of most countries at a similar income level. Access to basic infrastructure including electricity, clean water, and modern sanitation has also risen drastically, from less than half to more than 75 percent of the population. Despite rapid and significant reductions in poverty over the last decades, significant pockets remain, particularly in vulnerable coastal areas and the Mekong River and Red River deltas where populations are highly exposed to impacts associated with climate change, including sea level rise.

The effects of climate change on Vietnam's development achievements and future growth objectives require strengthened resilience planning and financing to stem impacts, particularly among the poor who are often disproportionately affected. Vietnam does and will increasingly experience significant impacts from climate change, largely attributed to high and increasing exposure to gradual-onset impacts. Climate risks to coastal economies are aggravated by the loss of mangrove forests, excessive drainage, groundwater extraction, and overfishing. Droughts, salinization, extreme temperatures, and changes in growing seasons and floods, compounded by sub-standard housing in exposed areas and a lack of assets to buffer shocks, strongly impact the livelihoods of poor rural and urban households. Over the past 25 years, extreme weather events have resulted in 0.4 to 1.7 percent of GDP annual loss. By 2050, a 1–3 percent loss in real GDP is predicted from climate change impacts.

Vietnam has stepped up its efforts to re-orient development towards green growth. The National Climate Change Strategy and Vietnam Green Growth Strategy lay out a vision not just to address a set of specific climate risks and opportunities to reduce waste and pollution, but to re-orient the whole economy towards a more sustainable mode of planning, incentives and development, which aims to position Vietnam as a modern competitive economy with high quality of life, and as a responsible member of the international community, on par with other major economies. The climate change strategy identifies the need for action on a range of threats (e.g. disaster risk management, food and water security, sea level rise) as well as opportunities for emissions reductions (e.g. renewable energy, energy efficiency, resource-efficient agriculture, and waste reduction and management). It also stresses its foundations in an ecological approach, particularly the importance of forests, improving capacity across state, private and public entities, and achievement of a range of broad socio-economic objectives, including food security, energy security, poverty reduction, gender equality, social security, public health and livelihoods. The green growth agenda is almost entirely contained within that of the climate change strategy as it focuses on sustainable use of natural capital, improving the efficiency of the resources used and reducing waste. However, the emphasis is not on managing risks, but rather on improving the quality of economic growth and therefore living standards through a healthy

environment, and increasing competitiveness and sustainability. It also recognizes even more centrally, the reliance on the public and private companies to change the patterns of consumption and investment.

Colombia

Colombia's dependence on its unique endowment of natural wealth underscores the urgency to ensure green economic growth. The country has a diverse geography with a variety of landscapes and ecosystems, and considerable renewable and non-renewable resources. Hosting close to 10 percent of the planet's biodiversity, Colombia ranks second among countries with the greatest biodiversity in the world (Convention on Biological Diversity, n.d.). It ranks seventh in the world in terms of area covered by tropical forests (FAO, 2015); natural forests cover more than half the country's mainland area. These assets constitute a comparative advantage to develop nature based economic sectors such as tourism, pharmaceuticals, cosmetics and agribusiness. In monetary terms, natural capital represents 15 percent of the country's total wealth. GDP share of income from natural resources[2] shows an increasing trend: from 0.51 percent in 1970 to a maximum of 9.28 percent in 2011. However, Colombia is extremely vulnerable to extreme weather events such as El Niño and La Niña that result in floods (and landslides) and droughts; with severe socio-economic impacts, that affect the poor more severely. These events are expected to increase in frequency and intensity with climate change, and their impacts are being exacerbated by the degradation of ecosystems. Moreover, the renewable portion of Colombia's natural capital has diminished over time.

Key economic sectors—notably transport, energy, industry, and agriculture—contribute to environmental degradation in Colombia, pointing to the need for a greener growth path. Pressures on natural resources exerted by industry—notably extractives, extensive livestock farming, urbanization, and motorization—have created levels of environmental degradation that impose significant and rising economic costs. Deforestation, land degradation, and soil erosion result in annual economic losses estimated to be around 0.7 percent of GDP, and occur primarily in areas of agricultural expansion, illegal mining, and drug-related activities. Extensive agricultural production occupies 35 million hectares of land, of which only 15 million are suited for such purposes. Deforestation is poised to worsen in the absence of controls in many post-conflict areas and important watershed ecosystems.

The country has become a global green growth champion in recent years. Green growth has emerged as a model of growth that ensures the protection of the country's natural capital base, prevents externalities associated to the costs of its degradation, contributes to competitiveness, and reduces the impacts of natural disasters and climate change. Colombia adhered to the OECD Green Growth Declaration in 2012 and is committed to decrease GHG emissions by up to 30 percent by 2030 in its Nationally Determined Contributions (NDC). In addition, it has committed to restore one million hectares of degraded land, to reach zero net deforestation in the Amazon by 2020 and to achieve the Sustainable Development Goals (SDGs). The 2016 Peace Agreement with the FARC explicitly targets environmental sustainability by indicating that development during the post-conflict period should guarantee socio-environmental sustainability and should not expand the agricultural frontier. A carbon tax aimed to discourage fossil fuel consumption has also been established. Latest in this series of efforts, in February 2017, the Government launched the Green Growth Mission to prepare the analytical underpinnings that will serve as a base to develop a long term national green growth policy. The policy was approved in July 2018.

2 The sum of the total value of oil, natural gas, coal, mineral and forest assets.

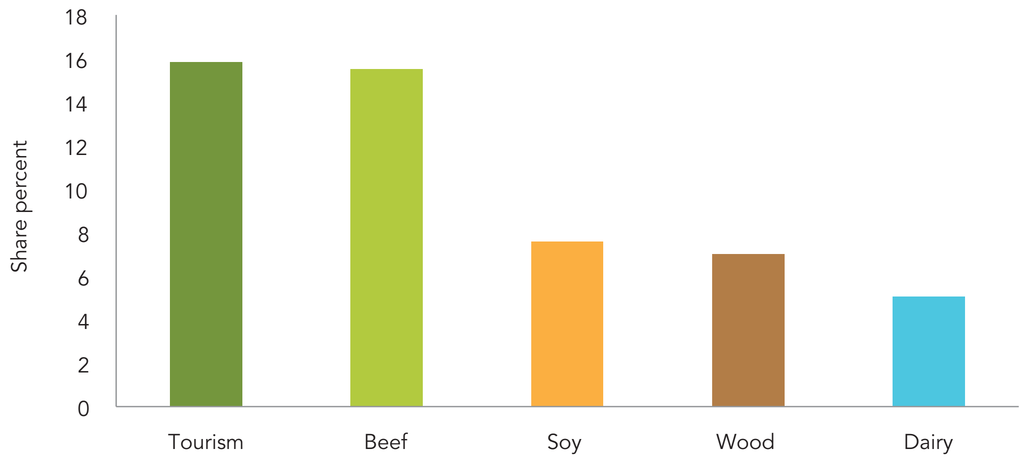
Chapter 3

Why is green growth relevant for Uruguay?

Green growth is of strategic relevance to Uruguay, first of all because the country's successful growth model is rooted in the country's rich natural asset base. Rapid growth in Uruguay has been associated with an increasingly important role of trade in the economy. Over the period 2005-2015, exports averaged 26 percent of GDP (World Bank, 2015), while imports and exports combined represented 53 percent of GDP in 2014 (World Bank, 2015), with Uruguay expanding its presence in the world markets more rapidly than its neighbors, Brazil and Argentina. Rapid export growth has been accompanied by job creation. Currently, about 30 percent of jobs are linked to the export sector (World Bank, 2015). Underlying this success, is the country's rich natural asset base, namely its fertile land, its water resource abundance, timber wealth and tourism potential. As shown in Figure 1, Uruguayan exports depend heavily on renewable natural resources and environmental services. With tourism, agricultural and forest products constituting the top five export sectors, together accounting for around 50 percent of the total value of exports, it is clearly important to ensure that natural assets provide the resources and environmental services on which the economy is based.

Uruguay stands out as an economy that is building wealth as it grows, and which is investing in its natural capital base. Key to sustainable development is the concept of capital accumulation. While GDP provides a measure of how much an economy produces each year, capital – or wealth – provides a measure of the assets on which production relies. GDP, taken alone, can be misleading as GDP can grow by selling out assets (e.g. by depleting forests, soil or mineral deposits). Recent estimates of total wealth (World Bank, 2018) i.e. the sum of produced, natural and human capital) show that Uruguay has increased its total capital by nearly 4 percent per year between 1995 and 2014 (Figure 2). As such, it stands above regional peers such as Argentina (around 2 percent), Brazil (around 2.5 percent) and Colombia (around 3 percent). More in general, the figure shows that GDP growth is positively correlated with total wealth growth: fast growing countries tend to accumulate wealth faster. While there can be variability, the

Figure 1. Rough estimate of the share of Uruguay's tourism and top four goods exports relative to the total value of goods and services exported, for 2016.



Source: own elaboration with data from Uruguay XXI and Uruguay XXI, 2017b.

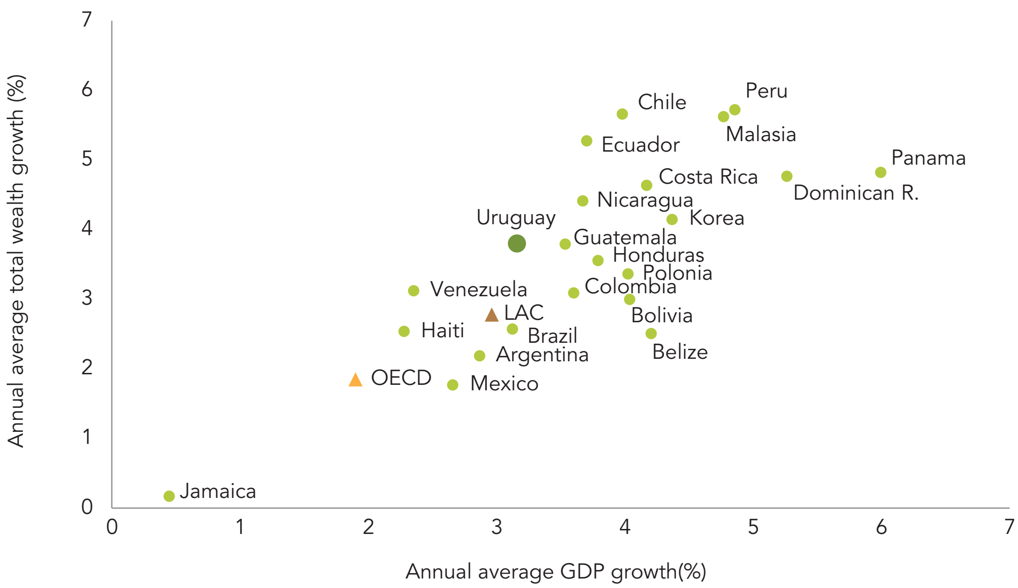
chart seems to suggest that the path to long term growth is characterized by accumulation of produced, natural and human capital. Looking more closely at natural capital (Figure 3), it is possible to see different development models across the quadrants of the chart. Some countries have been converting forest land capital into agricultural land capital (e.g. Malaysia, Nicaragua, Ecuador, Argentina), others have depleted both (e.g. Jamaica, Colombia and Venezuela). Uruguay has been investing both in its agricultural land, with a 5 percent growth per year between 1995 and 2014, and its forest capital, with a 4 percent growth over the same period. In this sense, the country stands out compared to peers.

Building on experience while overcoming the challenges ahead

Several initiatives have been launched and implemented in the agriculture sector showing Uruguay is already on the path to green growth. A MGAP's report published in 2017 reports the progress made by adopting since 2010 an "agro-smart" approach for Uruguay as a platform for competitive and innovative economic growth and development (MGAP, 2017b). This approach involved the creation of several public policies around six strategic axes which include the promotion of production intensification that is sustainable, and climate change adaptation and its cobenefits.

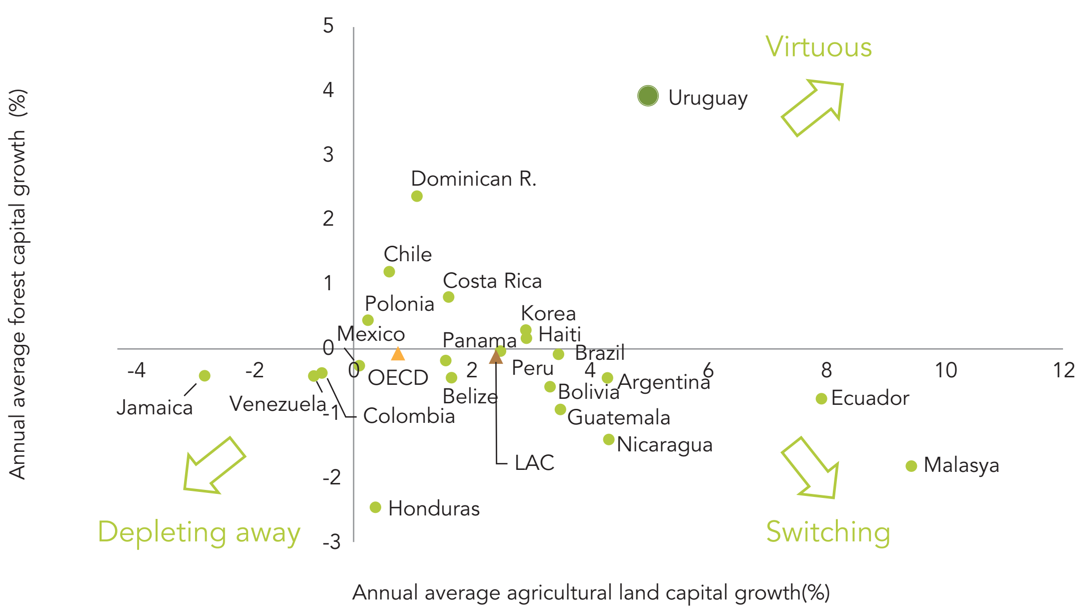
But MGAP has set an ambitious goal: almost doubling the number of people fed by Uruguayan products from 28 million to 50 million consumers worldwide. With only 3.5 million people in the country, exports account for the largest portion of food production. Producing food for 50 million people is a major challenge for a country with only 16.4 million hectares of agricultural land. In particular, there are four key issues as Uruguay aims at sustaining this increase of agricultural production: (i) a sustainable use of natural resources (especially soil, water, forest and biodiversity); (ii) an increasing attention

Figure 2. Wealth and GDP growth, 1995-2014 (comparing Uruguay to its peers in Latin America and the Caribbean and in the world).



Source: authors calculations based on data from World Bank, 2018.

Figure 3. Forest and agricultural land wealth growth, 1995-2014 (comparing Uruguay to its peers in Latin America and the Caribbean and in the world).



Source: authors calculations based on data from World Bank, 2018.

to emerging public health-environmental concerns; (iii) an enhancement of agriculture resilience, especially to climatic variability; and (iv) the achievement of commitments related to the climate mitigation agenda. Several of these points are discussed in the following paragraphs. The discussion starts from the key achievements to date and continues by laying out the future challenges.

Uruguay's trajectory

Sustainable intensification as a response to the need for sustainable use of natural resources

Over the last decade, the MGAP developed the concept of sustainable intensification in agriculture. The concept of sustainable intensification involves, among others, the following dimensions: sustainable soil management, incorporation of water in the production systems under a sustainable vision (quality and quantity), sustainable management of grazing areas, responsible use of pesticides, traceability and food innocuity for food consumers.

The development of comprehensive information systems such as the National System for Agricultural Information (SNIA) are at the core of improving nature resources management. While still under construction, the SNIA will enable to trace the impacts on soil, water and forests associated with agricultural production. It will also support the enforcement of policies (soil, traceability, certification, etc.) and so will be a promising tool to support the access to green markets. The SNIA will integrate all the distinct information modules of the MGAP, such as the existing traceability system for livestock and the existing system of agrochemical use, and the upcoming Soil Information System, which is currently under construction, and the Soil Management Plan System, among others.

Sustainable use of agricultural soil

Uruguay is implementing an innovative soil protection policy by enforcing mandatory Land Use and Management Plans for the recovery of agricultural eroded soils. Since 2013, farmers engaged on crop cultivations[3] are legally required to submit their land use plans, which cannot exceed soil erosion thresholds, along with evidence of crop rotation. Since 2017, this requirement applies to any farmer cultivating over 50 hectares of arable land. The plans and the evidence presented are inspected by the Government in a first stage through remote sensing technology (to detect crops without a plan of use), and then with field inspections for final control. By October 2017, 12,493 plans had been presented, covering 1.88 million hectares and 96 percent of all crop producers over 100 hectares. To date, Soil Management Plans have proven, through meticulous data collection and the preparation of hundreds of soil use and management plans, that Uruguay's agriculture generates high levels of production with less erosion potential for agriculture. It is expected that erosion will be reduced by 80 percent (MGAP, 2017b) and that this reduction will have a series of positive impacts in addition to the conservation of soils itself, such as the reduction of carbon emission and the reduction of nutrient transport and contamination to water bodies (such as in the Santa Lucia River basin). It also has been demonstrated Uruguay's vast capacity for implementing planning approaches with high degrees of success, largely due to the country's size, homogeneity, capacity for data collection and for developing innovative tools. The compliance of the policy has been supported by a geo-referenced module (*Sistema de Gestión de los Planes de Usos*) for the management and remote monitoring of said plans with the purpose of integrating it into the SNIA.

3 Meaning agriculture activities excluding natural grazing areas and artificial pastures.

Sustainable management of natural biomes

Uruguay has been implementing institutional changes and projects to promote sustainable management of grazing areas and forests. The grazing areas (*Campos Naturales*) are the predominant landscape in Uruguay (70 percent of agricultural land). They have a key role in agricultural production as a food source, and also provide several ecosystem services (carbon dioxide absorption, generation of soil, provision of clean water, recycling of nutrients, provision of genetic material, climate regulation, pollination). Created in 2012, a new roundtable (Mesa de Campos Naturales) aims at establishing plans to harmonize production with conservation of resources natural, and increase meat productivity with reduction of GHG emission per unit of output. In addition, the Reducing Emissions from Deforestation and Forest Degradation (REDD+) Readiness Grant[4], is intended to set up the institutional capacity and strategy to manage forests in a sustainable way for long-term economic growth; to support the livelihoods of local, rural and forest dependent communities; and to ensure that its important natural heritage is conserved.

Sustainable use of water resources

Uruguay also developed an irrigation strategy and related action plan in collaboration with the World Bank under the Water for Uruguay Technical Assistance. This strategy aims at promoting development of climate-smart agriculture, with water solutions for irrigation being a key aspect to increase farmers' resilience to climate variability and extreme events avoiding asymmetry with other water-related sectors, including environmental uses. The incorporation of supplementary irrigation into the main production systems (mostly grains and forage) is not expected to increase dramatically the water consumption (as the water requirements for supplementary irrigation is very low compared to rice, for example). It is also expected that the incorporation of modern techniques of irrigation in the cropping systems will reinforce the policy of soil preservation and the mitigation agenda by: (i) securing a better soil coverage; (ii) allowing a wider spectrum of crop diversification (by removing the potential bottleneck of water deficit for crops with higher water requirements); and (iii) contributing to the reduction of GHG emission. Lastly, this strategy also involves reinforcing coordination between MGAP and MVOTMA.

In the Santa Lucia River basin, the 2013 severe water degradation event triggered national authorities to take immediate action to reduce water pollution and ensure water source protection. In 2013, soon after the eutrophication episode in the watershed, MVOTMA launched an action plan – titled Action Plan for the protection of environmental quality and potable water sources. This plan, generally known as "11 Measures", included eleven actions to be implemented step-wise, such as the reduction of untreated discharges from sewage and industries, the identification and protection of highly sensitive areas for water supply, the enforcement of the Land Use and Management Plan regulation on farmers, and the ban of new establishments for intensive livestock production, such as feedlots, in a defined area. As of today, a number of these actions have already been implemented while others are still under implementation.

As part of the "11 measures" Action Plan, the MGAP promoted the Sustainable Dairy Plan ("Plan de Lecheria Sostenible" in Spanish) that aims at reducing soil degradation and water pollution in sensitive areas. This Plan entails the

4 The Global REDD+ initiative, supported by the Forest Carbon Partnership Facility (World Bank acting as the Trustee), became operational in 2008 to assist countries in establishing the key pillars of REDD+ readiness: (i) developing their national reference scenarios for emissions from deforestation and forest degradation; (ii) adopting and complementing national strategies for reducing deforestation and forest degradation; and (iii) designing national measuring, reporting, and verification systems for REDD+.

extension of the Land Use and Management Plans, organic and chemical fertilizers use plan and waste management plans to dairy establishments in the environmentally sensitive Santa Lucia River watershed. This initiative also provides financial support for small and medium dairy farmers for the design and execution of solutions to reduce nutrients export into water sources, including both technical assistance and financial investments.

Increasing attention to emerging public environmental health concerns

Sustainable management of pesticides

The MGAP recently implemented a monitoring system for phytosanitary products. The recently launched Satellite Monitoring System for the Use of Phytosanitary Products monitors and controls the use of pesticides (including application by tractors and/or planes) in real time via satellite information in field crops. This system contributes to mitigate impacts on population living around agricultural areas and monitor the use of pesticides in agriculture.

Certification, traceability and food innocuity for consumers

One hundred percent traceability in beef production is a tool for Uruguay to enter exclusive and higher value markets. Uruguay has in place a national informational scheme (the National System of Information for Livestock, or SNIG) that tracks and provides information on the history, from birth to retail, of each cut of meat that is exported or domestically consumed (Fernández-Arias et al., 2015). This scheme was established to solve a foot-and-mouth disease sanitary crisis, and in turn, helped position the Uruguayan beef as of superior quality and facilitated Uruguay's access to high end markets, particularly in the US and the EU, and to international certification. It enabled the upgrade of the meat to the stricter US Department of Agriculture labeling "Never Ever 3", which guarantees that the animals never received hormones, antibiotics and proteins of animal origin, from his birth to the animal slaughter, which allow Uruguay to strengthen its position on the market of high quality meat.

Traceability is also effective for some agricultural products such as honey, citrus, wine and poultry products. In the production of honey and bee products, traceability aims to identify the product along the productive chain, geo-referencing of apiaries and application of pesticides. The information obtained allows identifying possible problems, their origin and cause, in order to establish corrective measures. In fruit and vegetable production, recent legislation already establishes the future traceability of fruits and vegetables. Another chain that advanced in traceability is the poultry, which covers the activities and actors linked to the production of eggs and meat.

Enhancement of agriculture's resilience

The Development and Adaptation to Climate Change (DACC[5]) Project contributes to increase farmers' resilience to climate change. It provides technical and financial assistance to reduce the climatic vulnerability of medium- and small- sized farmers and to increase the long-term sustainability of the agricultural and livestock production (MGAP, n.d.). The project provided grants for the promotion of farmers-led irrigation (individual) and collective small-scale irrigation schemes. The DACC also supports the implementation of a parametric drought insurance index to reduce the impact of environmental shocks on livestock producers (MGAP, n.d.). In 2015, the MGAP initiated a 3-year long pilot to test the feasibility of this scheme in increasing farmers' resilience to climate risks (MGAP, 2015). Under this pilot,

5 Financed through a World Bank loan, a GEF grant, by the Government and by the private sector.

178 ranchers benefitted from having insurance coverage during three dry seasons. The goal of the recently approved Additional Financing of DACC project is to extend this pilot to 400 ranchers.

Contribution to the climate mitigation agenda

Co-benefits of Uruguay's soil conservation initiatives include climate change mitigation. Uruguay is a global leader in its efforts to enhance its environmental performance while producing high value goods and contributing to the fight against climate change. In this line, several initiatives that Uruguay has laid out already generate co-benefits for climate change mitigation and adaptation. The Soil Use and Management Plans are estimated to have already contributed to an annual soil carbon sequestration of about 2 million tons (World Bank, 2015).

The study "Low emissions growth options for Uruguay" found some low-cost, high-impact opportunities for reducing carbon emissions that could be carried out without compromising development or growth. The study (World Bank, 2014) analyses policies and instruments across the agriculture, energy, waste management and transport sectors, accounting for costs and benefits, both from the angles of investors and society. The study shows that the agriculture (including forestry) sector has potentially the highest contribution to decrease the GHG emissions: expansion of commercial forestry and preservation of native forest, changing practices for livestock diet, better management of grasslands, increase in irrigated area, and provision of water and shade for livestock are the most efficient low-carbon interventions (LCI) to reduce GHG emission.

Challenges ahead

Sustainable use of natural resources

The country's small geographic size implies that increases in production can only come through intensification. Limited by land availability, Uruguay's land use portfolio underwent a transformative process during the last decade, in order to increase production and take advantage of the favorable international market. The sector experienced a sharp intensification of production, understood as the increase of production per unit of land. From 2003, soy triggered the crop rotation plan, increasing tenfold the land annually used for crop plantations in only eight years (e.g. soybean crops increased tenfold in this eight-year period from only 80,000 hectares, and in 2016 they represented around 1,200,000 hectares). The reduction of pastures and increasing grains availability favored the implementation of intensive livestock practices, such as feed-lots, and dairy production intensification (Préchac et al., 2010). Over the period 2005-2012, milk production almost doubled (OECD & ECLAC, 2014) thanks to a sharp increase in milk production productivity of annual 3.4 percent over the last decade (OECD & ECLAC, 2014). Similarly, the rise in feedlot establishments contributed to an increase in livestock productivity, with an annual rate of 3.1 percent over the last decade (OECD & ECLAC, 2014).

This model of growth can come at a cost and a special type of risk, particularly relevant to Uruguay, is agriculture's potential impacts on ecosystems. Over the past years, Uruguay had to engage in effectively managing a rising number of environmental risks. The intensification, the rapid growth of the cultivated areas and the other transformation of the sector abovementioned may exacerbated emerging environmental risks: (i) soil erosion; (ii) overuse of water from the increase of water demand for

supplementary irrigation; and (iii) increased use of fertilizers and agrochemicals. Great advances have been achieved for (i) (cf. section 3.1.1.), but pressing challenges still remain for (ii) and (iii) as discussed below.

Sustainable use of water resources

Despite the abundance in yearly average, Uruguay suffers naturally from an extreme variability of water resources availability. The average annual rainfall is 1,240 mm with extreme variation in water availability that goes from -63 percent to +65 percent. December to March is the period with most current water deficit for agriculture and conflicts may arise to satisfy the needs of the farmers in the irrigation sector, other users and water for the environment.

To reduce production vulnerability to this seasonal variability, irrigated agriculture expanded from 52,000 hectares in 1970 to 205,000 hectares in 2010 (MGAP, 2017b) but, in the last years, further irrigation development has been limited to the development of supplementary irrigation, particularly for soy crops. Like almost everywhere in the world, the irrigation sub-sector is the main water user. The average volume of water used is 4,856 Mm^3 per year of which the main water uses are for irrigation (86 percent) and domestic consumption (11 percent), while industrial use (3 percent), and others (cattle and recreational) lie on the other end of the spectrum (DINAGUA-MVOTMA, 2011; FAO, 2010) The main irrigated crop is rice (160,000 ha, according to FAO) but the country is facing a growing development of supplemental irrigation for soy beans and pasture. About 50 percent of the volume withdrawn comes from direct outlets on rivers. However, irrigation development is now limited in most of the river basins of the country, in which it is not possible to issue new water rights for direct outlets. Development of storage capacity (dams), improvement of water efficiency and reduction in water losses are then crucial to sustain growth in the water-related sectors, including irrigated agriculture.

In Uruguay, agricultural intensification in recent years resulted in a sharp increase in the application of nutrients that can affect water quality. In the last 20 years, changes in Uruguay's productive structure, the adoption of new crop varieties and intensive production practices, led to a sharp increase in the use of pesticides and fertilizers, which are major sources of nutrients. Since not all of the fertilizers load applied is taken up by target plants, the rest stays in the soil, of which part is then flushed out by irrigation systems or precipitation to other land areas or to water bodies. In this way, fertilizers contribute to nutrient pollution in water. Uruguay's imports of pesticides and fertilizers for the period 1997 to 2005 increased by 350 percent (Chiappe, et al., 2008). This growing trend continued in recent years: fertilizers use in absolute terms practically doubled over 2005-2014 (FAOSTAT), although per unit of area, the increase was below 30 percent during the period 2004-2014 (Indexmundi, n.d.).

By now, there are already signs of stress related to water quality in two important watersheds in Uruguay (Santa Lucia River and Laguna del Sauce). In 2011, JICA-DINAMA reported high levels of water pollution in the Santa Lucia River watershed[6], Uruguay's major source of water supply. Aligned to this warning, in 2013, nutrient pollution levels in the Santa Lucia River triggered an eutrophication event[7], which resulted into non-potable water in consumers' water taps. In 2015, a similar event occurred in one of the most touristic destinations of Uruguay, affecting the potable

6 The Santa Lucia River watershed is located in the southern portion of Uruguay, and it extends over a total area of 13,480 km^2.

7 Plants need nutrients to grow, benefiting ecosystems in normal conditions. Eutrophication is when nutrient pollution, typically phosphorus and nitrogen, in water bodies triggers an explosive growth of algae (algal blooms). These algal blooms can be toxic to humans and animals and they can significantly reduce or even deplete oxygen in water, stressing or killing aquatic life. And they can disturb aquatic ecosystems by reducing diversity, affecting fish reproduction.

water service sourced by the Laguna del Sauce. These events are strongly interlinked with the agriculture sector, as it has been the major source of nutrient pollution from non-point sources in the Santa Lucia river (UdelaR, 2013) and also in the Laguna del Sauce (MVOTMA, 2017a).

In the Santa Lucia River basin, excessive levels of nutrients have been identified in the river, with phosphorus being the most pressing. Data collected over 2005-2014 in the two major water dams - Paso Severino and Canelón Grande - shows phosphorus levels ranging from 20-110 ug/L, significantly overpassing the legal threshold of 25 ug/L (Miralles & Trier, 2018). In 2013, high phosphorus levels in water dams generated the eutrophication event abovementioned, deteriorating water quality and consequently affecting negatively drinking water taste and odor. Studies affirmed that agricultural-related non-point sources are the main driver of nutrients emissions in the Santa Lucia River watershed (JICA- MVOTMA, 2010; UdelaR, 2013).

Increasing attention to emerging public health and environmental concerns

Sustainable management of pesticides

The increase in pesticides use is a rising environmental-health concerns and demands a sustainable management approach. Intensification of production also brought along a remarkable increase in pesticide use in Uruguay (Caon, 2013). Between 1991 and 2011, the total volume of pesticides used in Uruguay increased almost tenfold (FAOSTAT, 2017). Pesticides have been associated with economic losses in tomato production, bees' death and with severe economic and significant market losses in honey production (Perez, 2017; RAPAL, 2017; La Diaria, 2017). At a more regional scale, OSE has identified toxic pesticide-related residues in waterways, necessitating the further diversion of resources for preventative investments in water purification processes in recent years. In addition, pesticide residues in water bodies can also affect aquatic life.

Furthermore, pesticides can spur weeds and pests resistance, in turn demanding an increase in the product's application rates. Some countries are already facing this issue (the so-called pesticides treadmill). For example, in the US, it has been estimated that about 34 million hectares of farmland are infested with glyphosate resistant weeds (Dow AgroScience, 2015). Similarly, in Brazil, numerous weeds have developed resistance to glyphosate (Cerdeira et al., 2007; Cerdeira et al., 2011), and resistant weeds are also spreading quickly around the county (Vieira Godoy et al., 2015). The increase in pesticide use through intensification of production can exacerbate the environmental issues mentioned before. For instance, weeds resistance forces farmers to adopt heavy tillage, which triggers phenomena of soil erosion.

Enhancement of agriculture's resilience

While the recent efforts mentioned earlier are an important step in the right direction, climate variability has adversely affected the Uruguayan agri-food sector in the past, and expected climate changes will exacerbate these impacts. According the PLANAGUA (MVOTMA, 2017b) and based on climate scenarios for the next 50 years, the country is likely to face an increase in temperature (around 0.5 degrees Celsius in 2020, and up to 2.5 degrees Celsius in 2050), in total annual precipitation, and in frequency and intensity of extreme weather events (droughts and floods). Potential impacts associated with these increases include: (i) reduction in land productivity of commercial farms by 62 percent of the current level and 54 percent below the current level for small family-owned farms (by 2020), mainly associated with temperature increases; (ii) damages to public infrastructure, reduced agricultural production and rural

livelihood impacts, and challenges to maintaining healthy and sustainable urban ecosystems, due to increased flooding,[8] which in urban settings is magnified by inadequate storm water systems; and (iii) drought events that are more severe and intense, which in the past have been associated with significant agricultural losses[9], and in the future could also lead to negative consequences for energy production (due to the highly hydropower-dependent electricity sector) (World Bank, 2015). These and other climate related challenges threaten to magnify existing issues (that is, mainly those associated with water quality and storm-water runoff).

Contribution to the climate mitigation agenda

The agriculture sector continues to be the largest contributor to national GHG emissions, posing a great challenge to reduce emissions while increasing production (World Bank, 2015). The national GHG emissions of Uruguay are very small in global terms (0.05 percent). Even so, the agriculture sector accounts for 80.2 percent of national GHG emissions[10] and practically all methane and nitrous oxide emissions (93 percent and 98 percent, respectively) (Uruguay's First NDC, 2017). The major contributors to GHG emissions in the agriculture sector are crops cultivation, livestock, forestry and rice cultivation (World Bank, 2014). There is a tendency towards intensification, by increasing intensity of land management and production practices and by achieving higher productivity. Given these anticipated trends, World Bank (2014) projected that total emissions from agriculture would increase through 2035, but emissions per production unit would decline in many cases. This aggregated production from intensification, would help reduce GHG emissions globally by preventing deforestation for food production in other parts of the world (World Bank, 2014). However, Uruguay recently pledged to reduce total emission intensity of carbon dioxide, methane and nitrous oxide per unit of GDP by 2025 by 24, 57 and 48 percent respectively (First Nationally Determined Contribution (NDC) of Uruguay, 2017). Particularly, the two latter add on even more pressure to reduce emissions per production unit.

Harnessing opportunities: green growth as a driver of trade competitiveness

Green growth is not only a lens through which sustainability challenges can be tackled, it also represents an opportunity as it can contribute to the country's already successful export-led growth model. GDP growth is driven by exports in Uruguay. Exports are in turn rooted in the country's rich asset base. Currently, about 30 percent of jobs are linked to the export sector, which is in turn highly dependent on soils, forests, water and landscapes. As mentioned above, Uruguay has already made important strides in green growth, particularly through the implementation of forward looking environmental policies and programs, and has already used sustainable practices as a key driver of trade competitiveness. Greater integration in global (and regional) value chains, and specifically the identification of higher-value-added activities in sustainable segments, will be a critical priority as the country's limited size prevents it from benefitting from large economies of scale.

8 Over the past decade, Uruguay has already experienced an increase in the frequency and intensity of floods. This is a particular concern in urban settings, where 92 percent of the Uruguayan population lives. Flooding in 2007, for example, was the worst recorded in the past 50 years, having affected more than 100,000 people. The Government of Uruguay estimates that economic losses (mainly infrastructure damages and crop losses) totaled approximately US$ 20 million.

9 For example, the 2008/2009 drought resulted in direct losses to the agricultural sector of over US$ 340 million, the equivalent of 2 percent of GDP; and estimated indirect losses of up about US$ 1 billion.

10 Which is in relative terms more than in average worldwide, where agriculture sector contributes to 13 percent of the GHG emission and Land Use for 11 percent.

Box 2. Tourism as part of green growth.

A worldwide sustainable tourism[1] market is emerging and is associated with higher consumer willingness to pay. A relatively new market segment, adventure tourism[2], is expected to outperform growth in other tourism segments, with a 7 percent share of global market in 2015, likely to increase to 37 percent by 2020. Annual growth is expected to reach 40 percent over 2016-2021. Moreover, adventure travelers are higher-spending tourists with a spending estimated at US$3,000 per person. In similar fashion, ecotourism[3] had the highest level of client demand overall for travel activities in 2017, followed by cultural, environmentally sustainable, and hiking activities.

In Uruguay, tourism represents a significant and growing share of the GDP, expected to increase from 9 percent in 2016 to 11 percent in 2027 (World Travel & Tourism Council, 2017). When benchmarked against some of its competitors[4], Uruguay is not benefiting from the potential positive outcomes of protected areas and the Uruguay brand is not as recognizable for nature-related tourism as the rest of countries analyzed. As a predominantly "sun and beach" destination, Uruguay could analyze tapping on unexploited sustainable offering and so capture a greater share of the global adventure tourism and ecotourism markets in the coming years. Uruguay could seek support in organizations that help promote sustainable practices in tourist destinations, such as the Sustainable Travel International (STI) and the Global Sustainable Tourism Council (GSTC). Sustainable tourism can also help diversify the tourism source markets in Uruguay, which are highly concentrated with about 80 percent of all foreign tourists coming from neighboring countries.

1 Sustainable tourism is the term used to describe all kinds of tourism that is environmentally, socially, and economically sound.
2 Adventure tourism is defined by the Adventure Travel Trade Association as "travel that is inclusive of at least three elements: physical activity, cultural immersion, and natural environment".
3 Ecotourism is defined by The International Ecotourism Society (2015) as "responsible travel to natural areas that conserves the environment and improves the welfare of local people".
4 Argentina, Chile, Colombia, Costa Rica, Ecuador, Peru were selected as competitors for comparative analysis.

Focusing on a selected number of value chains, the green growth technical assistance found that there are important growth prospects and attractive price margins in the niches of sustainable beef, non-genetically modified (non-GM) soy, and organic milk powder (Criscuolo & Cuomo, 2018)[11]. Work under the technical assistance focused on a selected number of value chains of Uruguay's key export products (beef, milk, soy). Preliminary analysis was done for sustainable tourism as well but available information could not allow an in-depth review

11 "Green" and "sustainable" beef refers to the several classification labels (naturally raised, organic, grass-fed) that are also used to identify quality attributes. Labels can go from less to more environmental-friendly practices, thus implying less or more stringent requirements. In terms of green soy, this report specifically addresses the potential of non-genetically modified soybeans, as they bring long term environmental benefits by using fewer agrochemicals (herbicides), and promoted integrated conservation agriculture (i.e. minimum tillage). In terms of dairy, this report focuses on organic dairy, due to the significant economic premiums associated with organic labels and requires no agrochemicals, no antibiotics supplied to the animals, animals eating feed that better suit their nature.

(Box 2). The selection of the green segments analyzed was demand-driven, taking into account their large share of exports and their reliance on natural assets. Other products on which future research could focus and which would be important under a green growth lens include "under responsible production" soy markets, sustainable forestry, clean energy, information and communication technologies, among others. Overall, the analysis showed that there is a strong demand for the green products analyzed, which is expected to grow between around 6 percent (sustainable beef) and around 40 percent (adventure tourism) per year in the next five years. Such demand is expected to pay higher markups when compared to conventional products. Greener products may help to diversify exports into higher value-added niches, at the same time favoring investments in skills and boosting the adoption of new technologies and practices, while contributing to improve the management of the natural resource base of growth sectors.

Demand for green export products is mainly driven by changes in consumers' preferences. In global terms, evidence suggests that green commodities can provide access to more attractive markets and are associated with higher willingness to pay from consumers. Forecasts and recent trends of growth in sustainable food markets are promising. These growing markets are partially fueled by consumers preferring 'healthier'[12] food and appreciating environmentally-friendly production practices. In addition, a growing share of consumers in several countries show a propensity to buy from companies that are aware of their environmental impacts.

Sustainable beef

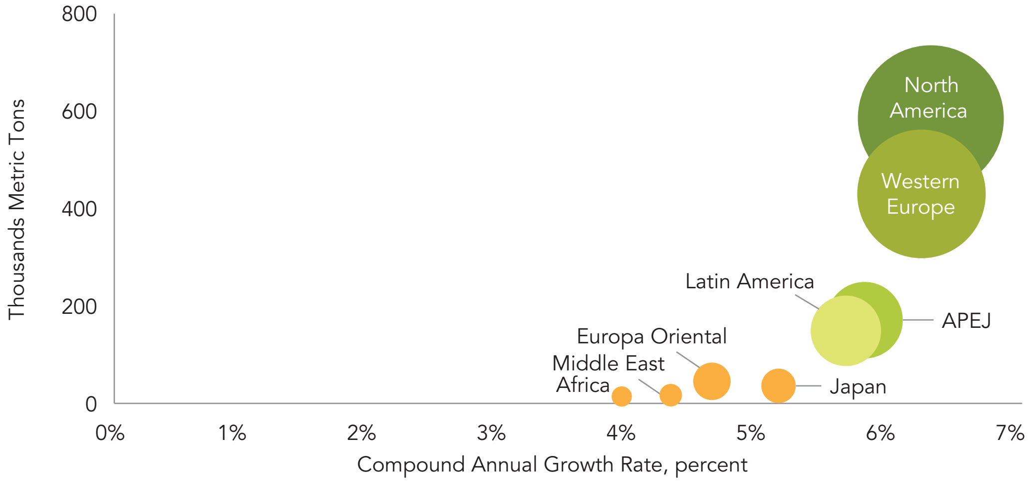
There is significant potential in the global sustainable beef market, which has shown increasing value added. The global sustainable beef market has shown a significant increase in value, driven by growing prices and is forecast to grow at 6 percent per year in value and 4 percent per year in volume to 2021. Conversely, the global beef market volume is expected to grow at around 1 percent per year. This growth has been driven by a rising consumer attention to the environment, health concerns from certain production practices and animal welfare. Regionally, North America and Western Europe are expected to experience the largest growth in value between 2016 and 2021 for sustainable beef, capturing 70 percent of the market in 2021 and 74 percent of the added growth (Figure 4)[13]. Rapid urbanization and increasing health concerns of the younger population in China are expected to lead market demand, estimated at 7 percent per year in value.

The US market appears particularly attractive considering market size, growth, import volumes and prices. Compared to the EU, the US has a larger share of beef imports, including 75-80 percent of the total value of US grass-beef sales, more generous import allowances and higher prices. In the US, grass-fed and organic grass-fed beef are the fastest growing segments, respectively at 43 and 183 percent per year in value, and 37 and 211 percent per year in volume between 2011 and 2016. Estimates of the grass-fed market place the overall value at US$1 billion in direct sales, and US$4 billion in total sales, including retail and food service operators. The markup over conventional beef stands at 71 percent for grass-fed beef and at 63 percent for organic beef. However, producers do not capture

12 It is important to clarify that in this report the term 'healthy' refers to consumer preference, which could be based on reasons that are not necessarily scientific.

13 Figure 4 shows market volume on the y axis, market growth on the x axis and future market size as the bubble size.

Figure 4. Sustainable beef market attractiveness by region.[15]



Source: Criscuolo & Cuomo, 2018.

financial gains associated with these prices due to a fragmented and inefficient value chain.[14] The fragmentation of the value chain presents an opportunity for larger and integrated sustainable beef production systems, able to market their product at a 20 to 30 percent markup.

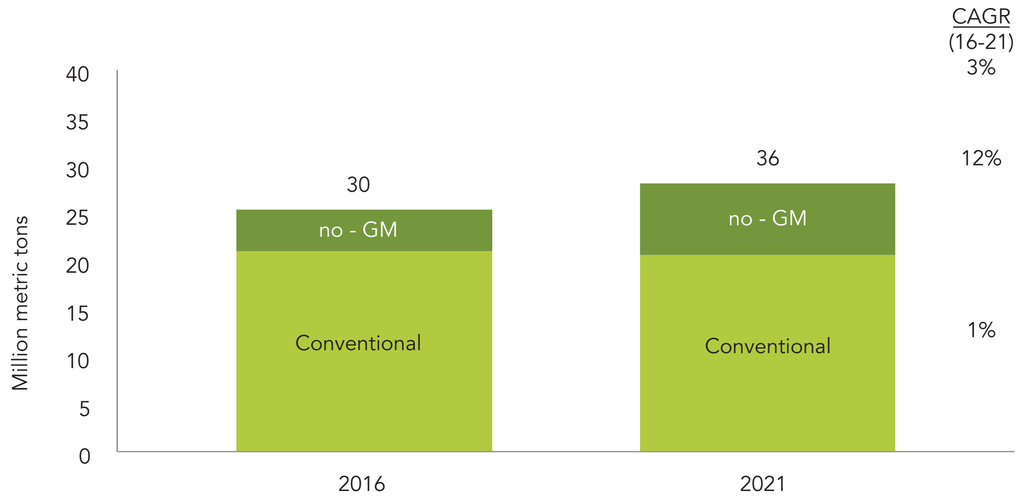
Non-GM soy

In spite of the lack of consensus on the matter, non-GM soy could be perceived as environmentally sustainable and, as such, be part of a broader green growth strategy. International literature review (Gomiero & Flammini, 2017) found that non-GM soy could use fewer pesticides than conventional soy by increasing the effectiveness of crop management and by adopting alternative agro-ecological practices. Perry et al. (2016) confirm this finding specifically for the US. When GM soy is initially used, one observes a reduction in herbicide use. But over time the use of chemicals increases because farmers have to add new chemicals as weeds develop a resistance to pesticides such as glyphosate. In addition, cultivation of non-GM soybean, when minimum tillage and other conservation agricultural practices are in place (i.e., sound rotations, cover crops, reasonable and balanced use of herbicides) can reduce soil erosion and guarantee soil protection.

The technical assistance found that current demand in the EU for non-GMO soy is unmet and estimates that the soymeal equivalent consumption will reach roughly 10 million metric tons by 2021 (Figure 5).[15] Non-GMO soymeal equivalent consumption is expected to grow at a pace of around 12 percent per year, compared to the conventional market which is expected to experience a relatively low growth at 1 percent per year. This growth is driven by the livestock industry, in an attempt to capture the increased awareness of consumers in the EU about GMOs-free products using positive, non-GMO labels instituted in several member countries for animal products reared on non-GMO feed. In 2014,

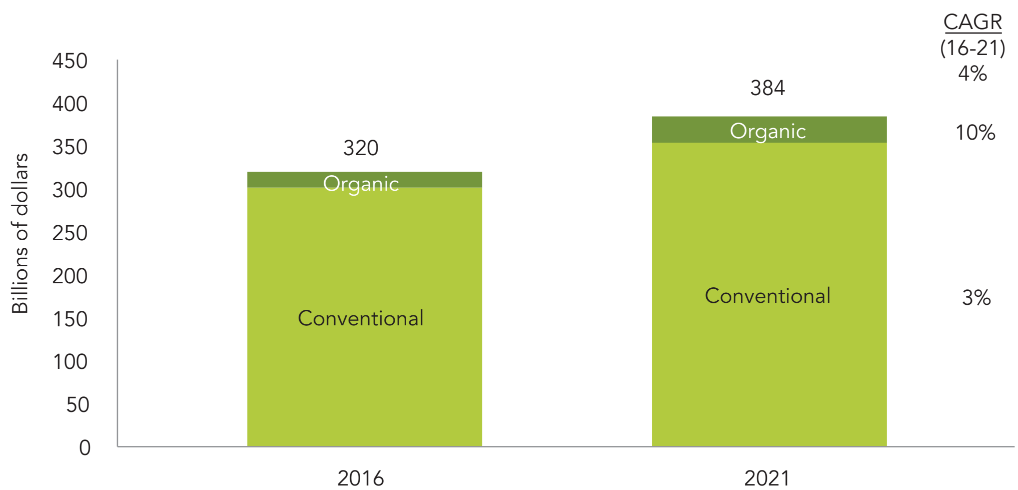
14 For example, the processing costs for small-scale businesses, reprinting 81 percent of sales, range from twice to four to six times as much as those of conventional beef producers.
15 Soymeal equivalent indicates the combination of soybeans and soymeal (which is around 80 percent of soybeans in weight).

Figure 5. Soymeal consumption in Europe for 2016 and 2021.



Source: Criscuolo & Cuomo, 2018.

Figure 6. Global milk market by type for 2016 and 2021.



Source: Criscuolo & Cuomo, 2018.

non-GMO soy offered markup ranging between 20 and 31 percent according to the certifiers and the country where it is traded, compared to between 5 and 15 percent in 2012. China is the largest market for non-GM soy food in Asia (35 percent), and is expected to maintain its share in a growing market until 2021, driven by negative perception of genetically modified organisms for health and traditional use of soymilk and flour in the diet.

Organic diary

Organic dairy is expected to show three times the growth of conventional dairy market, at 10.4 percent per year, up to 2021 and expected

to reach US$30.5 billion by 2021 (Figure 6).[16] Among organic products, the largest and fastest growing product segments are milk and yoghurt, expected to grow between 11 and 12 percent per year, and represent 90 percent of the market by 2021. Recognition of higher nutritional value, product diversification, and environmental concerns are supporting this market growth. Within the organic dairy sector, organic milk powder strikes as particularly attractive because of its high price at US$16 thousand per metric ton, compared to US$3 thousand per metric ton of conventional milk powder. The demand for global organic milk powder is also strong, with an expected market growth of 5 percent per year, expected to reach US$2.2 billion and around 134 thousand metric ton by 2021. Organic whole milk powder dominated the market in 2016 with around 54 percent of the market followed by skimmed milk powder (around 26 percent) and buttermilk and whey (around 20 percent). The largest markets were Europe and North America, which accounted for 73 percent of the global market, while regional demand in Latin America is small (US$75 million) and production is geared towards exports.

16 Conversely, the conventional dairy market was estimated at around US$300 billion in 2016 and expected to reach US$353 billion by 2021.

Chapter 4

Towards a roadmap

The road ahead: insights from the technical assistance

How should Uruguay design a green growth strategy that fits the country's broader development vision? Previous sections provided definitions of green growth (section 2) and how relevant the concept can be for Uruguay, in particular when it comes to harnessing the country's land and natural resources comparative advantage (section 3). Section 3.1 showed that Uruguay has already implemented a series of actions that are conducive to green growth. Drawing on the insights of the technical assistance, this last sub-section aims at proposing a roadmap for the design of a national green growth strategy[17]. The analysis and examples focus on the agricultural sector and the management of natural resources. Sectorial development projects and policies, regardless of their green attributes, must be framed within a comprehensive approach and not be treated in isolation. For example, a plan to protect family farmers in the Santa Lucia River basin in the face of an immediate financial crisis may be a short-term step to promote environmentally sustainable development, for example by directing small farmer support towards soil and water conservation investments in one of the most critical watersheds in the country. A green growth strategy should provide a common sense of direction for all relevant stakeholders, and must be designed with a sustainable lens in mind, before one can evaluate interventions' outcomes.

First step: Identify the growth drivers of green growth

Environmental – or green – policies need not be exclusively to protect the environment: they can in fact be a driving force for growth and development. A starting point for the design of the strategy is to identify which current and potential green policies can be contributors to

17 The roadmap is based on the World Bank team's insights from the technical assistance and on World Bank (2012), and does not arise from an explicit national consultation process.

higher economic outputs. World Bank (2012) highlights that environmental policies can contribute to growth through four channels: (i) inputs, i.e. increasing production factors; (ii) efficiency, i.e. reducing wasteful use of inputs; (iii) stimulus, i.e. stimulating the economy during recessions; (iv) innovation, i.e. accelerating the adoption of technologies. Some of these are directly relevant to Uruguay and are illustrated.

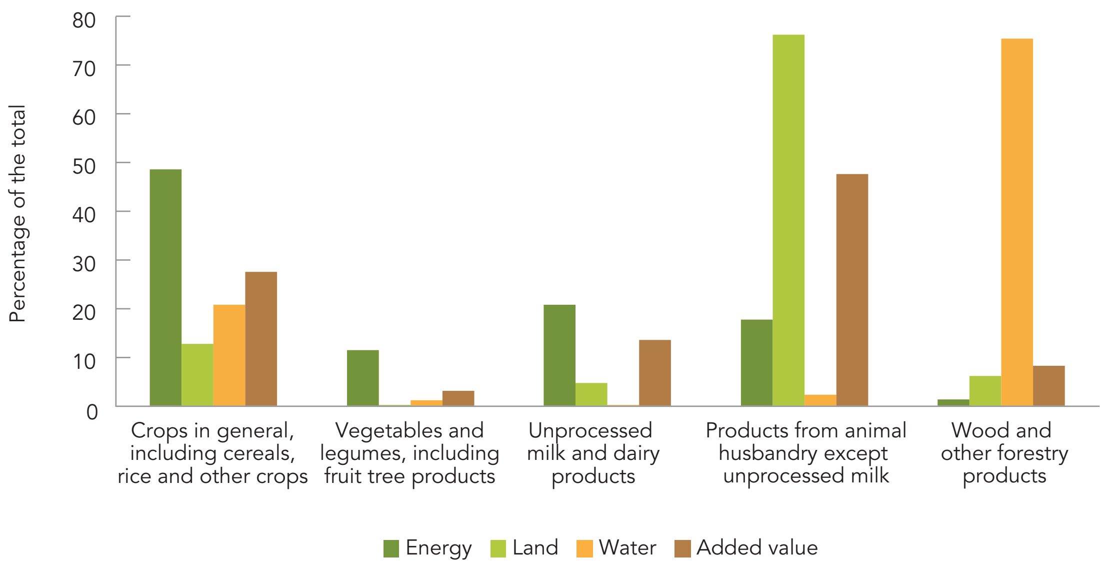
Policies to increase the availability of water during dry periods are an example of interventions that promote increases in factors of production. As noted in section 3, despite the water abundance when measured in yearly average, Uruguay suffers naturally from an extreme variability of the resource's availability. December to March is the period with most current water deficit for agriculture and conflicts may arise to satisfy the needs of the farmers in the irrigation sector, other users and water for the environment. In addition, water deficit can also be amplified because of a changing climate. As such, policies that support water saving and investments in water storage – while taking into account trade-offs and competing uses – are policies that boost the availability of a critical factor of production and hence allow increases in output.

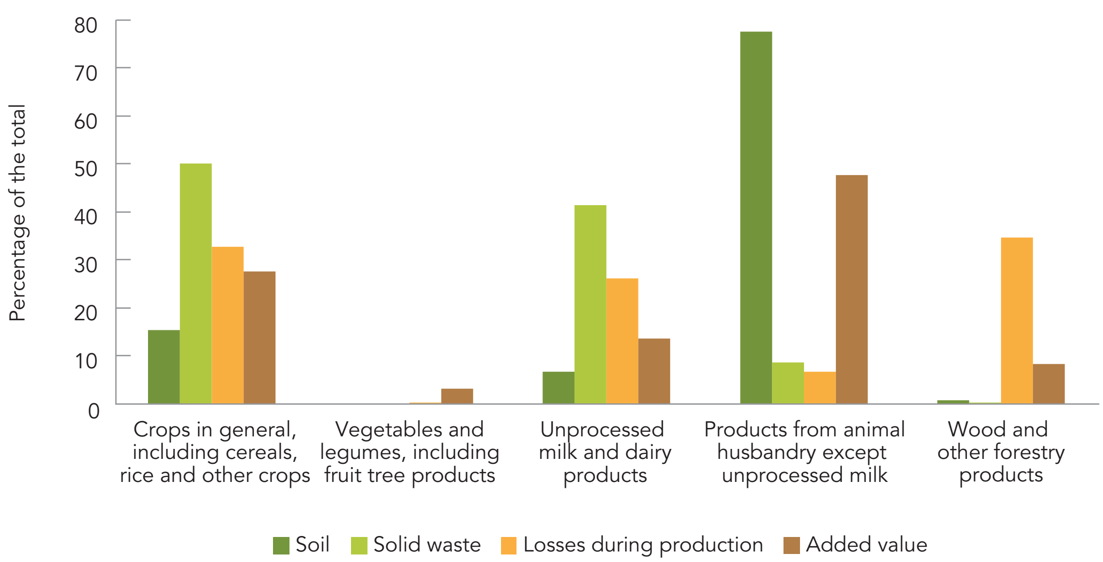
Green policies also contribute to growth by increasing efficiency in the use of production factors or by mitigating negative externalities. Again, water use efficiency is a particular case in point. More efficient use of water, allows to push agricultural production to its maximum potential. Natural capital accounting can be a key tool to track efficiency in the use of production factors. The contribution of the agricultural sector to the economy in Uruguay is relatively high as compared to high income countries, and thus a complete picture of the relationship between this sector and natural capital, is relevant for public policy. As a way to better illustrate, the national level pilot on Agriculture-Environmental account, developed during the technical assistance (Castañeda & Castera, 2018), provides preliminary *back of the envelope* information on the uses of natural resource inputs and on the negative effects of production. Figure 7[18] shows that cereal and sylvicultural production put much pressure on water resources (over 80 percent of total withdrawals), while cattle production intensively draws on land reflected not only in terms of spatial use (close to 80 percent of total land use), but also in terms of soil losses (more than 70 percent of total losses). Comparisons between economic sectors allow to understand how decisions in one sector can affect the performance of other sectors, not only in economic terms but also in relation to their impacts on the environment.

Another example of the efficiency channel is related to sustainable beef production. The implementation of sustainable practices in beef production could increase productivity by improving animal growth, reproductivity rate and health. Work by FAO suggests that the *"implementation of recommended sustainable practices could help reduce GHG emission in Uruguay by up to 43 percent and increase production in live weight terms by up to 200 percent"* (FAO & New Zealand Agricultural Greenhouse Gas Research Centre, 2017). These practices differ accordingly to livestock operational systems, and could be complemented with forage and manure management practices to increase the reduction on Uruguay's GHG emission (detailed information can be found in Criscuolo & Cuomo, 2018).

18 Owing to data gaps, these numbers are still very rough. In the future, more reliable data and a higher level of disaggregation of the economic activities would enhance the accuracy and comprehensiveness of these conclusions. For example, it is known from initial estimates that rice requires almost 100 per cent of the water required to produce cereals and oilseeds, so relevant information is lost when adding all the cereals in a single group. In any case, as the accounts portfolio is broadened, comparisons with all sectors of the economy will allow a better understanding of how decisions in one sector can affect the performance of other sectors, not only in economic matters but also in their relationship with the environment.

Figure 7. Illustrative use of Strategic Environmental and Economic Accounts to show the contribution of the environment to the agricultural sector (upper panel) and the impacts of the agricultural sector to the environment (lower panel) for 2015.





Source: Castañeda & Castera, 2018.
Note: The graphs are expressed as a percentage of the total for each variable, for the five sectors. The five sectors respond to the classification of economic activities of the Central Bank of Uruguay. Losses during production are those that occur during harvest or extraction, for example, the wood that remains in the forest. Solid waste includes all those waste generated by the productive activity, including organic and inorganic waste.

Second step: Identify environmental benefits and lock-in risks

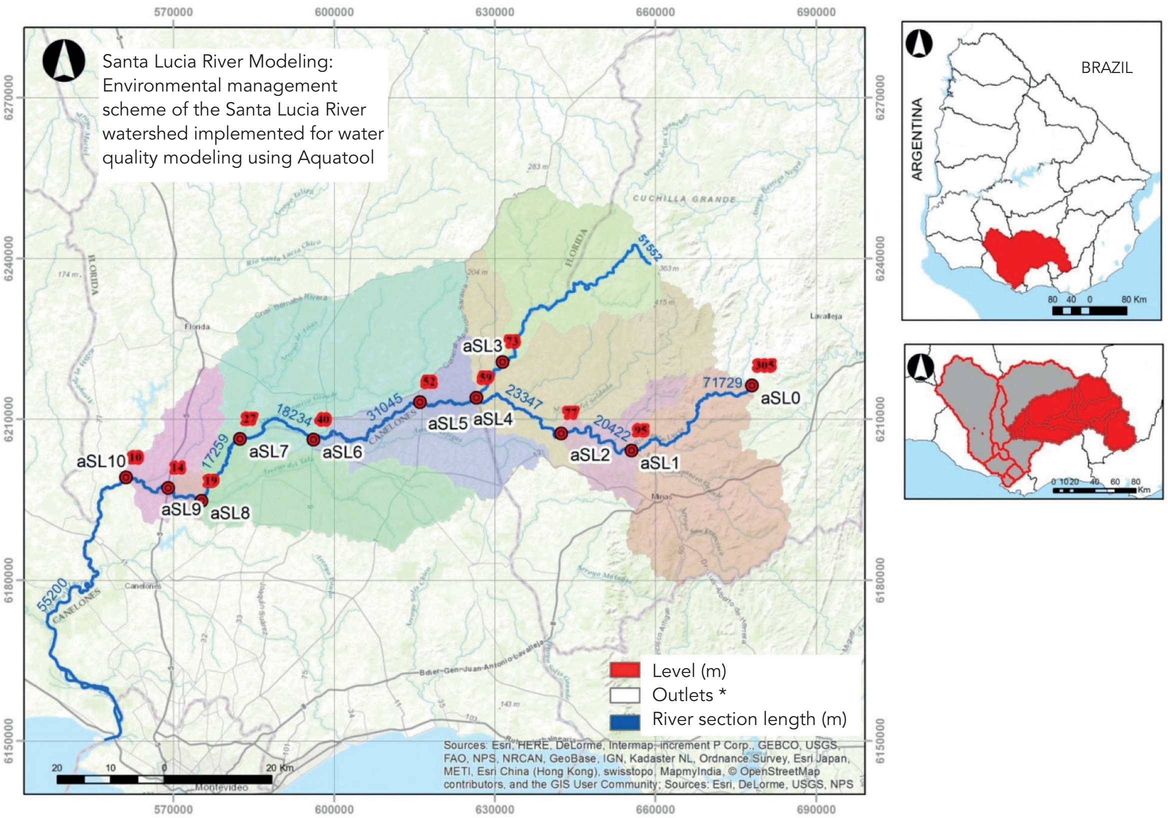
While environmental policies can contribute to growth, they certainly contribute to environmental quality and possibly to avoid irreversibility. Having taken into account the 'growth' dimension of green growth, the next step is to focus on environmental objectives for welfare improvements that exclude "grow dirty, clean up later" options. It is important to identify which environmental policies have the greatest impact on the economy, and on the welfare of the population with an eye towards disadvantaged groups. For example, water quality is certainly an important aspect of the quality of life of the population in urban centers and improvements in the quality of surface water can reduce costs of treatment by OSE and thus have a reduced impact on the national budget and / or in the costs paid by potable water users or taxpayers. It is also important to identify potential irreversibilities and weigh in the possible costs. For example, committing large areas of agricultural land to genetically modified crops could be extremely costly, in the future, if the country decides to enter new markets for non-GMO products at a later stage.

Building a solid information base is key to identify the environmental policies most important to welfare. In order to improve the understanding of the interlinkages between land use activities and water pollution in the Santa Lucia River watershed, the green growth technical assistance supported the design and implementation of a water quality modeling tool for nutrient pollution (Miralles & Trier, 2018). The implementation of the water quality modeling tool contemplated the characteristics of water quality issues in the Santa Lucia River watershed (important contribution of diffuse pollution); technical capacities in national institutions (MVOTMA, MGAP, SNAACC and academia); and the so-far developed informational and modeling tools available globally. The software package used was Aquatool, developed by the University of Valencia (Spain), and is applicable for medium and long-term environmental management and planning, with a monthly temporal step. By feeding the model with field data - physical, hydraulic-hydrological and water quality- the model estimates water quality parameters in geographic locations – or nodes – predefined by the modeler (Figure 8). Using pre-existing field data, the Santa Lucia River watershed model was adjusted to reproduce how the watershed operates, resulting in reliable prediction and the ability to simulate scenarios with different land uses and water quality.

The water quality modeling tool represents a highly valuable information tool to evaluate environmental performance of different policy measures and climate scenarios. The modeling tool meets previously unsatisfied needs of analysts and decision-makers and can be used for numerous purposes, such as identifying and quantifying impacts from existing interventions within the watershed (where, when, how, and an evaluation of the impact on environmental quality); assessing the potential impacts of new activities for granting installation or operation permits; tracking and evaluating the efficiency of the measures implemented through the "11 Measures" Action Plan (identifying success stories and better practices); and analyzing the impacts and benefits of the implementation of infrastructure (both gray or natural). Furthermore, the model is apt to forecast the Santa Lucia River watershed's response under different hypothetical scenarios, which could include changes in the land use and practices, and changes in hydrological patterns due to climate change. It could also be used to identify combinations of productive systems in the watershed that would target specific environmental goals, e.g. to meet water quality standards, to minimize GHG emissions, among others.

Integrating the water quality tool in decision making can contribute to identify synergies

Figure 8. Simulation of pollutant loads in the Santa Lucia River with the Aquatool model.



* The outlets are named using the format aSLX, where X represents a number

Source: Miralles & Trier, 2018.

between various sectoral efforts. For instance, an effort is being carried out by MGAP and the School of Agronomy of the University of the Republic, which aims at developing a modeling tool to quantify phosphorus export from soil. Once finalized, simulations could be performed with the water quality tool, after adjusting soil parameters in the model, to better understand the interlinkages between the loss of phosphorus in the soil and phosphorus levels in water. Similarly, the water quality model could estimate the impact that the implementation of the Sustainable Dairy Plan effort, under the DACC project, would have on the Santa Lucia River watershed system. In turn, the integration of the water quality modeling tool in operational matters, would demand maintenance, software updates and inserting more field data. As a result, the tool would be elevated as a sustainable resource to support decision-makers. Figure 9 illustrates an example of how the water modeling tool could contribute to inform decisions under a green growth approach.

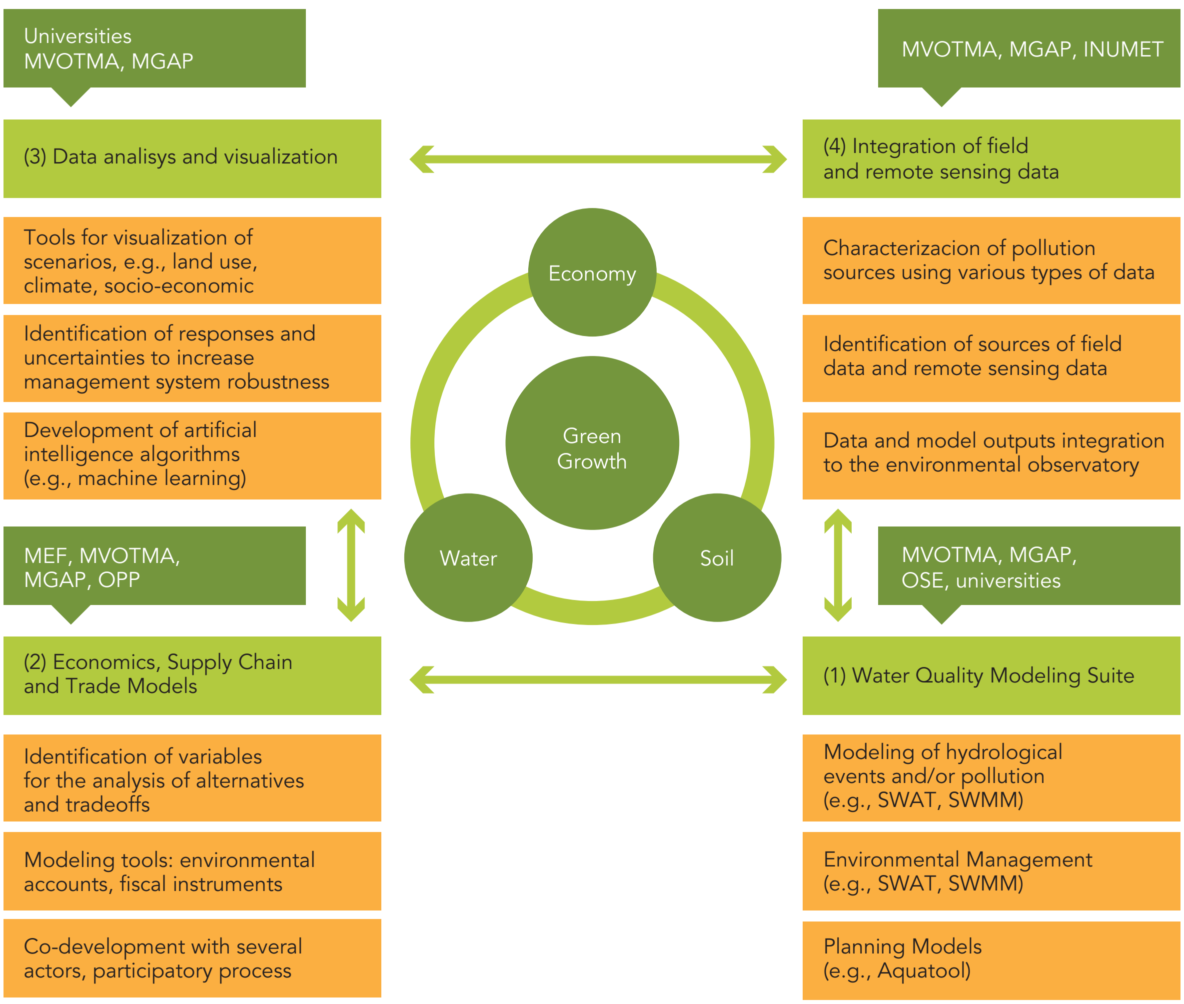
Third step: Prioritize intervention areas

The next step in delineating a green growth strategy is to identify the criteria to prioritize the sectors and areas of intervention. The identification of criteria for the prioritization exercise must take into account dimensions such as urgency and risks

Figure 9. Conceptual framework for the integration of watershed nutrient modelling activities in a green growth program.

The conceptual framework shows the elements for the country to achieve the development of a series of water quality modeling tools (1), both at the planning level (monthly time step) and at the level of environmental management (daily time step) and of response to hydrological or pollution events (subdaily time step). This suite of water quality models would require outputs of economic models (2) (for example, water demand) as inputs. These economic models would be the ones used by institutions in the country for planning and management of economic activities. In turn, the water quality models would provide information that could be used to feed the economic models.

In addition, the suite of water quality models would serve as a platform to integrate and analyze data from field measurements and remote sensing data (4). These datasets would be collected by different institutions in the country through monitoring activities, conducting data analysis and using visualization tools (3). This framework integrates coherently the country's data and model activities, and enables that each activity to interact with the others. In this way, this framework maximizes the exchange and update of the information used to make decisions, strengthening the country's green growth strategy.



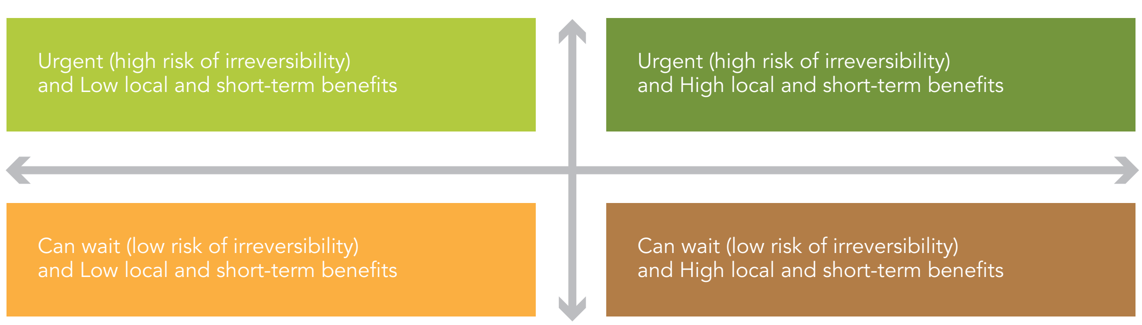
Source: Miralles & Trier, 2018.

of irreversibility, and the possibility of generating tangible benefits locally and in the short term. Some decisions made today may have long-term implications. For example, doubling or tripling the capacity of OSE for the treatment of drinking water could mean increases in public debt and higher taxes in the future. On the other hand, some decisions may have immediate benefits and have controlled costs, or higher net benefits. For example, the establishment of plantations in key riparian zones could generate hydrological benefits and at the same time be feasible with only limited resources. The recommendation is then to prioritize actions that generate immediate tangible benefits, which in turn can help the green growth agenda gain momentum, and help avoid irreversible and potentially harmful decisions.

Priorities can be set across two dimensions: (i) synergies between different types of benefits (e.g. local / short term); (ii) urgency of action. Figure 10 shows a possible framework, adapted from World Bank (2012). The figure categorizes actions into four types. The positive section of the vertical axis contains the activities that need to be done urgently, to avoid getting locked into unsustainable paths. The negative section contains actions that can wait. Along the horizontal axis one can find actions/policies that provide high local and short-term benefits (positive values) and those that provide benefits in the longer term or with limited impact locally (negative values). Priority should be given to activities that avoid lock-ins (and are thus urgent) and which provide immediate and local benefits (economic, financial, environmental, health-related, social) by creating synergies. These are found in the top-right quadrant of the diagram. Lowest priority should be given to actions that are less urgent and whose benefits occur in the longer-term and which do not impact the local economy directly (bottom-right quadrant). It is important to note that the categorization of the actions here included, is case dependent, depending on country's context, political agenda and income level.

Prioritization can happen at different scales, even within specific sectors or themes. For example, the markets opportunity study (Criscuolo & Cuomo, 2018) allows to identify priorities for the specific case of green upgrading of a number of value chains such as sustainable beef, organic diary and non-GM soy (Figure 11). Scaling up the efforts to promote exports of sustainable beef, could be a priority. Uruguayan production methods are already consistent with existing labels and some certifications have been approved (e.g. Never Ever 3). This means that the benefits of actions can be materialized in the short term and the country can avoid investing in technologies than can be costly to reverse in the future. A potential action Uruguay could

Figure 10. Scheme for priority setting.



Source: own elaboration from World Bank, 2012.

Figure 11. Priority setting applied to green upgrading in agriculture.

	Low local and short-term benefits	High local and short-term benefits
Urgent (high risk of irreversibility)	--	Scale up sustainable beef production and exports.
Can wait (low risk of irreversibility)	Develop organic diary industry.	--

Source: own elaboration from World Bank, 2012.

explore is to enlarge and integrate its sustainable beef production systems. Finally, organic diary could represent a priority for future action. Organic production requirements are extensive and time consuming (i.e. 2-3 years of transition for pastures). This said, the overall production could be adjusted without significant obstacles considering the "Never Ever 3" policy. Regarding non-GMO soy production, it could represent a second-order priority. Most of soy in Uruguay today is GMO. So, in spite of the potential need to avoid the side effect of pesticide dependence, significant changes in production and logistics would be necessary, alongside the need to develop a certification agency. However, further analysis should be conducted to better decide its prioritization level for Uruguay.

Fourth step: Design policies

The next step is to identify the types of policy instruments that could help achieve environmental objectives while promoting sustained growth and social welfare. Fiscal policy and economic incentives can play a key role in this regard. Colombia has approved a carbon tax in December 2016 with the explicit objective of fulfilling the commitments acquired with the ratification of the Paris Climate Agreement. The tax is a levy on the carbon content of fossil fuels, including all petroleum derivatives and all types of fossil gas that are used for energy purposes, provided they are used for combustion. As an economic instrument, by generating an additional cost on fuels, the tax seeks to reduce carbon dioxide emissions generated by its use while promoting a transition to alternative sources of energy.

If the mitigation of non-point source pollution from agriculture were to be a priority in Uruguay, the next step would be to consider the design of appropriate policy instruments. This case has been extensively analyzed in the green growth technical assistance (Piaggio et al., 2018). Non-point pollution can originate in vast territories and from multiple agents' actions. Pollution loads will depend on the complex interaction of many variables such as geographic location, climate, soil and topography. Moreover, effects can be cumulative. As a result, emissions from specific farmers are very hard – or prohibitively costly – to monitor, and the regulator is often able to only identify the aggregate effect. Furthermore, when other sources are present, the segregation of the contributions between these and non-point pollution is extremely challenging. In order to overcome these challenges, the design of the economic instrument should count with the engagement of all involved stakeholders and

reliable technical information, and may rely on indirect indicators of emissions.

Different policy instruments can be used to reduce non-point source pollution, spanning from pure command and control regulatory measures to mandatory economic instruments and voluntary mechanisms. Policy instruments can be classified in four categories: (i) instruments that use existing markets (e.g. emission taxes, input subsidies); (ii) instruments that create markets (e.g. tradable emission permits); (iii) regulations[19] (e.g. standards, prohibitions, zoning); (iv) voluntary agreements that include social participation (e.g. education programs, conservation payments, information). All categories of instruments aim at changing behaviors, but they act through different mechanisms. The first two aim at changing the relative prices that agents face when making production decisions. Regulations, on the other end are based on prohibitions and control. Voluntary agreements are non-binding and as such, environmental quality targets are not the prerogative of the regulator but also depend on the level of participation. These instruments are usually not mutually exclusive but complementary. For example, taxes (instruments that use existing markets) need to be inserted in a legal framework, as this framework includes regulations on minimum standards and the non-compliance of the regulations are sanctioned by fines. Thus, a combination of the instruments should be put in practice to reach the desirable environmental targets. Box 3 presents a synthesis of landmark international experiences and lessons learned in the design of policies for reducing non-point nutrient pollution.

Reducing pollution at the least cost to society is paramount and economic incentives can help achieve this goal. For command and control instruments to be implemented at the least possible cost, the regulator should ideally have information on each agent's ability to comply with the regulation and apply regulations selectively. It is inefficient to ask producers to reduce emissions to a certain standard if this comes at prohibitive costs, risking the shutdown of the productive activity. At the same time, it is inefficient to set light targets for everyone as society will pay the social cost of pollution while there may be producers that can meet more ambitious pollution reduction targets. However, producer specific abatement cost curves are difficult to estimate. Economic instruments, both those that use existing markets and those that create new markets, overcome this difficulty by letting each producer decide whether they prefer to cut emissions or pay the pollution price explicitly or implicitly established by the policy. Yet, they also need to be carefully designed and this technical assistance sheds light on this by looking at the international experience on economic instruments and drawing some lessons for Uruguay.

The technical assistance identified a number of untapped opportunities for designing economic incentives to control non-point source pollution in agriculture. Generally, the removal of fiscal or tax benefits that cause negative externalities over other agents or the environment usually results in an increase in social welfare as the loss of the agents that no longer receive the subsidy are smaller than the social benefits of the avoided externality. Several tax benefits on fertilizers use are in place in Uruguay. These tax benefits could be indirectly and unintentionally contributing to nutrient pollution. Table 1 elaborates on these benefits, which refer to two different tax systems – Income Tax on Economic Activities (IRAE; generally large producers) and Tax on the Sale of Agricultural Goods (IMEBA; generally small producers). An option that could be explored is the elimination of the refund and credits associated with the procurement of phosphate fertilizers by IMEBA and IRAE taxpayers, or direct these funds to practices associated with lower nutrient

19 The regulations category includes command and control instruments, which refer to the case in which regulators command polluters to adopt certain practices or measures to control pollution.

Table 1. Characterization of the Income Tax on Economic Activities (IRAE) and Tax on the Sale of Agricultural Goods (IMEBA) for agricultural producers.

	IRAE	IMEBA
Who?	The taxpayer may choose to pay IRAE or IMEBA, except in the following cases in which IRAE must always be taxed: • Annual billing > 2: Index Units ($UY 7: until June 2017) • >1500 ha. CONEAT index 100 at the beginning of the year • Income from sales of fixed assets and "productive associations" • Holdings that adopted the legal form of Public Limited Companies or Limited Partnerships for Shares • Permanent establishments of non-resident entities, Investment Funds and Trusts	
Rate	25 percent of net tax income	Fees vary according to the product sold, between 0.1 and 2.5 percent
Acquisition of phosphate fertilizers	40 percent of the purchase of phosphate fertilizers is computed as investment, receiving the corresponding exemptions in the income statement	Receives a credit equivalent to 12 percent of the purchases of phosphate fertilizers (Art. 24 Law N° 18,341 of 2008)
Agricultural services	VAT exemption	
Acquisition of registered fertilizers	VAT exemption on registered fertilizers, as well as various goods and packaging related to the application and storage of fertilizers (Art. 39 Decree 39/990)	
Import of registered fertilizers	VAT exemption on registered fertilizers	
Costs included in Tax filing	They can compute some costs, such as purchasing seed, or advisors' fees (advisory services for environmental management may be included) for a value of 1.5 times.	

Source: prepared based on interviews with experts from DGI, MGAP (Office of Agricultural Planning and Policy (OPyPA) and MVOTMA (DINAMA); Piaggio et al., 2018.

exports. Moreover, the current value added tax (IVA for its acronym in Spanish) exemption for agricultural services could be modified so as to only apply to strictly sustainable practices for the application of fertilizers (e.g. placement) and the acquisition of machinery for the adoption of these practices could be included under existing subsidies programs (e.g. P + L). Similarly, the ongoing IVA tax exemption on registered fertilizers could be differentiated according to their potential damage and the practice used for their application.

A further opportunity for the design of incentives to control pollution in agriculture is provided by the ambitious Sustainable Dairy Plans program. The program could be improved with the establishment of a market for tradable emissions permits. The incentive could importantly promote the sharing of information on fertilizers use by farmers. Currently, the Sustainable Dairy Plans include the submission from farmers of a fertilization plan for dairy production, so some instruments could be aggregated to gather information about individual contribution to

Box 3. International experience in the use of policy instruments for non-point sources pollution in agriculture.

The polluter-pays principle is not ubiquitously used in policy instruments for non-point pollution but some important exemptions are noteworthy. The "polluter pays" principle is applied to make the firm or agent responsible for producing the pollution also responsible for paying the damage caused to the environment. However, globally, the wide use of voluntary instruments suggests the prevalence of an approach that leaves the role of clean up to the State. Some countries in the EU have good examples of the application of the polluter-pays principle, including the ones that put a price on agricultural inputs. The Netherlands charged a tax on excess nitrogen and phosphorus in soil, establishing thresholds and an increasing block tariff system. Norway charged a pesticide tax that was estimated based on the toxicity of the input and the proximity of its application to sensitive areas. With respect to taxes based on active principle in fertilizers, several countries have implemented them, currently being Denmark the only country that continues to apply this type of tax.

With respect to instruments that create markets for non-point source pollution, the nutrient cap-and-trade markets of Lago Taupo in New Zealand and of Netherlands are particularly notable. The power of marketable permits is that it allows firms to buy emission permits when their pollution abatement costs are relatively high and it allows firms that invest in cleaner technologies to earn money by selling their surplus permits. The program established in Lago Taupo aims at reducing nitrogen pollution from agriculture by 20 percent by 2020. In 2010, the regional government launched a cap-and-trade market, calculating the farmers' emission permits from their nitrogen management plans. This market is complemented with environmental protection actions. Progress achieved so far suggests that the target will be successfully met (Kerr et al., 2015). Similarly, the Netherlands aimed at managing animal manure through a mechanism of market transactions to reduce pollution from animal waste deposited in soil. Permits were associated with fertilizer production and quotas could only be traded between regions with shortages to regions with excess nutrients in soil. This system was based on the expected phosphate content in manure (from the type of animal and other factors). Even though this system was removed, it could be replicated elsewhere as a useful tool to solve the problem of nutrient pollution in highly intensive animal production areas (Shortle, 2012).

Important lessons learned to implement successful economic instruments to manage diffuse pollution from agriculture include: (i) build a consensus between the regulator and the producers, on the basis that society at large benefits from the reform; (ii) develop instruments gradually, as a learning by doing process and with the active participation of producers; (iii) provide producers the access to information so they understand how their actions can affect pollution levels in the environment; and (iv) foresee substitute technologies available to farmers in the design of new economic instruments to avoid producers bearing the full cost of the policy and getting out of business.

nutrient pollution. One option to improve the current situation is the establishment of a deposit/refund scheme on the use of fertilizers and livestock feed. A tax would be applied ex-ante on these inputs and it would be returned after the submission of information about actual nutrient exports. The information collected through this scheme could be an input for the design of an economic instrument, for instance, a market for animal manure quota as the one used in Netherlands (described in Box 3). This market would allow the trade of rights between manure producers and agricultural farmers. Another option could be the implementation, for example, on a watershed scale, of a cap-and-trade system for the application of fertilizers, limiting the total amount of nutrients inputs. The case of Lake Taupo, New Zealand, which applies to nitrogen is noteworthy. The trading scheme in Lake Taupo is complemented with a conservation fund to mitigate pollution. Special consideration should be given to the mechanisms for assigning emission permits and to align relevant actors.

Even though the recommendations provided through the technical assistance have a strong focus on nutrient pollution, some of them could be used to strengthen ongoing efforts related to broader environmental issues. For example, some of the recommendations presented above can be used to contribute to Uruguay's climate change targets. For instance, cap-and-trade systems could be adapted to the case of GHG emissions. Similarly, the implementation of tradable fertilizer quotas, such as the one implemented in the Netherlands, in the Santa Lucia River watershed could be analyzed. This quota system would enable permit transactions between fertilizer producers (for example, dairy establishments) and fertilizer consumers, including crops farmers. Each one of these instruments would contribute to foster Uruguay's green growth path while safeguarding the country's food production objectives.

Fifth step: Monitor and evaluate

Finally, a green growth strategy should establish the mechanism for evaluating and adjusting green growth policies. A successful strategy must be both clear and flexible, and its provisions must balance feasibility and ambition. The relationship between the economy and environmental quality is governed by complex interactions. Our understanding of this relationship is likely to evolve thanks to technological progress, environmental information and, particularly in the case of Uruguay, the evolution of consumer preferences at the international level. The creation of an information system for environmental management, emphasized by SNAACC in several of the meetings during the technical assistance, the establishment of environmental quality monitoring systems and the implementation of a natural capital accounting are key to allow a green growth strategy to be updated as the knowledge base evolves.

An example of adaptive planning is the process by which Uruguay is designing a second-generation plan for the Santa Lucia River Basin. This has been a key contribution of the green growth technical assistance, which has piggybacked on the water quality modelling tool described above. The plan outlines sequential activities that are instrumental for the identification and selection of future scenarios that Uruguay should move forward to. These activities are expected to be finalized by June 2018 and include: the definition of thresholds on nutrient loads for the Santa Lucia River watershed (water quality indicators to be monitored, and frequency and location for collection of data); the simulation of the measures included in the "11 Measures" Action Plan promulgated by MVOTMA to evaluate the impacts/benefits associated with each one of the measures; the analysis and simulation of additional measures that could potentially contribute to improve water quality; and the identification and selection of those that are to be the most impactful ones for the recovery

of water quality in the Santa Lucia River. The water quality modeling tool will be instrumental for the implementation of these activities and the findings obtained will provide rich information for the elaboration of the new Plan.

Final remarks: building the institutions for green growth

Uruguay's path towards green growth has already begun. At the national policy level, Uruguay today enforces one of the most advanced soil protection regimes for arable land in the world. In 1982, Uruguay passed a Soil and Water Conservation Law (Law Nº 15.239) that established the background and technical rules for the preservation of soils and waters with agricultural purposes and the recovery of eroded soils. In light of this law, and of the promulgation of the 2015 budget law (Law Nº 19.355), soil use and management plans became a requirement for any farmer cultivating over 100 hectares of arable land if owned and over 50 hectares if rented. By October 2017, 12,493 plans have been presented, covering 1.88 million hectares and 96 percent of all crop producers over 100 hectares. In addition, Uruguay has set action plans for the protection of environmental and drinking water sources in strategic watersheds (MVOTMA, 2013; MVOTMA, 2015). At the international level, Uruguay's First Nationally Determined Contribution (NDC) to the UN Framework Convention on Climate Change (UNFCCC) includes targets and actions for the reduction of the methane and nitrous oxide emissions intensities of beef per production unit, for carbon sequestration principally through afforestation and keep the organic carbon in soil, and for the reduction of carbon dioxide emissions intensity particularly for the energy and transport sector. Up to date, Uruguay has already achieved substantial progress in the areas of electricity generation and afforestation.

Continuing along this path will require institutions and political leadership. In this sense, the creation of the SNAACC has been a critical milestone in Uruguay's efforts towards sustainable development. Created in 2015 through law 19.335/2015 and its regulatory decree 172/2016, SNAACC plays a key role in natural resources management by improving interministerial coordination and promoting more sustainable natural resources management. SNAACC is directly attached to the Presidency and is responsible for articulating and coordinating public and private institutions and organizations for the design of public policies related to the environment, water resources and climate change. SNAACC is part of the National Environment System (SNA, from the Spanish acronym). In addition, under the purview of the Environment Cabinet, it manages and monitors inter-ministerial agreements related to environmental policies and it provides technical and operational support to ministries and other public entities. As a national green growth strategy takes form, anchoring the vision to a solid institutional framework will be key for the very sustainability of this vision.

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Complementary Studies

Abstracts

1. Market opportunities for green upgrading and innovation

Criscuolo & Cuomo, 2018

Sustainability demand analysis for the beef, soy, dairy and tourism industries

Uruguay is emerging as a green growth champion worldwide. The country's successful growth model is rooted in the country's rich natural asset base. Currently, about 30 percent of jobs are linked to the export sector, which is in turn highly dependent on soils, forests, water and landscapes. Uruguay has already made important strides in green growth, particularly through the implementation of forward looking environmental policies and programs, and has already used sustainable practices as a key driver of trade competitiveness. Greater integration in global (and regional) value chains, and specifically the identification of higher-value-added activities in sustainable segments, will be a critical priority as the country's limited size prevents it from benefitting from large economies of scale.

The report presents a demand analysis of green international market segments of key conventional Uruguayan exports (beef, dairy, soy and tourism) from an economic perspective. These sectors were chosen because of their large share of exports (over 50 percent of total value in 2014) and their intensive use of Uruguay's natural assets. Greener products may help to diversify exports into higher value-added niches, at the same time favoring investments in skills and boosting the adoption of new technologies and practices.

This analysis is based on a literature review of specialized publications on beef, soybean, dairy, and sustainable tourism, consultations with relevant industry specialists, and compilation of available data sources, including the commissioning of two technical market reports on sustainable beef and organic milk powder, as well as three reports of the Food and Agriculture Organization of the United Nations on the environmental benefits of these "green" commodities.

The report touches upon "green" and "sustainable" beef, which refers to several labels

(naturally raised, organic, grass-fed) that are also used to identify quality attributes and can go from less to more environmental-friendly practices, thus implying less or more stringent requirements. The report digs deep in the differences between these labels. In terms of green soy, the report specifically addresses the potential of non-genetically modified soybeans, as they bring long term environmental benefits by using fewer agrochemicals (herbicides), and promote integrated conservation agriculture (i.e. minimum tillage). In terms of dairy, this report focuses on organic dairy, due to the significant economic premiums associated with organic labels and requires no agrochemicals, no antibiotics supplied to the animals, animals eating feed that better suit their nature. The analysis of these markets, in terms of geography, puts emphasis on Uruguay's key export destinations, such as the European Union, Unites States and Asia, including China. Sustainable tourism is an approach to management of tourism and involves several types of tourism. Focus is given to adventure tourism and ecotourism.

The report finds that there are important growth prospects and attractive price margins in the segments of sustainable beef, non-genetically modified (non-GM) soy, and organic dairy, and a potential to strengthen Uruguay's international offer of sustainable tourism. The analysis shows that there is a strong demand for these green products, expected to grow between 6 (sustainable beef) and 40 (adventure tourism) per cent per year in the next five years (11 per cent for organic dairy, 16 per cent for non-GM soy). The forecasts value wise (volume wise) for 2021 are: US$11.2 billion (1.8 million metric tons) for sustainable beef, US$31 billion for organic dairy, US$11.5 billion (10 million metric tons) for soy, US$ 3.7 trillion for sustainable tourism, along with higher markups and environmental benefits when compared to conventional products.

In addition to the economic benefits of a green growth international integration strategy, there are important environmental co-benefits associated with the sustainable production and processing practices of "green" value chains. For example, the introduction of sustainable practices for beef could help reduce greenhouse gasses emission in Uruguay by up to 43 percent and increase production in live weight terms by up to 200 percent[20]. Similarly, the introduction of non-GM soy associated with sustainable crop and soil management practices can lead to a significant reduction of the use of pesticides and herbicides[21]. Organic cattle production, as part of the organic dairy value chain, represents a farming practice able to preserve soil health, while reducing environmental pollution from nutrient runoff and from potentially polluting compounds, such as pesticides, and minimizing antibiotics resistance amongst cattle[22].

Overall, this report sheds light on strong demand niches that could provide new opportunities to Uruguay and provides recommendations for further work. Among the four sectors analyzed, sustainable beef is a low hanging fruit that further analysis could focus on. Uruguayan beef production methods are already consistent with existing labels and the country has already been certified by some high-standards certifications (e.g. Never Ever 3 - cattle that have not received antibiotics, hormones or proteins of animal origin), thus further certification could be explored to adopt an export "Organic+" strategy to the US.

20 Food and Agriculture Organization of the United Nations; New Zealand Agricultural Greenhouse Gas Research Centre. (2017). *Low-carbon development of the beef cattle sector in Uruguay, reducing enteric methane for food security and livelihoods.* Rome: Food and Agriculture Organization of the United Nations; the Ministry of Livestock, Agriculture and Fisheries, Uruguay; the New Zealand Government and the Climate and Clean Air Coalition.

21 Gomiero, T., & Flammini, A. (2017a. unpublished). *Targeting the global market for organic powdered milk: how would the limitation on the use of synthetic fertilizers affect nutrient runoff from dairy production in Uruguay?* Food and Agriculture Organization of the United Nations.

22 Gomiero, T., & Flammini, A. (2017b. unpublished). *Uruguay green growth: targeting non-GMO soya.* Food & Agriculture Organization of the United Nations.

This strategy could involve, for high quality cuts, a combination of environmentally-friendly farming practices that promote low greenhouse gasses emission with organic and grass-fed certifications. For non-premium cuts, producers could explore the opportunity to provide both sustainability and quality assurance to food service industries at a premium compared to conventional beef.

In addition, Uruguay could potentially look at attractive segments in the other sectors analyzed, particularly in the organic dairy and sustainable tourism markets. Uruguay could explore the organic milk powder niche to take advantage of a 5-times markup compared to conventional milk powder. Organic production requirements are extensive and time consuming (i.e. 2-3 years of transition for pastures), but overall production could be adjusted without significant obstacles considering Uruguay already fulfills the Never Ever 3 requirements. The implications of organic production practices in production efficiency is analyzed. To fully take advantage of growing opportunities in the tourism market, a different strategy to pursue a more niche and differentiated market beyond improving the existing offerings, particularly centered on "beach and sun", is needed. Uruguay already has the potential assets to attract more tourists sensitive to sustainability issues. However, regarding the fourth sector analyzed, soy, preliminary results indicate that shifting soy production in Uruguay to non-GM would present significant costs in terms of logistics and production practices. All these compelling findings should be complemented with a further supply-side and gap analysis, which will help formulating actionable recommendations for Uruguayan firms to be able to compete in the identified green market segments.

The full study is available at the following link: www.worldbank.org/uy

2. Modeling water quality and updating the action plan for water quality in the Santa Lucia River basin

Miralles & Trier, 2018

The Santa Lucia River basin is one of the most important river systems in Uruguay, due to its ecological features, its location and its diverse uses. Among other traits, it is the source that supplies drinking water to more than half of the national population, including the metropolitan area of Montevideo and nearby cities, as well as being an irrigation source for the most water-intensive agroindustry area in the country.

Due to the importance of this basin, the Government of Uruguay, through the National Secretariat of Environment, Water and Climate Change (SNAACC), the Ministry of Housing, Territorial Planning and Environment (MVOTMA), and the Ministry of Livestock, Agriculture and Fisheries (MGAP), among others, has underwent efforts to determine the watershed's environmental condition, evaluating the environmental impacts already occurring in the basin, and advancing on the estimation of the responses that the basin could give under different scenarios. Particularly, the improvement of water quality has been at the core of these efforts, driven by a significant deterioration of the water quality of the basin's waterways. In 2013, a severe eutrophication event affected the provision of drinking water to consumers, driving authorities to implement an Action Plan for the protection of the environment and drinking water sources (Action Plan for the Protection of Environmental Quality and Availability of Drinking Water Sources in the Santa Lucia River Basin). The complexity of the Santa Lucia River basin system is associated with environmental variability (annual climate, climatic cycles, changes in production systems) and the coexistence of very diverse water uses. This complexity requires that water quality assessment, as well as the study of system's response to different impacts, to be based on a long-term vision and on a multi-institutional approach.

In this context, the general objective of this study is to strengthen ongoing initiatives in Uruguay to address the problem of water pollution by nutrients in the Santa Lucia River basin, by promoting the consolidation and the sustainability of decision support tools relevant to the basin's environmental performance, and by learning from international experiences in nutrient management modeling at the watershed

scale. Methodologically, the activities developed as part of this study were founded on dialogue and collaboration between the technical team of the World Bank and several institutional technical teams of the Government of Uruguay.

Specifically, this study contributed to the creation of institutional capacities in the country for the development of quantitative tools to support nutrient management decision-making in the Santa Lucia River basin, and the initiation of the implementation of one of these tools. Additionally, this study involved the creation of a comprehensive roadmap for environmental quality protection, in order to promote further progress beyond the technical assistance timeframe. The roadmap's ultimate goal is to lay the foundations to ensure the continuity of a management framework that involves modeling activities and water quality data sources in Uruguay. This framework should be: integrative – combining optimally models and data -, flexible - allowing a wide variety of modifications without causing disruptions - and scalable - extendible to other areas of the country -, as has been agreed with several institutions in the country. This roadmap also includes specific actions for the update of the Action Plan (2G Plan), which is a high priority for the Government of Uruguay. The results emerged from this study will serve as inputs to the 2G Plan.

The tasks related to water quality modeling in the Santa Lucia River basin focused on developing a quantitative tool that generates objective and transparent information to support decision making in the basin by the different government agencies. For this, a work plan for the development of a simulation model of water quality in the Santa Lucia river basin was convened and executed, which followed the following steps: (i) conduct a detailed review of the modelling tools used by the National Directorate of the Environment (Aquatool platform) and their datasets; (ii) create a working group with the participation of technical teams from different government institutions (SNAACC, MVOTMA, MGAP) and universities, to design a water quality modeling strategy (nutrients) for the Santa Lucia River basin that could operate at different temporal and spatial scales, and that could be flexible and scalable enough to extend it to other basins in the country; (iii) learn from international experiences in nutrient management modeling at the watershed level and analyze the feasibility of incorporating remote sensing as a water quality data source for simulation models that could potentially be developed in the country.

As a result, a reliable water quality modeling tool was obtained for the Santa Lucia River, being cornerstone for the generation of information and for the support of the Action Plan updating process to improve the water quality in the basin. This tool, fed with inputs such as physical, hydrological (flows) and pollutant loads (from diffuse sources and segregated by sub-basins) field data, at entry data points, estimates water quality levels at points of interest. By using already available field data, the model of the Santa Lucia River basin was adjusted to reproduce how the system operates, resulting in a tool that can reliably simulate different scenarios of land use and water quality.

Finally, the roadmap includes recommendations for the development of a nutrient modeling strategy in the Santa Lucia River basin in the short (6 months) and medium term (2 years). This roadmap aims to contribute to a better understanding on nutrients sources and to help Uruguay's government agencies identify the appropriate tools and strategies to provide the necessary information to support decision-making regarding the prioritization and monitoring of actions to mitigate impacts on watershed's water quality. The roadmap consists of several components (some of which were initiated during the technical assistance): recommendations on data management and work structure, a roadmap for the elaboration of the 2G Plan, a roadmap for water quality modeling of the watershed, and additional insights to support the sustainability

of the modeling tool for water quality decision-making at the watershed level. Regarding the roadmap for water quality modelling, its purpose is to generate a system for water quality modeling that will enable the analysis of the system's responses to different actions and conditions in the basin such as: identify the impacts of interventions within the basin; predict environmental performance of potential initiatives to evaluate their approval by regulatory agencies; monitor the implementation of the Action Plan's individual measures, identify best practices, and determine the response capacity of the basin's water bodies; simulate scenarios, for example, pollutant load reduction, and changes in infrastructure (gray and natural).

Through this study, noteworthy progress was made on the development of a strategy for water quality modeling in watersheds, and the proposed roadmap promotes further progress in this direction. Important aspects to consider are the need to identify barriers in the implementation and the continuity of this effort in the Santa Lucia River basin and in other watersheds in the country, and to deploy the use of the modeling tool at different government action levels. In this way, the achievements of this technical assistance will be sustained and improved through training, model's maintenance, software and data updates, and through the incorporation of an adaptive planning approach to the operations of the institutions in Uruguay involved in the improvement of water quality in the Santa Lucia River basin.

The full study is available at the following link: www.worldbank.org/uy

3. Natural capital accounts of Uruguay: an initial approach and considerations for institutionalization

Castañeda & Castera, 2018

Uruguay's efforts to incorporate elements of green growth into public policy decisions have been channeled through various actions, particularly through the implementation of innovative environmental policies and programs. As part of these actions, a technical assistance was carried out between the Government of Uruguay and the World Bank during 2017-2018, with the objective of supporting policy dialogue to identify green growth pathways that could be incorporated to ongoing discussions and efforts. One of the objectives of the Uruguay Green Growth technical assistance was the development of case studies to identify the feasibility of implementing natural capital accounting (NCA), a methodology intended to help understand the state and trends of natural capital and its relationship with the economy. More specifically, the objective was to evaluate if NCA could be included in the statistics that are periodically disclosed by the country through the development of two pilot exercises: (i) environmental-agricultural account at the national level and (ii) water account for the Santa Lucia River basin. The development of these pilot exercises also had the purpose of developing local capacities that could continue this effort in the future and of introducing relevant institutions to the methodologies available to implement the NCA.

The use and application of approaches involving NCA in public policies and private decisions has spread throughout the world in recent years, particularly to inform on sustainable natural resources management. This approach goes beyond economic conventional indicators, such as the Gross Domestic Product (GDP), by factoring in physical and monetary aspects of variables that are not considered or that are not explicitly revealed in conventional economic statistics, such as the contribution of ecosystems. The System of Environmental and Economic Accounting (SCAE), recognized by the international statistical community, is the analytical framework to carry out the NCA. The SCAE is a satellite system of the System of National Accounts (SNA). It helps understand the contribution of natural assets, including ecosystems, to economic growth, and, at the same time, enables the examination of the impacts of the economy on natural capital. The SEEA has also been widely used as an integrating

framework to provide information to promote and sustain green growth.

As for the environmental-agricultural accounting pilot exercise, some preliminary estimates were obtained to understand the contribution of natural capital to the Uruguayan economy and the impacts of the economy on its natural capital. The results showed that some economic activities such as cereal production and forestry exert more pressure on water resources, while livestock uses a higher proportion of land in relation to other agricultural activities and contributes substantially to soil losses (more than 70 percent of the losses of all agricultural activities). The account includes the economic activities of agriculture, livestock and forestry in accordance with the definitions and classifications of the Central Bank of Uruguay, which are based on the group A of the International Standard Industrial Classification (ISIC). In general terms, in Uruguay these activities are called agricultural activities.

Regarding the water account for the Santa Lucia River basin, it involved the collection of data related to water physical flows and pollutants loads discharged into the water bodies. By combining this data to the information provided by national accounts, intensity indicators were estimated, such as water use intensity per unit of gross value added (GVA) generated. For the four agricultural products considered in the exercise, results showed that the activity with the highest water use intensity is barley with 1,032 m3 per 1,000 Uruguayan pesos of GVA, followed by soybeans with 512 m3 per 1,000 pesos Uruguayan VAB, corn and sorghum with 331 m3, and wheat with 128 m3.

With respects to water quality, results suggest that nitrogen represents a high proportion of the wastewater discharged into the waterways in the Santa Lucia River basin, and soybean production is the one that exerts the greatest pressure on them with a contribution of 2,296 kg of nitrogen per 1 million Uruguayan pesos of GVA, followed by barley with 2,167, corn and wheat with 694, and corn and sorghum with 576 Kg of nitrogen per 1 million Uruguayan pesos of GVA. Regarding phosphorous intensity in the waterways in the Santa Lucia River basin, results showed that soybean production generates the greatest pressure, with a value of 613 Kg of phosphorus per 1 million Uruguayan pesos of GVA, followed by corn and sorghum with 154, barley with 103 and wheat with 33 Kg of phosphorus per 1 million Uruguayan pesos of GVA.

These pilot exercises for Uruguay, although preliminary and incipient, show that natural capital accounts are a quantitative tool of feasible application to support public policies in Uruguay, including those that target green growth objectives. The pilot exercises demonstrate the feasibility of developing and implementing accounts at different levels: national (agricultural and forestry sector) and subnational (basin). The combination of environmental and economic information can have multiple benefits such as: (i) Having the ability to compare performance across geographic areas, sectors and companies, (ii) Being possible to use data from different spatial scales and to integrate this information in a consistent manner; and (iii) Moving towards an accounting framework that could be integrated to statistical frameworks of other sectors, such as health and education.

The full study is available at the following link: www.worldbank.org/uy

4. Policy instruments for the control of water pollution and GHG emission from agriculture diffuse sources

Piaggio, Alpízar, Guzmán, & Ruta, 2018

Review of international experiences and guidelines for their design for nutrient control in the Santa Lucia River basin (Uruguay)

In recent years, Uruguay has been subjected to the consequences of diffuse pollution from the agriculture sector. Policy instruments can be designed to change the behavior of actors that generate polluting emissions. Agricultural pollution from diffuse sources is caused by multiple agents, depends on climatic and environmental variables, and the impacts can be cumulative. As a consequence, it is very difficult (or extremely expensive) to quantify and monitor individual emissions from agricultural producers.

In Uruguay, the control of diffuse pollution from agricultural activities has been approached, in general terms, through voluntary technical assistance programs that promote cleaner production practices. However, since 2013 the regulation of land cover management has been extended nationwide. This regulation involves the submission of Land Use and Management Plans (PUMS) from farmers with land under irrigation practices and extensive crops. In addition, as of 2013, the Action Plan for water protection in the Santa Lucia River basin is established, which includes setting standards and regulations to reduce agricultural pollution from diffuse sources.

The objectives of this study are: i) to analyze current policy instruments related to agriculture and its environmental performance; and ii) generate recommendations on new policy instruments or modifications to current policy instruments to be explored by decision makers. For this purpose, the study presents a classification of policy instruments for the control of diffuse pollution from agricultural sources from the point of view of economic efficiency, and a review of international experiences in the implementation of these instruments. This work is based on the results collected through interviews with policymakers and discussion activities, and on an extensive literature review. It does not

intend to propose a definitive solution, but rather to generate elements to promote dialogue and to help improve existing instruments.

In general, policy instruments can be classified into four broad categories[23]: i) instruments based on existing markets (e.g. taxes or subsidies on emissions or inputs correlated with them), ii) the creation of markets (e.g. through the creation of tradable emission credits, or tradable permits), iii) regulation (e.g. standards and prohibitions), and iv) voluntary agreements incorporating citizen participation (e.g. payments for conservation, information, etc.).

Based on the analysis of international experiences, different mechanisms are identified to quantify pollution from agricultural activities: i) emissions proxies, such as estimates of soil loss and of fertilizers in water bodies, ii) specific indicators of producer contribution, such as the amount of polluting inputs; and iii) concentrations in the environment, that is, aggregated measures at a relevant scale (e.g. river basin).

Regarding policy instruments based on existing markets, in the European Union there are some cases in which the tax base is determined by the potential hazard of fertilizers and pesticides, and by the expected estimated from fertilizers and pesticides use records. Netherlands charged a tax on the excess of phosphorus and nitrogen in the soil, establishing thresholds and a block tariff system. On the other hand, Norway applies taxes on the use of pesticides, and are estimated according to product toxicity and to their potential damage for each site. Similarly, Denmark applies taxes to fertilizers' active principles, being the only country that still maintains taxes on the use of fertilizers.

Several European Union countries removed the application of taxes on the use of fertilizers. This is mainly due to lobbying from the agricultural sector, and taxes' ineffectiveness to reduce the use of fertilizers. The latter may be a consequence of the lack of substitutes for these inputs. Thus, one of the conclusions of the study is the importance of designing tax policies along with alternatives to replace the inputs or practices that are intended to be discouraged, in order to effectively move producers towards less harmful practices that do not affect their economic benefit.

Finally, this study analyses emissions markets related to the improvement of water quality. The active - and promising - case that involves a water quality market to control diffuse pollution from agriculture, is the case of Lake Taupo, in New Zealand. This case is thoroughly studied:

1. *Establish a comprehensive modeling framework for the design of policies to promote the articulation of multidisciplinary information.*
2. *Deepen the analysis of the emission mitigation options available to Uruguayan producers.*
3. *Set realistic goals and agree in a participatory way on the causes and possible solutions for which the policies will be designed.*
4. *Review existing tax schemes and redirect them in such a way that they continue promoting production while helping to achieve environmental quality objectives. The report presents opportunities to be explored to redirect these taxes to mitigate nutrients yields from diffuse sources of agriculture.*
5. *Design new policy instruments that complement existing instruments, helping them to gain efficiency. Two examples of these are deposit schemes to complement an existing program, and fertilizer use markets. In addition, the implementation of incentive schemes for the restoration and conservation of riparian areas could be explored.*
6. *Understand in detail farmers' decision-making process regarding land use, fertilizers use, and the response of producers to different incentives, both economic and non-economic.*

23 Sterner, T., & Coria, J. (2012). *Policy Instruments for Environmental and Natural Resource Management. Journal of Chemical Information and Modeling* (2nd ed., Vol. 53). New York: RFF Press. https://doi.org/10.1017/CBO9781107415324.004

7. Understand barriers to technology adoption and participation in policy programs, including transaction costs, barriers to information access, absence and structure of markets, among others.

The full study is available at the following link: www.worldbank.org/uy

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