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AGRICULTURE AND NATURAL RESOURCES MANAGEMENT SECTOR FRAMEWORK DOCUMENT

ENVIRONMENT, RURAL DEVELOPMENT AND DISASTER RISK MANAGEMENT DIVISION

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ABBREVIATIONS

DEM	Development Effectiveness Matrix
ECLAC	Economic Commission for Latin America and the Caribbean.
EAP	Economically active population
FAUSAC	Facultad de Agronomía de la Universidad San Carlos de Guatemala [Agronomy School of the Universidad San Carlos, Guatemala]
FAO	Food and Agriculture Organization of the United Nations
ITQ	Individual transferable quota
IARNA	Instituto de Agricultura, Recursos Naturales y Ambiente de la Universidad Rafael Landívar [Institute of Agriculture, Natural Resources, and Environment, Universidad Rafael Landívar]
INIA	Institutos Nacionales de Innovación Agraria [National Institutes of Agricultural Innovation]
INTA	Instituto Nacional de Tecnología Agropecuaria [National Institute of Agricultural Technology]
IFPRI	International Food Policy Research Institute
IFAD	International Fund for Agricultural Development
OVE	Office of Evaluation and Oversight
OECD	Organization for Economic Cooperation and Development
NSG	Non-sovereign guaranteed
SFD	Sector framework document
TFP	Total factor productivity

I. THE SECTOR FRAMEWORK DOCUMENT IN THE CONTEXT OF THE CURRENT REGULATIONS AND THE INSTITUTIONAL STRATEGY (2010-2020)

A. The Agriculture and Natural Resources Management Sector Framework Document as part of the existing regulations

1.1 This document replaces the Sector Framework Document (SFD) on Agriculture and Natural Resources Management (document GN-2709-2), approved by the Operations Policy Committee (OPC) on 21 May 2013, in accordance with paragraph 1.20 of document GN-2670-1, "Strategies, Policies, Sector Frameworks, and Guidelines at the IDB," which establishes that SFDs are to be updated every three years.

1.2 For purposes of this SFD, agriculture is understood as the economic sector encompassing crop farming, livestock, fishing, and forestry activity. Only renewable natural resources are covered, including soil, water, forest biomass, and fisheries; thus, this SFD does not cover nonrenewable natural such as oil, gas, and mining resources. This SFD is one of the twenty SFDs prepared under document GN-2670-1, which together provide a comprehensive vision of the region's development challenges. This SFD complements the Environment and Biodiversity SFD (related to the conservation and preservation of natural resources); the Food Security SFD (related to food availability and access); the Climate Change SFD (related to climate change mitigation and adaptation issues), the Support to SMEs and Financial Access/Supervision SFD (related to access to financial services); the Transportation SFD (related to access to rural roads); the Energy SFD (related to rural access to energy); the Social Protection and Poverty SFD (related to social protection programs); the Integration and Trade SFD (related to international trade); and the Gender and Diversity SFD (to ensure cultural adaptation of services with an ethnic origin and gender perspective).[1] This SFD is also framed by the Bank's five sector strategies, relating in particular to the IDB Integrated Strategy for Climate Change Adaptation and Mitigation, and Sustainable and Renewable Energy (document GN-2609-1).

B. The Agriculture and Natural Resources Management Sector Framework Document and the IDB Institutional Strategy

1.3 The Agriculture and Natural Resources Management Sector Framework Document is consistent with the Update to the Institutional Strategy 2010-2020 (document AB-3008), which identifies low productivity and innovation, the social and economic impacts of climate change, and social exclusion and inequality as structural and emerging development challenges of the region.

II. INTERNATIONAL EVIDENCE ON THE EFFECTIVENESS OF POLICIES AND PROGRAMS IN THE SECTOR AND IMPLICATIONS FOR THE IDB'S WORK

2.1 This section presents a review of the literature citing the main findings of international research and studies on the subject of agricultural policy and natural resource management. In general, the following topics are discussed: allocation of

[1] Such adaptation considers how to improve access to natural resources for productive and conservation activities for women, indigenous peoples, and Afrodescendents.

agricultural public spending, the importance of investment in rural infrastructure and the delivery of agricultural services (research and technology transfer, technology adoption, agricultural information, plant and animal health, and access to rural financial systems), the vulnerability of agriculture to the effects of natural disasters, and the importance of governance for the sustainable use of natural resources.

1. Public expenditure financing investment in rural public goods is more effective and produces a higher economic return than that financing private goods.

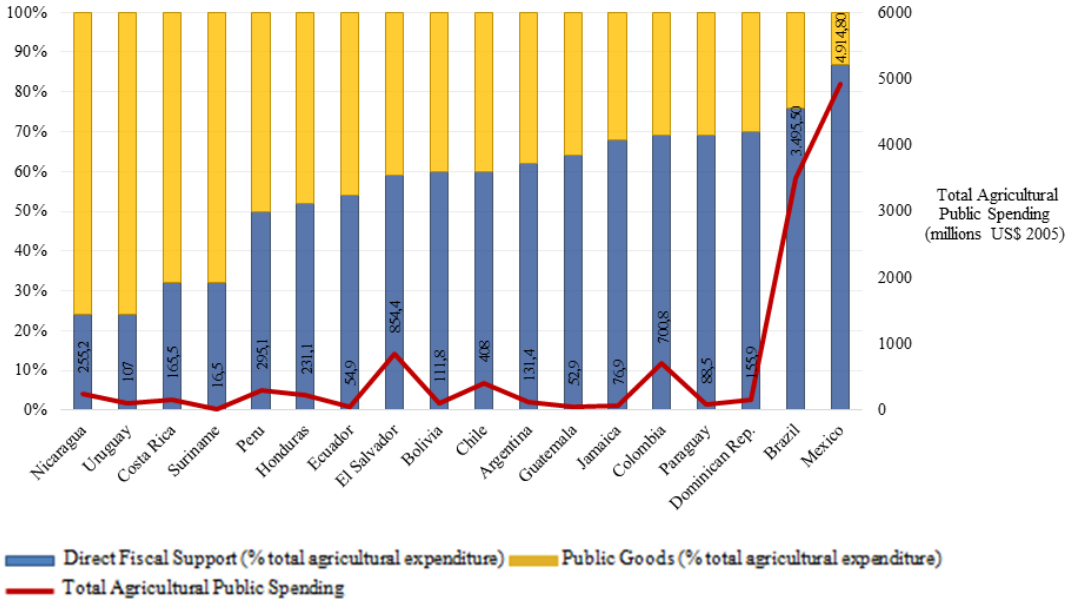
2.2 The economic literature on the effectiveness of the use of public finances shows that investments aimed at providing rural public goods (e.g., rural infrastructure, technological innovation, plant and animal health, market information, and natural resource stewardship) brings higher economic returns and has a bigger impact on productivity, income, and sustainable management of natural resources than does public spending aiming to provide private goods (e.g., buying and distributing inputs, production subsidies). The evidence shows that shifting expenditure on the financing of private goods toward rural public goods increases rural per capita income, reduces adverse impacts on natural resources management, and contributes to poverty reduction (Lopez and Palacios, 2014; Lopez and Islam, 2011; Lopez and Galinato, 2007; Sills et al., 2015). Similarly, returns on investment in rural infrastructure, agricultural innovation, and rural education tend to be higher than returns on public expenditure aimed at providing private goods in both Latin America and the Caribbean and other parts of the world (Fan et al., 2008; López, 2004; Foster et al., 2011). In Latin America and the Caribbean in particular, the evidence suggests that the breakdown of rural public spending is more important than the size of the expenditure. López and Galitano (2007) showed that allocating a larger proportion of public spending to public goods has a more sustainable impact on agricultural gross domestic product (GDP) than an increase in total public spending without altering the relative importance of the investment in public goods. A recent study (Anriquez et al., 2015) upholds the findings of López and Galitano. Using agricultural public spending data from 19 countries of the region for the period 1985-2012, Anriquez et al. (2015) find that redistributing 10% of total public expenditure on private subsidies toward public goods can increase per capita agricultural income by approximately 5%. Similarly, a meta-analysis by Alston et al. (2000) analyzing rates of return on agricultural research and extension in 292 studies[2] reported an average rate of return of 48% for research, 62.9% for extension services, and 37% for research and extension together. These studies show that investments in agricultural research and extension have contributed to increased agricultural output through productivity improvements.

2.3 The evidence on effectiveness and returns associated with investments in rural public goods suggests that there is room for improvement in the structure of agricultural public spending in the region. Recent studies by the Bank on estimates of agricultural support in 18 countries of the region show that, in general, the scale and proportion of spending aimed at rural public goods is small (see Figure 1). On average, 13 countries allocated less than half their public spending to public

[2] The studies include the analysis of crops, livestock, fishing, and forestry.

goods, putting more emphasis on direct fiscal support as a sector policy instrument in the period 2006-2012.[3]

Figure 1. Breakdown of agricultural public expenditure by Latin American and Caribbean countries (2006-2012)



Source: Adapted from Anriquez et al., 2015.
Note: Annual national averages, 2006-2012 (US$ million 2005); data for 2013-2014 in the case of some countries.

2. In an initial phase of retargeting public expenditure allocated to private goods, "smart subsidies" can be a transitional alternative to reduce direct government subsidies.

2.4 There is a substantial body of economic literature suggesting that public investment geared toward the large-scale direct distribution of inputs or direct subsidies has a low social return, restricts private sector investment, and slows the adoption of more efficient technologies (Valdés, 2012; IARNA and FAUSAC, 2013). Likewise, Jayne and Rashid (2013) identified the following risks associated with providing subsidies: (i) they crowd out other more necessary public investments with greater returns; (ii) they are ineffective in the long run; (iii) they have low benefit/cost ratios compared to other policy instruments; and (iv) their political nature makes it difficult to plan an exit strategy. At the aggregate level, in Sri Lanka and Guatemala, fertilizer programs showed a negative benefit/cost ratio (Valdés, 2012; IARNA and FAUSAC, 2013). At the micro level, an impact assessment of the fertilizer subsidies program in Guatemala showed that it had no positive impact on output, income, or food security among the participating households (IARNA and FAUSAC, 2013). Moreover, programs of this kind can generate negative externalities by crowding out the activity of other private agents

[3] In addition to analyzing the allocation of public spending to direct supports and public goods, estimated total producer support (paragraph 3.2) includes producer price support. As a result, the set of supports for private goods via policy interventions tends to exceed those presented in this section.

providing services to producers, to the detriment of the long-term development of input markets. According to Cannock (2012), the fertilizers program in Guatemala is crowding out private sector purchasing and distribution, given that using fertilizer yields positive private marginal net profits. Input subsidies may also slow the adoption of more up-to-date technologies (Khanna and Zilberman, 1997; Lee, 2005). In Ecuador, for example, urea subsidies delayed the adoption of more efficient and environmentally sustainable technologies (Avila-Santamaria and Useche, 2016). These outcomes, in conjunction with the high fiscal cost, difficulty of targeting effectively to benefit the poorest segments of the population, and difficulty of planning an exit strategy limits the effectiveness of this type of intervention (Banful, 2011; Baltzer and Hansen, 2011).

2.5 It is well known that small-scale producers in many countries of Latin America conduct their productive activities on an informal basis (i.e., no security of land tenure, no access to finance or only through informal sources and at high cost, very low levels of capital and no access to insurance instruments to mitigate risks, little or no access to technical assistance services, and far from markets and value chains for inputs and outputs). Under such conditions, their ability to adopt technologies and improve production is limited. In an initial phase of retargeting public expenditure from private to public goods, a "smart subsidies" mechanism of supports via vouchers or coupons can be an effective way of promoting access to inputs or technologies with low levels of adoption. "Smart subsidies" mean subsidy strategies that favor market solutions to promote technological development while at the same time contributing to the development of input or technology markets targeting the poorest producers (Tiba and Prakash, 2011). Specifically, these "smart subsidies" should respond to market failures identified in the rural context, such as: (i) liquidity constraints and lack of access to credit; (ii) limited market size or absence of market opportunities (thin markets); (iii) information asymmetry; (iv) high transaction costs, and other factors (Feder, Just and Zilberman, 1985).

2.6 In countries such as Nigeria, Kenya, and Malawi, smart subsidy programs for the adoption of fertilizers and improved seeds generated positive impacts on the yields of small-scale farmers, increased their income, and improved their food security (Awotide et al., 2013; Chibwana, 2014). Moreover, these subsidies had a bigger impact when to the poorest and most vulnerable population groups (Mazvimavi et al., 2013; Kriti, 2015). Nonetheless, the difficulty of targeting them effectively so that they benefit producers who need access to these inputs, and the distortionary effects on the functioning of the private sector, remain the greatest obstacles to the implementation and effectiveness of such interventions (Sheahan, 2014; Ricker-Gilbert et al., 2011; Jayne, 2015). Additionally, support programs must have a reliable exit strategy since they generally give rise to interest groups that apply pressure to expand and extend the programs beyond what is justifiable.

2.7 The evidence on "smart subsidies" to promote technologies and encourage their adoption by small-scale farmers in Latin America and the Caribbean shows them to have positive impacts on income and productivity, particularly when interventions have targeting mechanisms to benefit on small-scale farmers and mechanisms to identify an exit strategy. In Bolivia, the evaluation of the "Direct Supports for the Creation of Rural Agrifood Initiatives" found that the funding of vouchers for the adoption of technologies increased productivity, income, and food security among small-scale farmers (Salazar et al., 2015). Positive outcomes in terms of productivity and incomes were also found in programs implemented in

Nicaragua, Argentina, and Uruguay (Flores et al., 2014; Rossi, 2013; Maffioli and Mullally 2014). However, there has been little analysis of the long-term sustainability of these impacts or the spillovers these programs may cause.

3. Investment in rural infrastructure helps make the agricultural sector and economic activities associated with the use of natural resources more competitive by improving productivity, employment, and income and fostering commercialization.

2.8 The empirical evidence shows that investment in rural infrastructure is essential to foster the growth and sustainability of the agricultural sector and the use of natural resource. For example, investment in infrastructure facilitates the integration of agricultural producers into product and input markets (Pinstrup-Andersen and Shimokawa, 2006), reducing the impact of adverse shocks and offering new opportunities for the development of more profitable activities (Jouanjean, 2013). Similarly, access to rural infrastructure raises agricultural output, product volumes sold, employment, and rural incomes.

2.9 **Transportation.** According to the Transportation SFD (document GN-2740-3), investment in transportation infrastructure in rural areas plays a fundamental role in agricultural productivity and poverty reduction. This effect arises out of improvements in market access and lower transaction costs. The empirical evidence suggests that investment in roads and highways has an important effect on raising rural incomes (Ali et al., 2015; Mu and van de Walle, 2011; Khandker, Bakth and Koowal, 2009). Specifically, improved rural road infrastructure is associated with greater output (Tong et al. 2013; Dorosh et al., 2012; Khandker, Bakth and Koowal, 2009), greater household consumption (Stifel, Minten and Koro, 2012; Wondemu and Weiss, 2012; Dercon et al., 2009), positive impact on employment (Rand, 2011), and higher incomes (Webb, 2013; Escobal and Ponce, 2008). Transportation infrastructures also have a positive impact on the economic return from natural resources such as fisheries and forests (Schmitt and Kramer, 2009).[4] Lower transportation costs also improve access to local and export markets, generating incentives to increase productivity. Greater distances to markets have a negative effect on product sales (Valkis et al., 2003; Nkhori, 2004). For example, for Peruvian farmers, an additional hour of travel reduces the likelihood of selecting a specific market by 29% (Valkis et al., 2003). In the case of export markets, the Bank's research shows that lower transportation costs significantly increase exports: in Chile and Peru, a 1% reduction in transportation costs would enable exports from more remote regions to be increased by 4% to 5%, whereas in Colombia a 10% reduction in transportation costs would increase exports by an estimated 5% to 7% (Mesquita Moreira et al., 2012). In particular, a 10% improvement in trade-related infrastructure has the potential to increase agricultural exports from developing countries by 30% (Moïse et al., 2013). There is also some evidence that lowering transportation costs has a positive impact on the adoption of technologies that improve the sustainability of natural resources, such as methods to prevent erosion and investments in activities utilizing natural resources (Nkonya et al., 2011; Okoboi and Barungi, 2012).

[4] Investments in the forestry sector, plantations, and native forest management are directed related to transportation costs, which account for 30% to 40% of total production costs.

2.10 **Irrigation.** Irrigation is one of the greatest determinants of productivity and stability of agricultural yields, but at the same time represents a major challenge for the sustainable use and management of water resources. The positive impacts of access to irrigation on production, income, and food security are widely documented (Ahmed, Mume and Kedir, 2014; Nkhata, 2014; Domenech and Ringler, 2013). Access to irrigation drives a virtuous circle improving farmers' productivity by raising crop yields (Palmer-Jones et al., 2012). An analysis of the irrigation operations portfolio financed by the World Bank show that between 1998 and 2008, 92% of projects reviewed reported increases in agricultural output (IEG, 2011). Similarly, access to irrigation raises income and household consumption, and provides risk-reduction mechanisms by lessening seasonal variability and vulnerability to climate events (Hagos et al., 2012; Kuwumo and Owusu, 2012; Dillon, 2011; Wood, You and Zhang, 2004). In Peru, access to irrigation projects increases household consumption by 17%, while raising the value of output and sales by 72% and 83%, respectively (Del Carpio, Loayza and Datar, 2011). Moreover, access to irrigation stimulates technological change on farms by promoting the use of complementary inputs such as improved varieties and water-saving technologies (Smith, 2004; Bhattarai and Narayananmoorthy, 2003; Hasnip et al., 2001; Hussain and Hanjra 2003, 2004; Huang et al. 2006). However, past experience with public investments in irrigation shows that it is necessary to improve water use efficiency for agriculture to guarantee the sustainability of agricultural production (World Bank, 2005). To this end, technology solutions have focused on reducing volumes of irrigation water, improving distribution systems, and strengthening administration schemes. The management of these systems through irrigator associations also encourages efficient water use (World Bank, 1995) and can boost demand for labor, marketing of agricultural products, and generally raise economic activity in the regions concerned (IEG, 2009). In turn, systems where irrigator associations are responsible for water management are more efficient at resolving conflicts in collective action, providing better maintenance of systems by empowering associations in relation to the governance of their own resources, and creating incentives for associations to market their produce, etc. (Vermillion, 2005; Bandyopadhyay, Shyamsundar and Xie, 2010). In Bolivia, an impact evaluation of the PRONAERC program funding irrigation systems to promote the efficient use of water resources administered by irrigator association shows that beneficiaries increased their income (30%), improved their productivity (46%), and increased sales of agricultural products (80%) (Salazar et al., 2016). Similarly, analysis in the Philippines found that irrigation systems managed by irrigator associations have a greater likelihood of implementing and applying management rules (six times higher) and carrying out collective infrastructure maintenance work (nine times higher) than irrigation systems centrally managed by government (Araral, 2011). Lastly, for irrigation investments to be sustainable, systems must be put in place for governance of the water resources in the watershed with established property rights and specific actions for maintenance of the feeder watersheds (World Bank, 2005)

2.11 Despite numerous studies confirming the effectiveness of irrigation investments, during project design it is important to consider the environmental externalities that may arise and include specific measures to maintain the feeder watersheds; possible distributional effects that may be caused by irrigation works construction, particularly from the building of dams (Duflo and Pande, 2007); and the differential effects on members of the community and households, particularly women,

together with the impacts on health and nutrition. Access to irrigation should therefore be considered not just as a tool for increasing agricultural production but also as an element of a comprehensive poverty reduction strategy.

4. Technology research and development are essential to achieving sustainable increases in agricultural productivity and improving natural resource utilization.

2.12 Research and technology transfer have played a key role in improving agricultural productivity over the last 50 years (Pardey et al., 2012). Given their high rates of return, the Food and Agriculture Organization of the United Nations (2012) considers research and technology transfer to be priorities in meeting growing food demand. Specifically, recent studies estimate rates of return on investments in research ranging from 43% to 67% (Alston et al., 2014; Huffman and Evenson, 2006; Jin and Huffman, 2015), due mainly to spillovers relating to investments of this kind (Jin and Huffman, 2015). Likewise, strengthening agricultural innovation and research processes represents one of the most important and lasting solutions for promoting agricultural growth and reducing poverty (Fan, 2008). In the case of Latin America and the Caribbean, the evidence suggests that investments in agricultural research are closely related to increases in economic growth, agricultural development, and poverty reduction (IAASTD, 2009; IDB, 2010). Nevertheless, despite the high economic returns and low growth rates in agricultural productivity in various countries, growth in public investment in research has slowed worldwide (Pardey et al., 2015). Moreover, the role of the private sector in agricultural research has been growing globally, accounting for 44% of agricultural research spending in 2009, compared with 36% in 1980 (Pardey et al., 2015). Nonetheless, private expenditure on research and development is lower in low-income countries, representing just 0.06% of total private expenditure and 1.7% of total expenditure in 2009 (Pardey et al., 2015).

2.13 Research and development in agriculture and natural resources in the region is mainly led by public innovation institutions, while the presence of private companies is still in its infancy (Trigo et al., 2013). In this context, to produce synergies, national innovation systems have been created in Latin America and the Caribbean that are designed as a network of agents including public innovation institutions, research centers, academia, and the private sector (Trigo et al., 2013). These national systems have mainly been used to generate two intervention mechanisms, seeking to increase the role of the private sector and academia in agricultural innovation and research. The first comprises innovation funds, implemented in countries such as Brazil and Argentina, and the second corresponds to production consortia set up in countries such as Chile to solve specific problems identified as strategic for the development of the productive sector through associations between scientific institutions and the private sector (Trigo et al., 2013).

2.14 The economic benefits of research are also evident in the area of natural resources. In the forestry sector, the application of improved genetic material in eucalyptus developed by the National Institute of Agricultural Technology (INTA) in Argentina, managed to increase the volume extracted in thinning and clearcutting by 20% with respect to the materials used previously, and significant advances were also obtained in the management of loblolly pine (Pinus taeda) (Norberto, 2005). An economic evaluation on the cases cited, considering plantations in locations of suitable quality and forecasting their growth based on INTA's technical

growth simulators, suggests rates of return for producers of 22% for eucalyptus and 17.3% for pine (Roccatagliata, 2012).

2.15 Equally important are processes of technology dissemination through extension mechanisms to supplement investment in agricultural research. These extension programs need to focus on providing technical assistance and information on the use and implementation of new technologies. Rates of return on agricultural extension have been estimated at over 100% (Jin and Huffman, 2015). As part of agricultural extension it is important to focus efforts on the most vulnerable population groups, particularly the poorest farmers and women living in rural areas. The evidence shows that in many rural contexts, women and poor farmers have more limited access to extension services and technology dissemination, although they stand to gain the greatest benefits (Ragasa et al., 2012; Davis et al., 2010). The Food and Agriculture Organization of the United Nations (FAO) estimated that women in the agricultural sector only receive 5% of the world's extension services. Against this backdrop, it is important to promote strategic interventions addressing this population segment.

5. Adoption of agricultural technologies and practices for climate change adaptation and mitigation has positive impacts on productivity, income, and natural resource sustainability.

2.16 A variety of environmentally sustainable agricultural practices and technologies (e.g., agroforestry, soil and water conservation, improved pasture management) have the potential to improve production while potentially helping mitigate the impacts of climate change and/or better enabling farmers to adapt to these impacts (McCarthy, 2014). As regards the adoption of climate-change adaptation technologies, impact studies on Bank-funded agricultural technology adoption projects in Uruguay, Argentina, the Dominican Republic, and Panama showed that a higher level of adoption of technologies by farmers has a positive impact on farm yields (Winters, Salazar and Maffioli, 2010). In the case of water resources, the more limited availability of water resources in the region highlights the need to improve the productivity of agricultural water use (World Bank, 2005). New irrigation technologies being adopted represent a new solution for the challenges of water resource shortages (World Bank, 2005). In Bolivia, the Direct Supports for the Creation of Rural Agrifood Initiatives Project (CRIAR), which financed adoption of climate change adaptation technologies including technologies, encouraging more efficient use of water resources, found that beneficiaries increased their productivity by over 100%, and household incomes rose by 36% (Salazar et al., 2015). Similarly, an evaluation of the PRONAREC program in Bolivia to facilitate climate change adaptation by small-scale farmers through the adoption of irrigation systems to improve the efficiency of water resource use, shows that beneficiaries increased household incomes by 30% (Salazar et al., 2016).

2.17 Additionally, as regards conservation farming practices, a number of studies have demonstrated the positive effects of implementing these environmental, production and economic feasibility indicators, particularly in situations of extreme climate change (Muschler and Bonneman, 1997; Lin et al., 2008). Similarly, these practices are essential to sustain productivity without soil degradation or natural resource depletion (World Bank, 2008). In Latin America and the Caribbean, a review of the literature on the effectiveness of implementing conservation farming practices suggests that they offer environmental and economic benefits in the driest areas in particular (McCarthy, 2014). Agroforestry practices also play an

important role in climate change adaptation (McCarthy, 2014). In El Salvador, an evaluation of the El Salvador Environmental Program (PAES) promoting adoption of agroforestry and soil conservation programs found that beneficiaries significantly increased the area devoted to environmental conservation activities (Bravo-Ureta, Cocchi and Solis, 2006). In Honduras, evaluation of the MARENA program promoting the adoption of agroforestry systems and soil-conservation and forest protection technologies, found that beneficiaries increased the total value of their output, yielding an internal rate of return of over 12% (Bravo-Ureta et al., 2011). In Nicaragua, the impact evaluation for the Socioenvironmental and Forestry Development Program (POSAF II), which promotes agroforestry, forestry and mixed production systems, found that beneficiaries had a value of output per hectare US$103.5, US$126.5 and US$143.8 higher than the control group for agroforestry, forestry and mixed production systems, respectively (Bravo-Ureta, 2012). Furthermore, an impact evaluation showed that producers applying direct seeding in Pakistan obtain better yields and higher incomes (Ali and Erenstein, 2013). These interventions need to be evaluated systematically to deepen our understanding of their impact on natural resource sustainability.

6. Plant and animal health raises productivity, contributes to better use of natural resources, and raises the incomes of small-scale farmers.

2.18 International trade growth has enabled countries to reduce the risks to their natural heritage and consumer health by establishing regulations on health and safety measures for market access. A compilation of studies analyzing the impact of various Bank-financed plant and animal health programs in Peru, Ecuador, Uruguay, and Belize confirms their effectiveness (Ibarrarán, 2009). In the case of plant health interventions, an evaluation of the Agricultural Health and Agrifood Safety Development Program in Peru found beneficiary producers in the fruit fly eradication component, regardless of farm size, to have a greater likelihood of implementing prevention and control measures (34%), increasing fruit production by 65%, improving the value of their produce by 15%, and increasing the proportion of fruit sales by 19% (Salazar et al., 2016). Similarly, the economic evaluation of this program reports an internal rate of return (IRR) of 22% (Cannock, 2015). Peru's better health status boosted its bargaining power relative to other countries, creating opportunities to sell on international markets (GRADE, 2008b). Additional evidence also shows that integrated pest management programs and field schools increase production, reduce rejected exports, and raise farmers' incomes when they are implemented taking the biological conditions of pests and economic conditions of production into account (Kibira et al., 2015; Carlberg, Kostandini and Dankyi, 2012). In the forestry area, a study in Chile showed that the economic benefits of pest control using biological factors came to over two million pesos per hectare, far exceeding the cost of treatment, which was 2,000 to 4,000 pesos per hectare (Baldini et al., 2003). Integrated pest control interventions can also generate positive impacts for the environment and natural resources by cutting the use of pesticides and other agrochemicals (Grovermann et al., 2015; Kibira et al., 2015).

2.19 In the case of animal health, the implementation of a mange control program in camelids in Peru considerably reduced the prevalence (1.8% vs. 16%) and incidence (3.6% vs. 12%) of the disease among treated animals (Ibarrarán, 2009). The case of Uruguay also demonstrates the benefits of animal disease control for international trade. Specifically, once foot-and-mouth disease-free without

vaccination status was achieved in 1996, the value of meat exports rose by more than 50%, producing extra annual gains of around US$110 from exports to the U.S., trade to Pacific countries was increased, and savings of US$8 million a year on the cost of vaccination were obtained (Knight-Jones and Rushton, 2013; Otte et al., 2004). One important issue to consider regarding the empirical evidence mentioned is that the impacts found are apparent among small- and medium-scale producers.

7. Investments facilitating linkage with markets through access to relevant information, communication technology or social capital lower transaction costs, increasing market efficiency, raising agricultural productivity, and improving the utilization of natural resources.

2.20 Access to timely information and communication technology, productive organization arrangements, and improvements to commercial quality are critical elements in facilitating timely linkages between producers and markets. Interventions to improve market access focus mainly on lower the transaction costs of market participation. In Ecuador, for example, linking small-scale farmers to the market increases their output by 33% (Cavatassi et al., 2011a). It also increases sales, agricultural income, and input use (Cavatassi et al., 2011b). Empirical evidence in Bolivia also shows that farmers with the best market access farm larger areas, achieve higher output, and have greater biodiversity on their land (Reyes-García et al., 2004; Salazar and Winters, 2012).

2.21 **Information and communication technologies.** Access to communication technologies, such as telephones or the Internet, increases the efficiency of rural markets by decreasing transaction costs and increasing access to information, leading to improvements in selling prices and income for the rural population (Chong, Galdo and Torero, 2009; Goyal, 2010). In Peru, for example, access to telephones in rural areas raised the value of agricultural production by 16% and lowered production costs by 23% (Beuermann, 2015). Similarly, timely access to relevant information facilitates linkages with markets and reduces farmers' vulnerability. In Peru, access to market prices for the main crops raised the prices at which beneficiary producers sold their crops by 13% and their likelihood of selling their crops by 12% (Nakasone, 2014). The evidence also shows that having information on a specific market increases the likelihood of participating in that market (Goetz, 1992; Valkis et al., 2003; Nkhori, 2004). In the case of Colombia, Camacho and Conover (2011) found that producers receiving information on market prices and weather conditions by text message were less vulnerable to agricultural losses and fluctuations in the selling prices of their crops. In India, access to market information by fishing communities via cellular phones raised selling prices and lowered production costs (Jensen, 2007).

2.22 **Social capital and associations.** In the absence of complete markets, as is the case in rural areas, social capital becomes a decisive factor in agricultural output and improving access to production factors, markets, and credit, and in the adoption of technologies (Abay et al. 2014; Okten, 2004; Salazar and Winters, 2012). Access to social capital through associations empowers producers and lowers transaction costs. From the perspective of transaction costs for farms, in the case of Mexican producers, access to producer organizations had a positive effect on output (Key et al., 2000). There is also evidence that access to social capital facilitates the adoption of environmentally sustainable technologies and practices (Muange, 2015; Munasib and Jordan, 2011, Ainembabazi et al., 2015) and access

to inputs (Francesconi and Ruben, 2012; Abate et al., 2014; Ainembabazi et al., 2015).

8. Access to rural financial services has positive impacts on productivity and income, particularly among small-scale farmers.

2.23 An insufficient supply of financial services specifically designed for the needs of small-scale farmers and for the use of natural resources, where investments take a long time to mature, is one of the biggest constraints on raising productivity as it restricts investment, linkages with value chains, the use of inputs, and technology adoption (World Bank, 2014; Jack et al., 2015; Banerjee et al., 2013). Access to credit has positive impacts on the agricultural sector by raising incomes and productivity (Mahoukede, Aliou and Gauthier, 2015; Awotide et al., 2015). In the region, empirical evidence from Peru demonstrates that tight credit reduces agricultural productivity by 26%, and profits by 17% to 27% (Guirkinger and Boucher, 2008; Fletschner, Guirkinger and Boucher, 2010). In Nicaragua and Ghana, there has been shown to be a connection between lending to small-scale farmers and an increase in their income (Carter et al., 2012; Karlan et al., 2012). On the supply side, the limited provision of financial services is partly due to the inherent risks of farming (e.g., environmental shocks), but also to difficulties associated with: (i) obtaining reliable information about borrowers' ability to pay, due to the rural population's being highly scattered; and (ii) establishing measures to guarantee loan payments, given the scant financial collateral of small-scale farmers in the form of physical assets (Gallardo et al., 2006). It is therefore difficult for financial service providers to avoid the risks of adverse selection and moral hazard. Moreover, in the case of agribusiness, a meta-evaluation confirms that, in general, actions to improve access to finance produce positive outcomes for productivity and incomes. However, a significant share of studies reviewed offer mixed evidence, depending on the context of the analysis (Nankuni and Paniagua, 2013).

2.24 Rural women's access to financial services is correlated with increased investment in human capital, which is an important factor in raising productivity. However, in most developing countries, this population segment faces greater limitations on access to these services than do men (FAO, 2011). In Colombia, for example, just 8% of rural women have access to credit (DANE, 2014). Therefore, to bring rural women into financial markets it is important to design personalized interventions to address the specific limitations faced by this segment of the population in terms of supply and demand (Fletschner and Kenney, 2011).

9. Strengthening of land ownership rights increases productivity and resource sustainability, stimulates markets, and promotes investment, particularly among the most vulnerable population groups.

2.25 Interventions seeking to strengthen land ownership rights give farmers an incentive to make productive and sustainable use of land resources. Establishing and maintaining property rights is a public good that reduces the risk of losing land through expropriation or squatting, and creates incentives for investment (Ghatak and Besley, 2010). It also facilitates market transactions by allowing land to be transferred to more productive producers (World Bank, 2003). In Latin America and the Caribbean, formalizing land tenure is mainly associated with titling programs. The associated impacts include increased investment, productivity and income for farmers (Lawry et al., 2014). Studies in Nicaragua and Peru show

positive effects on productivity, income, and agricultural investment. In particular, in Peru, analysis of the “Land Titling and Registration Project” in Peru (loan 906/OC-PE) found positive effects on long-term farm investments and land values (Torero and Field, 2005; Antle et al., 2003; Aldana and Fort, 2001). In Nicaragua, land titling programs had a positive impact on security of tenure, increasing investments in land, asset accumulation, and incomes (Deininger and Chamorro, 2004; Hernández and Reardon, 2012; Foltz, Larson and Lopez, 2000). Land titling programs can also be tools for enhancing natural resource sustainability. Specifically, the evidence shows that land titling has positive impacts on the adoption of environmental practices and technologies for soil and water conservation (Quisumbing and Kumar, 2014; Ali, Deininger and Goldstein, 2014; Deininger, Ali and Alemu, 2009). Titling programs have also been regarded as potential tools to stimulate financial markets and access to credit, in particular. However, the empirical evidence does not show strong causality confirming this hypothesis. Ultimately, land tenure reform should consider credit market operation in order to boost its impact (Carter and Olinto, 2003).

2.26 Modernizing and introducing new technology in administration systems are further ways of helping to lower property transaction costs and stimulate the land market. In Georgia, investments in online information systems and improved legal frameworks reduced both the time taken to register properties (from 39 to 9 days) and the financial costs of doing so (from 2.4% to 0.6% of property value). In turn, as a result of these investments there was increased activity in land markets and an increase in the number of mortgages and credit transactions by producers and private lenders (World Bank, 2007). Evidence has also been found in China that modernizing administration and transfer services can also stimulate the land market (Huang and Ding, 2015). The Bank has also been leading various projects to improve land administration systems. The evidence suggests that these interventions have produced important results, including the creation of multipurpose land registers, georeferencing of plots, large-scale regularization of land tenure, demarcation of nature reserves, etc., making innovative use of low-cost technologies and generating high quality outputs. These interventions followed participatory methodologies based on community consultations and adopting mass communication campaigns (OVE, 2014).

2.27 It is worth noting that land tenure reforms can have perverse effects on the most vulnerable population groups, including ethnic groups and women, who face social and/or financial barriers preventing them from realizing the benefits of these interventions (Lawry et al., 2014). For this reason, programs aiming to strengthen land tenure must have the flexibility to incorporate mechanisms capturing the complexity of each context, promoting participation by vulnerable population groups and considering such aspects as social customs and traditional knowledge, as well as the gender perspective (Meinzen-Dick et al., 2009, Lawry et al., 2014).

10. The impact of climate change and natural disasters accentuate the vulnerability of agriculture and natural resources.

2.28 Farmers face a series of risks that exacerbate the vulnerability of their output, such as the impacts of natural disasters, climate change, price volatility, and diseases

and pests (World Bank, 2013d), making their income highly volatile.[5] Latin America and the Caribbean was the region with the second highest number of natural disasters in the period 2001-2012 (Guha-Spair et al., 2013). In this context, the region's agricultural production is exposed to the risks of drought and flooding. Using data from 94 countries (including 68 developing countries) covering the period 1961-2005, Loayza et al. (2009) estimated that agricultural growth dropped 2.2% and 0.8%, respectively, as a result of drought and severe storms. In the case of climate change, a world agricultural simulation model produced by Nelson et al. (2009) predicts that the main effects of climate change on agricultural economies will be a significant reduction in yields of the most important crops. To address the impact of climate change, it is essential to implement adaptation measures (Fernandes et al., 2012; Vergara et al., 2013). Irrigation is a promising alternative with which to address the issue of slow crop yield growth in the region (IICA, 2007). Agricultural insurance is also a means of offsetting the variability of output caused by natural disasters. A study in Peru interviewing 800 farmers showed that the use of indexed farm insurance could increase yields by 20% to 60% (Boucher and Mullally, 2010). Moreover, based on a systematic review of indexed farm insurance, Cole et al. (2012) concluded that more evidence was needed on its effects on sector productivity. There are also agricultural practices and technologies (e.g., agroforestry, soil and water conservation, improved pasture management) that can potentially improve output while either reducing greenhouse gas emissions or improving the carbon capture capacity of agricultural land (Winters et al., 2010; González et al., 2009).

2.29 Additionally, market instruments exist for managing the risks of the impact of climate change, natural disasters, and food prices (e.g., price variability). These include the futures and options market, wholesaler promissory notes, and indexed insurance against natural disasters. According to Gillson and Busch (2015) these instruments have limited cost for public resources and can guarantee food supplies in the event of a drop in local production. They are also an alternative to physical food stocks, which the literature has widely shown to have a high fiscal and opportunity cost as a means of managing price risks (FAO et al., 2011). However, these instruments are not yet widely implemented in countries affected by natural disasters. Actual availability of insurance is especially important in the case of small-scale farmers with limited access to finance and little capital, since significantly reducing certain risks not only encourages the adoption of best practices but limits the likelihood of falling into poverty traps. Getting such instruments up and running generally requires complementary actions to generate the necessary climatic and agronomic information to design efficient insurance instruments.

11. Governance and the policy framework are essential to ensure the sustainable use of natural resources.

2.30 Natural resources that are common property and/or open-access (such as forest, fishery, and water resources) require an appropriate policy and governance framework. Without proper regulation, the fact that these resources are open-access leads to overexploitation and possible irreversible exhaustion of the

[5] Studies at the farmer level in India and Burkina Faso (Rosenzwieg and Binswagner, 1993; Carter, 1997) show coefficients of variation of agricultural income of over 100% due to the absence of risk management mechanisms.

resource (Gordon, 1954; World Bank, 2009). In most countries, governments[6] are responsible for providing management services to ensure both the conservation of the resource and the economic return obtained from it. International best practice (OECD, 2003; OECD, 2013; Cochrane and Garcia, 2009; OECD, 2012; Cosgrove and Rijsberman, 2014) stresses that effective governance systems rest on the following pillars: (i) a developed legal framework; (ii) an effective framework of policies and institutions implementing resource management programs;[7] (iii) applied research and information systems[8] to inform managers about regulatory decision-making; and (iv) systems for enforcement, monitoring and accountability that also promote participation by users and civil society. Empirical evidence suggests that sound governance promotes the establishment of more efficient types of natural resource tenure, thus generating better economic returns (Costello et al., 2012; Villasante, 2010; World Bank, 2009; Kline and Moretti, 2014; Sills et al., 2015).

12. A wide range of policy instruments is available for natural resources management. Their effectiveness and efficiency varies with scale of production.

2.31 There is experience using policy instruments to manage natural resources sustainably both in the Latin American and Caribbean region and elsewhere around the world. The fact that access to utilization of these resources is open means that new actors (e.g., fishers, loggers) are continually drawn by the profits associated with their extraction. The situation often continues until the levels of extraction fall, along with profits, and there is a crisis in the industry. The classic response countries use is to implement instruments regulating entry or levels of extraction. International experience and that of the region with conventional policies of this kind has shown them to be ineffective as they have not generated appropriate incentives (Wilen, 1988 and 2006; Smith and Wilen, 2003). The effectiveness of other conventional policies, such as buying back fishing boats or relocating employees, has also proven to be limited (Holland et al., 1999; Munro and Sumaila, 2002; Clark et al., 2005; OECD, 2013). The region has recently adopted property-rights based management systems to deal with the problem of open access to resources. In fishing, an individual transferable quota (ITQ) system has been implemented in countries such as New Zealand, Canada, and the United States, generating substantial economic gains (Arnason, 2012; Sanchirico, 2015). The ITQ system has also been adopted in Latin America and the Caribbean, generating an increase in earnings obtained from fishery resources in Peru (Kroetz et al., 2016) and Chile (Kroetz et al., in press). In the case of small-scale coastal

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6 The question of the public financing of natural resource management services remains relevant in the region. A common argument for recovering the cost of services is that industry is the main beneficiary (Arnasson, 1999; Haynes, Geen and Wilks, 1986; Milazzo, 1998). In many OECD countries a significant share of the cost is recouped through levies on industry.

7 Management activities normally involve (Arnasson, Hannesson and Schrack, 1999): (i) administration of existing systems, such as fishing monitoring licenses, permits, catch records; (ii) adjusting management rules, such as the definition of the annual total allowable catch (TAC) in the case of fisheries; (iii) and introducing new management systems, such as fishing quotas or limiting the number of boats.

8 The most frequent examples of applied research include compiling data, socioeconomic surveys, data analysis, and assessing the status of the stock of the resource. These activities are normally determined in response to information requests from decision-makers responsible for implementing management regulations.

fisheries, establishing territorial usage rights in the fishing industry together with fisheries management organizations have proven to be more effective than the ITQ system (Cancino et al., 2007; MRAG, 2009). In the forestry sector, governments have allocated large swaths of public woodland for forestry production through forest concessions auctioned to the private sector for a set period of time (e.g., 30 years). The concessions are contracts between government and users allowing the extraction of a specific volume in a specific area of forest (Gray, 2002). The system of forestry concessions has been adopted in countries such as Brazil, Peru, Bolivia, Guatemala, Guayana, and Suriname, leading in some cases to an increase in the sustainability of resource use (Pfaff et al, 2014). In countries such as Bolivia, Brazil, Colombia, Peru, Guatemala or Mexico, governments have also recognized local communities' rights to forests, transferring large areas of forest to local communities as forest commons (White and Martin, 2002). The effectiveness of natural resources management systems based on property rights largely depends on the quality of governance and local management capacity (Christy, 1997; Jardine and Sanchirico, 2012; Ribot, 2003). In the case of water resources, water resource usage rights systems have been implemented (OECD, 2012). Experience with usage rights has been mixed as a result of overallocation and the variability of resource availability due to climate factors. This has led countries to introduce measures that, on the one hand, reduce pressure on the resource, such as establishing water markets (Easter and Huang, 2014), setting water charges (World Bank, 1997), and promoting the adoption of more efficient water-use technologies (Carey and Zilberman, 2002). Moreover, countries have adopted measures to develop alternative sources, such as investments in storage infrastructure, reducing distribution losses, managing water recharge by reforesting recharge areas, and the combined use of surface and underground water (World Bank, 2004). The experience of OECD countries suggests that measures to reduce pressure on water resources are often effective in the short-to-medium term, whereas developing alternative sources, such as water storage, are more cost-effective in the medium-to-long term. The effectiveness of water resource management measures depends on the specific circumstances.

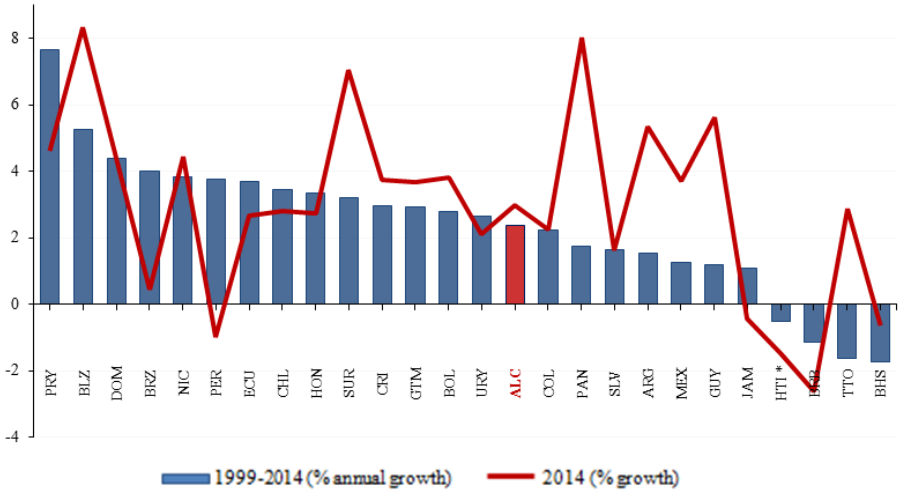
2.32 **Summary.** The empirical evidence shows that, in terms of sector policy, public expenditure that targets rural public goods is more effective at combating rural poverty and improving sector productivity and natural resource sustainability than expenditure on private goods, such as the purchase and/or distribution of inputs or products. Public and private investments in rural infrastructure, agricultural services (agricultural research, technology transfer, plant and animal health, food safety, agricultural information), and access to financial products contribute directly in this regard. Natural resources that are common property and open-access (such as forest, fishery, and water resources) require a policy and governance framework and effective management instruments to ensure their efficient utilization and, ultimately, their sustainability in the long run.

III. Main Challenges in the Region and Problems that the Bank Wishes to Address in the Sector

3.1 Between 2000 and 2014, the real agricultural GDP of Latin America and the Caribbean grew at an average annual rate of 2.8% (see Figure 2), less than the rate for the region's total GDP (3.5%). This was slightly higher than the

2.7% achieved in the 1990s and the 2.4% in the 1980s, although it fell short of the 3.5% received in the 1970s (ECLAC, 1997; CEPALSTAT, 2015). Similarly, it is worth noting that agricultural GDP grew 3.4% in the period 2000-2010. This contrasts with 28% growth in the period 1990-1999. Lastly, agricultural GDP has grown 15% so far this decade (2010-2014). The countries leading this growth are Paraguay, the Dominican Republic, and Peru, for which this indicator rose by around 76%, 58%, and 42%, respectively, over the period 2004-2014 (CEPALSTAT, 2015). Growth in agriculture has been shown to help reduce poverty in Latin America and the Caribbean. Between 1990 and 2013, the incidence of poverty in the region's rural areas dropped from 65% to 48%, while extreme poverty in rural areas dropped from 40% to 28%. Several analyses corroborate the data showing that in Latin America and the Caribbean, aggregate growth based on agriculture would be more effective at reducing poverty than nonagricultural GDP growth (2.7 times more effective according to Foster and Valdés (2010), World Bank (2008), and Lingon and Saoulet (2007), or 2.5 times more effective according to Bravo-Ortega and Lederman, 2005).

Figure 2. Average annual agricultural GDP growth rate at constant prices by country, 1990-2014 (%)



Sources: CEPALSTAT (2015)
Note: National averages in 2010 dollars. Includes data on agriculture, livestock, hunting, forestry, and fishing.

3.2 The stability of macroeconomic policies following the reforms embarked upon in the mid-1980s helped create a more appropriate macroeconomic context for the growth of agriculture and agricultural productivity in Latin America and the Caribbean. These policies included, in particular, a neutral monetary policy for exchange rates and a trade regime that reduced anti-exporter biases and high levels of protection of tradables. These changes improved incentives for private investment in land and, ultimately, helped boost agricultural exports (Dewbre et al. 2011; Foster and Valdés, 2010; ECLAC, 2007). The region went from extracting rents from the sector of almost US$10 billion a year in the 1980s, to supporting farmers with more than US$5 billion a year following the reforms (Anderson and Valdés, 2008). Additionally, estimated total producer support in a sample of

14 countries of the region came to US$21 billion in 2012[9] (IDB Agrimonitor, 2015). Nonetheless, the countries of the region still need to address distortionary policies in agriculture, particularly those based on price support, which have shown poor performance as a means of raising farming families' incomes (IDB Agrimonitor, 2015). The trade protection enjoyed by such products as milk, rice, chicken and sugar, on average, to the detriment of such products as soy, beef, and maize, is affecting the region's comparative advantage in agriculture and the efficiency with which private sector resources are allocated (IDB Agrimonitor, 2015).

3.3 World population is expected to rise by more than a third (2.3 billion people) between 2009 and 2050, with most of this growth in developing countries.[10] Food demand will therefore rise substantially during this period (FAO, 2013a). Trade in foodstuffs rose by an annual average of 8% from 1970 to 2013 (FAOSTAT, 2014). Increased demand and the food trade will put pressure on the use of natural resources. For example, agricultural products that are relatively important for international trade requiring large quantities of water to produce include meat, which needs 15,000 liters of water per kilo, and corn (maize), which needs 2,500 liters per kilo (Mekonnen and Hoekstra, 2012). In this regard, the region's agricultural sector will play a key role, not just in meeting this demand for food but in the sustainable use of natural resources.

3.4 Latin America and the Caribbean stand out for their natural resource endowment, and agriculture is the main sector demanding these resources. The region's forest biomass totals almost 900 million hectares, equal to half of its land surface and almost a quarter of the world's forest cover. Over 30% of the world's freshwater and around 40% of renewable natural water resources are found in the region (UNEP, 2010). Latin America and the Caribbean is responsible for 12% of the sector's global output, which it produces from 12% of the planet's arable land. Agriculture contributes almost 5% of the region's GDP (15% or more of GDP in Haiti, Guyana, Nicaragua, and Paraguay).[11] It provides employment for one in five workers (and is the biggest employer in rural areas) and its exports make up almost 30% of the region's total trade, the highest absolute value for any region comprising developing countries. The region accounts for 14% of global food exports, and generates 56% of world soy exports, 45% of coffee, 31% of sugar, 28% of meat, 32% of chicken, 64% of bananas, 18% of citrus fruits, and 41% of corn (FAOSTAT, 2013).

3.5 Given their economic, social and environmental importance in the region, agriculture and natural resources must contribute to sustainable growth and poverty reduction, which are key aspects of the region's development in the years ahead. However, they will only be able to do so if economic activities associated

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[9] These data refer to the sum of total producer support in 14 countries, using the producer support estimate (PSE) methodology. The countries included in this calculation are Argentina, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Honduras, Jamaica, Mexico, El Salvador, Paraguay, Peru and Uruguay.

[10] The population of the Latin American and Caribbean region is projected to increase by 150 million people by 2050 (FAO, 2013a).

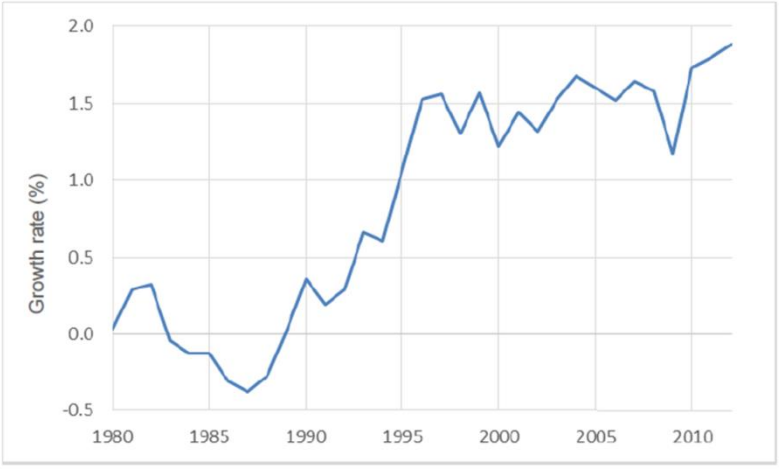
[11] This value underestimates the importance of agriculture's links to other sectors. In the cases of Chile, Colombia, and Mexico, Valdés and Foster (2005) report that the value of the sector's GDP may be increased by 89%, 28%, and 52%, respectively, if the links between agriculture and other sectors are included.

with the sector are more competitive, more socially inclusive, and develop in a manner that is environmentally sustainable.[12] This sector framework therefore identifies four challenges to be addressed in the sector, in order to meet that objective: (i) the low level of productivity relative to its potential and heterogeneity; (ii) the weakness of natural resources management; (iii) its vulnerability to natural disasters and climate change; and (iv) the unequal contribution of the sector's growth to the rural population.

A. Agricultural productivity lags behind its potential and is very uneven across the region.

3.6 The region's output increased between 1990 and 2014 (see Figure 2). Nevertheless, there is still room to improve agricultural productivity. A recent study (Nin-Pratt et al., 2015) shows that the total factor productivity (TFP) of the region's agriculture grew by 45% between 1980 and 2012, with an average annual growth rate of 1.2%. It is worth noting that the progress of TFP has fluctuated over the last 30 years. In the 1980s, which were characterized by import substitution policies and a bias toward industry, the average rate of TFP growth in agriculture was 0.5%. In the 1990s, when macroeconomic (fiscal, monetary, and trade) reforms were embarked upon, accompanied by a set of policies more favorable to the agricultural sector's development, the average growth rate of TFP was 1.2%. Finally, in the 2000s, the consolidation of the macroeconomic reforms and rising international prices for agricultural products helped achieve a higher average growth rate of TFP than in the three previous decades (1.7%) (see Figure 3).

Figure 3. Average annual growth rate of total factor productivity 1980-2012 (%)



Source: Nin-Pratt et al. (2015)

[12] The strong performance of the agricultural sector and natural resources management by Latin America and the Caribbean will contribute to Sustainable Development Goal number 2, which aims to "end hunger"; number 12, to "ensure sustainable production and consumption patterns"; number 13, to "take urgent action to combat climate change and its impacts"; and number 15, to "protect, restore and promote the sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss" by 2030. The Sustainable Development Goals were approved by the General Assembly of the United Nations in September 2015.

3.7 Despite this growth, although the gap by which TFP[13] levels lag those in the OECD countries narrowed between 1980 and 2012, it remains wide, at almost 50%. Although global figures show favorable performance, it is uneven across countries and sub-regions. Thus, comparing just the average regional TFP weighted by agricultural GDP (where Brazil, Argentina, and Mexico account for close to 75% of the region's agricultural output) with OECD countries between 1980 and 2012, the gap narrows significantly, to 20%. Countries with a high endowment of land (more than 10 hectares per agricultural worker) show better performance than countries with a small endowment of land (see Table 1). The former posted annual rates of productivity growth of 1.6%, while countries with limited land registered an average annual rate of half that (0.8%). Yet even in this aggregate, variability can be seen in each of these groups, denoting different levels of innovation throughout the region.

Table 1. Annual growth rate of agricultural productivity, 1980-2012

Countries with high endowment of land (ha/EAP >10)		*Countries with low endowment of land (ha/EAP <10)*	
Country	**%**	**Country**	**%**
Argentina	1.5	Bahamas	1.5
Bolivia	1.6	Barbados	-0.6
Brazil	2.5	Belize	0.5
Chile	2.3	Costa Rica	2.5
Colombia	1.0	Ecuador	1.9
Guyana	1.3	El Salvador	0.5
Mexico	1.5	Guatemala	1.0
Nicaragua	1.7	Haiti	-0.9
Paraguay	1.6	Honduras	1.2
Uruguay	1.5	Jamaica	0.9
Venezuela	1.4	Panama	-0.5
		Peru	2.4
		Dominican Republic	0.9
		Suriname	-0.1
		Trinidad and Tobago	1.2

Note: ha/EAP = hectare per member of population economically active in agriculture
Source: Nin-Pratt et al. (2015)

3.8 The international evidence shows that productivity indexes in the agricultural sector correspond positively to investments in agricultural public goods such as rural infrastructure, research and technology transfer, and plant and animal health. In this regard, the region shows a low level of agricultural investment, with just five countries exceeding the regional equivalent of 1% of agricultural GDP, and in only three countries do more than 30% of professional staff have a doctorate (IFPRI and IDB, forthcoming). Moreover, Trigo et al. (2013) found investment in R&D in Latin America and the Caribbean to be inadequate and highly concentrated in just a handful of countries. Consistent with their higher levels of TFP growth, Brazil, Mexico, and Argentina account for 78% of the region's agricultural research

[13] In this case, the simple average of the countries' levels of TFP was taken.

expenditure, with the remainder accounting for just 22%.[14] Just as irrigation systems in the region are less efficient[15] (39%) than the world average (56%) (Willaarts et al., 2014), diseases and pests that affect agricultural activity also have a direct impact on the sector's productivity. The fruit fly, coffee rust and borer beetle, the cotton weevil, the black sigatoka fungus on banana plants, and the huanglongbing that attacks citrus trees in farming activities; or foot-and-mouth disease, bovine brucellosis, classical swine fever or avian influenza in livestock activities; adversely impact yields to a greater or lesser extent in the countries of the region.

B. Natural resource utilization faces sustainability challenges due to weaknesses in governance and the correct use of management tools.

3.9 Fish catches by the main countries of the region have fluctuated considerably in recent decades. After peaking in 1994 the trend has been downward. Peru accounted for 60% of total catch. Other countries with large percentages were Chile, Argentina, Mexico, Brazil, and Venezuela (FAO, 2012). As in other parts of the world, growing catches in the region have been driven by technological development, an expanding fishing fleet, a growing labor force, and the relative impacts of governments' financial transfer policies (FAO, 2006a; OECD, 2006; Gréboval, 2007). Many fisheries have been overfished in the last two decades (World Bank, 2009; FAO, 2006b; Agüero and Claverí, 2007). A wide range of factors have contributed to the current state of overfishing, which has led to overcapacity. One important issue is the lack of governance structures and sound policy frameworks when managing open-access resources of this kind (Swan and Gréboval, 2004; Gréboval, 2007).

3.10 With regard to water resources, the Environment and Biodiversity Sector Framework Document (document GN-2827-3) suggests that the long-term availability of water for its various uses is a challenge, particularly considering the highly uneven distribution of water resources. Mahlknecht and Zapata (2013) highlight that the growing need for irrigated land, large hydroelectric projects, and soaring urban populations are exacerbating potential conflicts between various sectors over water use and increasing environmental pressures in general. According to the FAO, the main uses of water resources are agriculture (73%), domestic consumption (18%), and industry (9%) (FAO, 2014a). According to OECD estimates (2012), the region's water demand will rise 55% by 2050, and 40% of the population will be living in watersheds under severe water stress.

3.11 It is currently estimated that less than 10% of tropical forest in the Latin America and the Caribbean is being managed sustainably (FAO, 2015b). The ultimate outcome of this trend in the region over the period 2010-2015 was deforestation of almost four million hectares (FAO, 2015b). If governments fail to address the problem of open access, governance, and correct use of policy instruments, the use of the region's forests will largely be based on predatory and illegal logging, which subjects legitimate forestry companies to unfair competition based on lower production costs and discourages legitimate businesses, smallholders, and

[14] Notably, in Brazil and Argentina much of the technological change is reflected in the soy-grain complex, where direct sowing represents 70% of cultivated land in Brazil, and 80% in Argentina.

[15] Irrigation efficiency is the ratio between the water used for crops and the water distributed for irrigation.

communities from adopting best practices and technologies associated with sustainable forest management (Holmes, 2015; Putz, 2008; Smith et al., 2006).

C. Agriculture and natural resources are highly vulnerable, in particular to the impact of climate change, natural disasters, and yield and price volatility.

3.12 As indicated in the section on empirical evidence, farmers face a series of risks making their production more vulnerable, such as effects of natural disasters, climate change, price volatility, and diseases and pests (World Bank 2013). Farmers try to reduce their vulnerability through formal and informal risk management strategies.

3.13 The incidence of natural disasters in the region has doubled over the last 30 years, with a total of 416 events over the last decade (World Bank, 2013). A recent FAO study (2015a) found that from 2003 to 2013 Latin America and the Caribbean lost crops and livestock worth US$11 billion through natural disasters, the losses corresponding to almost 3% of the projected value of production in the period. Similarly, there was a US$13 billion increase in agricultural imports due to natural disasters in this period, and lost exports of US$1 billion.

3.14 The IDB Integrated Strategy for Climate Change Adaptation and Mitigation, and Sustainable and Renewable Energy (document GN-2609-1) and the Climate Change Sector Framework Document (document GN-2835-3) suggest that it is likely that the increase in vulnerability to climate change will have adverse effects on agriculture and natural resources such as water resources, and marine/coastal and fishery resources. In agriculture, climate variability, higher temperatures and alterations in hydrological precipitation and evapotranspiration cycles will directly affect harvest yields and rural communities' living standards, and may have significant direct economic impacts on this sector. Using simulation models, reductions of 21% to 34% in corn yields have been estimated for Honduras, Guatemala and Panama, and of up to 66% in bean yields for Guatemala (ECLAC et al., 2012). Similarly, in Brazil, Colombia, Central America, and the Caribbean, yields of oilseed crops could be reduced more than 50% by 2020 in a modest emissions scenario. Similarly, grain yields could be reduced more than 25% in Brazil, Argentina, and Mexico (Fernandes et al., 2012). Moreover, ocean warming will cause a drop in maximum fishing potential in various countries of the region (Cheung et al., 2010). Regionally, by 2050 the impacts of climate change are expected to cause reductions of US$32 billion in exports of corn, soy, wheat and rice (Fernandes et al., 2012). The International Food Policy Research Institute (IFPRI) (2009) and World Bank (2010a) estimated that annual financing needs for the adaptation of the agricultural sector to climate change in Latin America will be of the order of US$1.2 billion through 2050.

3.15 With regard to water resources, the Environment and Biodiversity Sector Framework Document (document GN-2827-3) warns that the long-term availability of water for all its various uses is a major challenge. For northeast Brazil, climate change scenarios show a decline in water availability for irrigation agriculture as a result of the loss of precipitation and increased evapotranspiration (IPPC, 2014). Moreover, conservative estimates put the cost of adapting irrigation infrastructure in Latin America and the Caribbean at around US$4.3 billion through 2050 (Agrawala et al., 2010).

3.16 Rising food prices affect both rural and urban populations, which are almost exclusively net food purchasers. Robles and Torres (2010) estimate that in the

region the food price crisis of 2006-2008 raised poverty rates by one percentage point in Guatemala, Honduras, and Peru, and by four percentage points in Nicaragua. Most urban households were affected. A minimum percentage of rural households benefited from higher prices (no more than 20% of rural households in Honduras and Nicaragua, just 5% in Peru, and 4% in Guatemala). What stands out is that the average loss (as a percentage of total spending) was greater in rural than in urban areas.

3.17 Farmers use a variety of risk-management strategies to address these risks, such as informal loans, diversifying income sources, and diversifying crops. However, production risks can be managed efficiently with insurance. But even so, it is not widely used in the region, although agricultural insurance has a long history in some Latin American and Caribbean countries. From the 1950s to the 1980s programs were mainly offered in the public sector and were generally tied to loans for small-scale farmers. Most of these programs obtained poor returns, were expensive to run, and had high losses, exacerbated by the low premiums and poor management. Most of these programs were discontinued in the late 1980s. Since the 1990s governments have been promoting agricultural insurance through private companies, usually backed with government funds. At present, 18 of the 25 countries of the region have some form of agricultural insurance program. Nonetheless, premiums represented just 0.37% of agricultural GDP in Latin America in 2009, compared with an average of 6% in Canada and the United States. Latin America represented 4% of total agricultural insurance contracts signed worldwide in 2010, most of which were in Argentina, Brazil, and Mexico (85% of the total), Chile, Uruguay, and Paraguay (10%) and the Andean countries (3%) (World Bank, 2010b).

D. Agricultural growth has not benefited rural populations equally in Latin America and the Caribbean.

3.18 Notwithstanding the positive aggregate impacts of agricultural growth on poverty in the region, agriculture's ability to reduce rural poverty in Latin America and the Caribbean has tended to be greater in those areas where producers had access to improved technology, technical assistance, and technical and managerial assistance, capital markets, infrastructure, secure property title, or export opportunities (FAO, 2010). In some areas, such the Pampas of Argentina, the coastal area of Peru, Brazil's central-western region, the central zone in Chile or Guatemala, the northwest of Mexico, or the South Atlantic area of Nicaragua, the sustained growth of agriculture has made rural poverty reduction possible through new employment opportunities.

3.19 Achieving greater equality of access to resources and a greater contribution to rural poverty reduction involves meeting the challenges facing producers who have less access to resources for production. These producers, termed "small-scale farmers" or "family farmers," account for 81% of the farms in the region and are characterized by the preponderant use of the family work force, with agriculture as their main source of income (FAO, 2014b). It should be noted that family farming comprises three distinct segments: (i) consolidated family farming, with land resources offering higher potential, market access (technology, capital, and products) and producing surpluses enabling capitalization of the productive unit; (ii) transition family farming, geared toward selling and own consumption, with productive resources that meet the family's needs but have difficulty producing surpluses to develop the productive unit; and (iii) family subsistence farming,

geared toward own consumption, with insufficient productive resources and income to provide for the next generation, leading to nonfarm employment, migration, and dependence on social protection programs (Berdegue and Fuentealba, 2011). The subsistence segment accounts for the largest share of family farms (around 60%), the transition segment for 28%, and consolidated family farming for 12% (FAO, 2014b). The incidence of poverty among transition and subsistence segments tends to be greater than for the rural sector as a whole (Schejtman, 2008), appears to be more vulnerable to the impact of climate change, includes indigenous groups, and suffers from a gender gap.[16]

3.20 The challenges facing small-scale farmers vary depending on their ability to generate a saleable surplus. For producers with this capacity, limitations on investment can arise out of market failures (including somewhat unclear property rights to natural resources), size or location hindering access to markets or preventing them from connecting to value chains due to their limited access to quality rural public goods such as rural infrastructure and agricultural services, particularly involving innovation, information, and plant and animal health, as well as suitable financial products (FAO, 2012). This makes transaction costs for these producers higher than for other producers, affecting their economic returns.

3.21 For those producers whose production is exclusively for their own consumption (subsistence agriculture), usually the poorest in rural areas, a solution based solely on agriculture is not viable. An analysis of the complementarity of assets in developing countries seems to suggest that joint interventions in education, land, and infrastructure could serve to improve income levels for these producers (Foster et al, 2011). Likewise, an active policy of social protection, with a focus on areas of subsistence agriculture, would enable these households to improve their income-generating capacity (FAO, 2012). Recent studies in Latin America (Maldonado, et al, 2016) have identified positive synergies between rural productive programs targeting low-income groups and social programs, particularly social programs with conditional cash transfers. Moreover, recent work shows that programs combining social and productive features achieve lasting impacts (Banerjee et al., 2015). This is an area where greater understanding is needed of specific policies that can link the two dimensions efficiently.

3.22 **Summary.** This section presented the four challenges in agriculture and natural resources management that the Bank believes must be confronted in Latin America and the Caribbean, if a contribution to sustainable growth and the reduction of poverty and equality for the region is to be expected from this sector. This SFD's Dimensions of Success will be framed by such factors as: (i) the lagging potential and uneven productivity of agriculture, affecting the sector's competitiveness; (ii) the vulnerability of natural resources to climate change and natural disasters; (iii) the weakness of the governance of natural resources, affecting long-term environmental sustainability; and (iv) the limited coverage of the benefits of the sector's growth among rural populations.

[16] In Latin America and the Caribbean, women account for 20% of the agricultural labor force, varying from country to country, and between 15% and 40% of heads of rural households. In terms of access to land, only 19% of all property title holders in the region are women (FAO, 2011).

IV. LESSONS FROM THE BANK'S EXPERIENCE IN THE SECTOR

4.1 Between 2013 and 2015, more than 203 loan and technical cooperation projects were approved from the public sector window, along with 52 non-sovereign guaranteed (NSG) operations, and 55 publications were produced on the agriculture and natural resources management sector in Latin America and the Caribbean. Added to the cumulative results since 1959, this makes the Bank a valuable reservoir of know-how and experience. Over this period, technical cooperation and operations have largely been concentrated on the lines of action proposed in the previous SFD: agricultural innovation, agricultural health, food safety, land administration, irrigation, and information. The system of agricultural policy analysis (Agrimonitor) was strengthened and supplemented, and is widely disseminated. At the same time, knowledge has been generated on topics relating to the evaluation of agricultural productivity at the regional level, the state of extension systems in various countries, and evaluation of the fisheries administration system, and an impact evaluation was completed on some of the operations concluded during this period. A great many lessons were learned and good practices derived from these actions and their evaluations. The following section summarizes the recommendations of the Office of Evaluation and Oversight (OVE) regarding the Bank's work in the sector, the progress made on the evaluability of the portfolio (Development Effectiveness Matrix (DEM)) and the main lessons learned from the progress monitoring reports (PMRs), loan documents, and other documents, together with the contributions of sector specialists in the areas where the Bank has been active.

A. Reports of the Office of Evaluation and Oversight (OVE)

4.2 OVE's review of the Bank's support to the agricultural sector in the period 2002-2014[17] looked at the overall relevance of the support given, and the relevance, effectiveness, and implementation of projects in three key thematic areas (direct support to agricultural producers; animal and plant health and food safety; and land administration and regularization). It also sought to identify the factors affecting the success of various types of interventions in various contexts and make recommendations on how the Bank could increase its support to the sector.

4.3 The report found that, in general, the portfolio has been aligned with the Bank's strategic documents, and it made the following recommendations, which are relevant and have been reflected in this sector framework:

a. Delineate clear criteria on the definition of public and private goods and the circumstances under which the financing of private goods by the Bank is justified, in particular, cases of direct support to producers and agricultural health and food safety services.

b. Ensure adequate upstream diagnostic work to fine-tune project identification and design. Where there is insufficient information to make a diagnostic assessment, examine the alternative of starting interventions with a pilot project.

[17] Review of the Bank's Support to Agriculture, 2002-2014: Evidence from Key Thematic Areas (document RE-467-1) (OVE, 2015).

c. Continue enhancing monitoring and evaluation work to promote learning and long-term effectiveness.

B. Results of the Development Effectiveness Matrix (DEM)

4.4 One of the Bank's most significant advances in the sector has been to design and execute rigorous impact assessment methodologies that have yielded results of significance in determining the effectiveness of agricultural programs and natural resource management, and to give feedback on new program design decisions. In this regard, as in the period from 2009 to 2012, when significant progress was made on levels of evaluability, sovereign guaranteed agriculture and natural resource management projects consistently showed high overall evaluation scores, with averages above the Bank's averages on most of the dimensions envisaged in the analysis. In the period 2013-2015, the evaluability of agriculture programs has been very high, ranging 8.9 to 9.2. It should be noted that the measurement methodology in this period (2013-2015) was changed in 2014, reducing the number of dimensions from 4 to 3. The new dimensions shown in Table 2 are: program logic, economic analysis, and monitoring and evaluation. On all three dimensions it can be seen that over the last three years the average has always remained above the general Bank average.

4.5 The Bank's commitment to the results-based agenda has been ongoing. Rigorous methods have been pursued to evaluate project impact using stochastic allocation of treatment and counterfactuals wherever feasible, and using methodologies offering the highest degree of reliability in the quality of the analysis otherwise. In this regard, the use of impact evaluations on the sector's projects increased from 60% in 2013 to 75% in 2015 (see Table 2). The methods proposed in the evaluation plans are mostly innovative and individualized in terms of their implementation, addressing the specific characteristics of each project, its country context, but also the standards identified in the guides prepared by the Bank for this end (e.g., the technical guidelines on designing impact evaluations for agricultural projects, and on evaluating the impact of land administration programs). Between 2013 and 2015, moreover, impact evaluations were completed on such topics as direct support programs for small-scale farmers to adopt technologies and a plant and animal health program (fruit fly). Impact evaluations were also designed for projects in land titling, irrigation, agricultural innovation, and price information. These evaluations have contributed to the sector dialogue with the countries, to improve the design of investment programs and policies.

Table 2. Summary of DEMs for sovereign-guaranteed projects in agriculture and natural resources management (Ag&NR), 2013-2015

Dimensions evaluated	2013		2014		2015	
	Ag&NR	Bank	Ag&NR	Bank	Ag&NR	Bank
Program logic	9.8	8.8	9.6	9.1	9.1	9.0
Economic Analysis	9.6	9.6	10.0	9.5	8.6	9.4
Evaluation and monitoring	8.3	7.8	9.0	7.8	8.9	7.9
Total evaluability	**9.2**	**8.7**	**9.5**	**8.8**	**8.9**	**8.8**
Impact evaluation (% projects approved)	60%	49%	75%	43%	75%	44%

C. Lessons learned from the Bank's projects in the sector

4.6 The Bank's sovereign guaranteed projects in the agriculture and natural resources management sector offer a series of lessons learned that have been compiled in numerous project completion reports (PCR), and used as input to various loan proposals, as well as in knowledge products created by the Bank between 2013 and 2015. Table 3 sums up the main lessons learned by type of intervention performed.

4.7 Similarly, a crosscutting lesson from all the projects in the sector is the need to strengthen the capacity for monitoring and evaluation of intervention results. This is particularly relevant in the case of the sector's non-sovereign guaranteed projects. There is still a considerable need to continue increasing knowledge on the development effectiveness of projects in the sector, although the Bank's efforts to include impact evaluations in the design will make relevant information on this point available.

Table 3. Lessons learned from Bank projects by area of intervention

Forest Resource Management
• The strengthening of forestry governance, the clarification of land ownership rights and mechanisms to improve agricultural productivity in deforested areas are necessary conditions for reducing the advance of deforestation. The elimination of the characteristic of open access to forestry resources, combined with incentives to stop the advance of extensive agriculture of low productivity, could effectively control the felling of primary forests. • Advancing toward a high value-added, competitive, and sustainable forestry and timber industry depends on the provision of high quality public services. Information systems and inventories, research and technology transfer, health risk management and fire prevention are essential.
Land Resource Management
• Any process of land tenure regularization, including the issuance of land titles, should involve granting full ownership of the land to the occupant. The issuance of land titles to occupants unable to demonstrate clear and full ownership of their property ends up subsequently giving rise to irregular situations of land tenure. • In areas with irregular land tenure situations, investment in property registration without legal clarification of land property rights proves to be of little value. The legal reconciliation of the reality in the field with the legal information in the register at the time of property registration increases its reliability and transparency. • Setting up new information systems is a complex process that generally requires fine-tuning once in operation. However, even when the process is carried out in stages, there are big advantages to planning the full transition. In turn, changes to information systems must be preceded by a process review/reengineering so that these changes are incorporated in the new information systems. • In some cases it may be advisable to launch projects with a pilot phase to identify potential problems, including limitations of the legal framework. • Transaction costs for the service of recording real estate property affect the sustainability of investments in clarification of ownership, particularly in impoverished rural areas. Lack of access and cumbersome and costly procedures for registration discourage the registration of future real estate transactions for properties with clear title, giving rise to irregular land tenure. • Technical and methodological elements are a crucial part of any program of land regularization. If regularization is done efficiently and at low cost, transaction costs are reduced and participation by beneficiaries is encouraged.
Fisheries Resource Management
• Creating the conditions and incentives to establish property rights over the resource will ensure its future sustainability, and prevent open access to the resource, which leads to its overexploitation. A regime that grants property rights based on socio-economic and scientific information, has adequate oversight, and does not contain subsidies for fishing will ensure biomass levels for future extractions.

Agricultural Technological Innovation (Research and Technology Adoption)

- Integrating research and agricultural technology transfer is necessary to ensure the link with the productive sector and achieve results. Experimentation and validation on demonstration plots for producers is a good practice for such integration.
- Capacities for research and agricultural technology transfer are strengthened through international cooperation, especially in small countries. The connection with international research centers and the private sector make it possible to leverage the latest scientific information and maximize the identification of new demands for innovation.
- Recruitment of researchers and high level extension workers is necessary to strengthen the system of agricultural innovation. This strategy should be accompanied by sustainable mechanisms for financing remuneration in the long term.
- Agricultural supports have greater impact when they are based on instruments that reduce economic distortions, are managed in a cost-effective manner, and the level of subsidy encourages self-selection by small-scale farmers. Direct support through income transfers, decoupled from specific commodities, use of inputs or prices, are more efficient policy mechanisms than price supports or delivery of inputs, creating fewer market distortions.
- Agricultural technological innovations with positive environmental effects in the long-term have a higher degree of adoption among producers if they exhibit sufficient profitability in the short term. The adoption of technologies for soil conservation among small-scale farmers may be limited if the time gap between investment in such technologies and reaping their benefits is too wide.
- The provision of agricultural technical assistance services is more effective if it involves the introduction of on-farm technological changes. The economic impacts of agricultural technical assistance or agricultural extension are limited if they are unaccompanied by technological packages geared toward increasing farm yields.

Agricultural Health and Food Safety

- The promotion of collective action schemes among farmers is key to their participation in actions for agricultural health, with a view to prevent a small minority from thwarting the realization of its benefits. It is fundamental for producers and their organizations to join health campaigns and participate in the decision process so as to ensure programs' legitimacy, continuity, and sustainability, without which they will not achieve their goals.
- Technical autonomy of the executive agency is crucial due to the nature of the threats faced by health services. The local and international credibility of the agency demands that its decisions be taken solely on scientific basis, with no other interference.
- A policy of sharing costs with beneficiaries is important for sustainability. Health actions require an extended time horizon to be effective; therefore, contribution from beneficiaries helps to mitigate natural fluctuations in public funding.
- Good technical performance by health control institutions requires continuous programs to update and train their officials.
- A legal framework is needed for plant and animal health with clear competency to regulate and implement corrective measures that are harmonized with international standards. Framework legislation and specific regulations on quarantine and health oversight help to make campaigns flexible and effective, offering certainty and clarity for the private sector.

Water Resources Management and Irrigation

- Transferring the management of irrigation systems to the actual users or to specialized companies is a measure that effectively helps to increase possibilities of project success. Decentralized governance models in the irrigation subsector, usually through irrigation associations, are more successful at cost recovery than public agencies. Likewise, involving users' associations in the design phase of refurbishment projects, and in the construction of new districts, results in designs being obtained in which they can operate and have a stronger commitment to maintain.
- Addressing the challenge of water scarcity requires integrated resource management at the watershed level for efficient allocation of resources among sectors, and greater efficiency in their use for irrigation. Resource management policies should combine economic instruments that assign value to the resource and ensure its sustainability, with special adaptation to local conditions.
- An appropriate framework of incentives ensures the use of technologies for water conservation among farmers. More realistic tariffs, without distortionary subsidies or under-valuations, will not only foster efficient use of the resource at the farm level, but will also permit improvements in the quality of service and ensure that proposed technologies are in keeping with the economic returns they yield.
- Funding farm investments is a subject that needs to be analyzed closely when preparing and proposing

effective solutions that do not rely primarily on public transfers, to avoid excessive delays and enable full utilization of the infrastructure built.
Rural Development
• Projects with multisector interventions at the rural level involving different government agencies have problems with execution and achievement of objectives, and generally take longer to achieve levels of execution similar to those of projects with more focused actions. Interventions to address problems in rural areas should have strategic planning with a focus that is primarily territorial. However, their execution should be carried out through individual programs and/or projects, with mechanisms for execution that minimize interagency transaction costs at public sector level.

4.8 Sovereign-guaranteed investment projects in the sector also reflect a pattern of disbursements above that observed for the Bank as a whole on aggregate. According to the 2015 Business Report[18] (drawing on 2014 data) 80% of projects underway (24 of 30) were disbursed in line with the trend estimated by SPD for each country and sector. This rating averaged 41.4% for all Bank projects, according to the report. Based on PMRs, in June 2015 55% of agriculture and natural resource projects in progress and being supervised by RND and for which information was available (17 of 31) were being executed satisfactorily. Internal calculations also show that in 2015 eligible projects disbursed 24% of their available balance at the start of the year, and 50% of them disbursed less than 25% of the available balance. To date, the active sovereign guarantee loan portfolio for the sector consists of 34 operations, 26 of which are in small and vulnerable countries.

4.9 During the period 2013-2015, 52 NSG operations were approved in the agriculture sector, with a value of US$302.7 million. The Inter-American Investment Corporation's active portfolio in the sector is worth US$476.1 million. These operations have promoted private-sector investment in the development and growth of agribusinesses. In particular, NSG loans financed investments in crop diversification, technological innovation to raise resource-use productivity and efficiency, and environmental sustainability.

4.10 Experience from projects in the NSG portfolio between 2013 and 2015 has shown coordination between the IDB Group's public and private sector windows to be very important in supporting countries' efforts to strengthen their regulatory frameworks, and encourage private investment. Public topics affecting the private sector include issues such as land tenure, natural resource management, environmental regulations, agricultural trade facilitation policies, rural infrastructure and public agricultural services, etc.

4.11 Other lessons learned from analyzing the NSG portfolio in agriculture include: (i) the importance for firms of diversifying their portfolio in terms of product and geographical location to mitigate seasonality, climate risk and commodity price volatility; (ii) recognizing that the agribusiness industry is highly dynamic and therefore that supervision of these operations requires close monitoring of operating indicators and businesses' financial ratios to identify shifts in the market that may have an impact on them, and measures to adapt to these shifts; (iii) borrowing companies' business models need to be analyzed comprehensively, including their dependence on subsidies or donations.

[18] 2015 Annual Business Review. SPD.

D. The Bank's competitive advantages in the region

4.12 Since its founding, the Bank has maintained a strong commitment to agriculture and natural resources management in Latin America and the Caribbean. Through its operations for technical cooperation and financing with and without sovereign guarantee, the Bank has been contributing to the development of the sector. The lessons learned indicate the wealth of experience gained by the Bank, which has made it possible to develop comparative advantages with respect to other multilateral agencies, allowing it to position itself in the last five years not only as one of the principal sources of financing for this sector, but also as a key repository of knowledge on the matter.[19] Going forward, the Bank's commitment to measuring the effectiveness of its interventions in the sector will provide it with assessments that will enhance project quality, while also strengthening its knowledge base and capacities.

4.13 In terms of work areas, the Bank has a comparative advantage to support the sector in the identified challenges of improving agricultural productivity, promoting the sustainable use of natural resources, reducing the sector's vulnerability, and making agricultural growth more inclusive. The Bank's team has technical know-how on these topics and the skills necessary to design and evaluate operations through the corresponding sectors, such as agriculture and natural resources. There are work areas in the sector where the Bank, recognizing the expertise and institutional capacity developed by other institutions, does not seek to take the leadership role, instead strengthening partnerships and supporting joint actions, for example in the areas of: (i) basic scientific research, with international centers and universities with a strong scientific reputation; and (ii) promotion and marketing of specific commodities. Going forward, the Bank's interventions in the sector should consider giving a bigger role to private enterprise and stepping up its interactions with internationally recognized entities. There is also ample cumulative experience on ways and means of supporting the sector that have been unsuccessful, which the Bank will refrain from supporting, such as: lending programs with high levels of interest rate subsidies; support for specific crops via distortions of the prices of final products or inputs; investments in irrigation and drainage systems that do not account for the sustainability of water resources and the potential adverse environmental impacts of reflows; arrangements for the exploitation of fishery or forestry resources without an effective governance framework to ensure their sustainability; and technology transfer systems without well-defined targets and effective mechanisms for tracking results.

[19] Since 2008, the Bank has focused on its knowledge program in the agricultural sector on the estimation of supports for the sector, using a methodology developed by the OECD (PSE, or producer support estimates). This methodology, which makes it possible to ascertain support both in terms of prices as well as through fiscal measures classified by asset type (private or public), has already been applied to 18 countries in the region, which together with what is being applied in Chile, Mexico and Brazil, means the Bank now has a unified database of key regional information for its sector dialogue.

V. GOALS, PRINCIPLES, DIMENSIONS OF SUCCESS, AND LINES OF ACTION TO GUIDE THE BANK'S OPERATIONAL ACTIVITIES AND RESEARCH

A. Goal and principles for the Bank's work in Agriculture and Natural Resources Management

5.1 The Bank's goal in the sector is to promote inclusive development of agriculture and the sustainable use of natural resources in Latin America and the Caribbean. Four basic principles will govern the Bank's actions in the sector:

a. **Economic principle.** Actions will magnify the comparative advantages of the region's countries in the sector, seeking to ensure factor (land, water) and product markets that are conducive to an efficient allocation of private and public resources (without creating economic distortions) for their sustainable growth.

b. **Profitability principle.** Actions will seek to achieve high rates of economic return at efficiency prices, in order to contribute to improving the well-being of rural families.

c. **Social principle.** Actions will favor social inclusion, seeking to benefit the majority of the population that depends on the sector, with special emphasis on small- and medium-scale producers.

d. **Environmental principle.** Actions will preserve ecosystem services where the sector's economic activities are conducted.[20]

5.2 There are differences among the countries of the region, and differences within the countries in the degree of sector development (e.g., commercial agriculture vs. subsistence farming). The Bank's actions will be geared toward addressing the needs of the countries given their context and the specific features of the group of beneficiaries.

B. Dimensions of Success, lines of action, and activities

5.3 To promote the inclusive development of agriculture and sustainable use of natural resources, the four challenges facing the sector in Latin America and the Caribbean must be addressed, as described in Section III: (i) the lagging and uneven productivity of agriculture, affecting its competitiveness; (ii) the utilization of natural resources with systems of access that lead to inefficient use and jeopardize their sustainability; and (iii) the vulnerability of the agriculture and natural resources sector to climate change and other risks, affecting its environmental sustainability in the short and long term; and (iv) the limited coverage of the benefits of the sector's growth among low-income rural populations, affecting their capacity for social inclusion. This SFD proposes four Dimension of Success, or aspirational outcomes to be achieved through the actions proposed here. First, an agricultural sector with high productivity that manages climate impacts, meeting the challenge of competitiveness; second, natural resources utilized sustainably, meeting the challenge of environmental sustainability; third, better management of the impact of climate change, natural disasters, and other risks, to reduce the vulnerability of

[20] This principle will help ensure that the proposed actions in the sector comply with the guidelines of the Environment and Safeguards Compliance Policy (Operational Policy OP-703) and the Bank's Special Program and Multidonor Fund for Biodiversity and Ecosystem Services (document GN-2703).

the agricultural sector; and fourth, rural households with incomes from the sector growing steadily over time, meeting the challenge of social inclusion.

5.4 Each of the proposed dimensions of success gives rise to lines of action that will guide the Bank's operational and knowledge activities for agriculture and natural resources management in the region during the time span of this SFD. These lines of action were identified based on interventions that have proven to be empirically more effective at promoting the inclusive development of agriculture and sustainable use of natural resources, based on: (i) a policy framework favorable to private investment in the agricultural sector[21] and sustainable management of natural resources that magnifies their comparative and competitive advantages; (ii) the promotion of investments geared toward the provision of public goods such as rural infrastructure and agricultural and financial services; and (iii) when justified, a limited, transitional orientation of public expenditure to direct supports targeted to cost-effective instruments.

5.5 In the lines of action under each Dimension of Success, this SFD proposes a set of operational and analytical activities that the empirical evidence and lessons learned and evaluations of Bank projects have shown to have a greater impact in terms of achieving the proposed goal. According to country demand, that set of activities will be executed in a crosscutting manner by sector divisions in coordination with the private sector. The proposed analytical activities seek to strengthen the Bank's capability for sector dialogue at the regional level and with each country by identifying key knowledge and areas for capacity-building through a knowledge program focused on (i) consolidating the agricultural support estimates begun in 2008; (ii) continuing similar work in the area of natural resource stewardship for countries of the region; and (iii) using information from impact evaluations of our flagship interventions with and without sovereign guarantee in each one of the Dimensions of Success, to continue learning lessons in the future.

1. Dimension of Success 1. Agriculture and natural resources management in the region achieve high levels of productivity, and climate impacts are managed in the sector

5.6 Dimension of Success 1 addresses the challenges of both productivity in agriculture and economic activities based on the intensive use of renewable natural resources, as well as reduction of the sector's vulnerability to climate change. Based on the evidence presented in Section II, the activities planned in the lines of action for this dimension will prioritize actions to increase growth and investment in the agricultural and natural resources management sector.

5.7 **Lines of action.** Two lines of action are proposed for this dimension:

a. Support sector policy reform processes to promote efficient markets for factors and products, incentivizing private investment in rural areas and making public expenditure on agriculture more efficient.

b. Promote the provision of rural infrastructure (irrigation, drainage, etc.), agricultural services (innovation, research and technology transfer, health,

[21] In Latin America and the Caribbean, approximately 82% of total sector investment is made by the private sector (farmers) (FAO, 2012).

food safety, information, etc.), and management of natural resources as public goods to improve the sector's competitiveness, facilitating access for the poorest and most vulnerable groups such as women and indigenous people.

5.8 **Activities.** During the period covered by this SFD, the following activities are proposed as priorities for the Bank in its country dialogues:

a. Modernization of country systems for agricultural innovation, emphasizing the strengthening of the apex agencies of innovation systems, the National Institutes of Agricultural Innovation (INIA), the lending framework, and efficient management of public expenditure on agricultural innovation, international cooperation in small and vulnerable countries, and the generation of technology for climate change adaptation by producers, mainly small-scale farmers, based on analysis of the behavior of the sector and its value chains.

b. Development and modernization of technology transfer systems, including the strengthening of the apex agencies for technology transfer, the financing model, and studies on efficient mechanisms/methodologies for technology transfer.

c. Modernization of country systems for plant and animal health and food safety, including arrangements for collective action and cost-sharing among farmers, as well as regulations with a regional outlook ensuring uniformity of quality standards between domestic and external markets.

d. Investment to improve producers' access to rural infrastructure with a subnational focus.

e. Regularization of land titling and modernization of registration and cadastre systems, facilitating access for the poorest and most vulnerable groups such as women and indigenous people.

f. Modernization of statistics systems and systems that provide information for farmers in terms of both prices and agroclimatic and technical information.

g. Improvement of access to credit for small- and medium-scale producers to make productive investments.

h. Preparation and dissemination of updated country-by-country studies on agricultural support estimates as an instrument for sector dialogue with the countries.

i. Impact evaluations conducted and disseminated on flagship projects in this line of action to determine best practices, focusing on the key factors in each case and gender and diversity distinctions.

2. Dimension of Success 2. Natural resources in the region are used sustainably

5.9 This Dimension of Success addresses issues identified in the extensive existing evidence emphasizing the importance of governance and the implementation of natural resource management instruments to solve problems created by open-access systems by allocating property rights to ensure that natural resources are utilized efficiently and sustainably.

5.10 **Lines of action.** The following lines of action are proposed under this dimension:

a. Promote sector policy and governance frameworks that clearly define roles and responsibilities commensurate with the capabilities of the responsible organizations, acknowledge the key technical, economic, and social features of natural resources, and are conducive to their sustainable use.

b. Promote management systems based on the regulation/monitoring and allocation of property rights over natural resources such as soil, water, and fishery and forestry resources.

5.11 **Activities.** During the period covered by this SFD, the following activities are proposed as priorities for the Bank in its country dialogues:

a. Improvement of institutional and legal frameworks governing the work of the authorities responsible for natural resources management so that they perform roles related to the governance, policy design, regulation, and supervision of the sustainable use of natural resources at the national and subnational levels.

b. Technical and operational capacity-building for natural resource management authorities in key areas such as information systems and resource monitoring and control.

c. Investment, technical assistance, and analytical work to support the design and implementation of public policies and management regimes for natural resources (water resources, land, forests, and fisheries) adapted to local conditions, based on the granting of property rights to eliminate the problems of open-access; as well as to support processes to reform the functions of collection and administration of resources to improve the financing of natural resource management.

d. Consolidation of knowledge and information in the possession of the authorities responsible for natural resource management on socioeconomic aspects of natural resource use, resource production, and stock status. This information is required to prepare resource management plans at the appropriate management levels (fisheries, forest ecosystem, watershed, or others), which may be agreed between the public and private sectors.

e. Support for policy dialogue at the national and regional level with relevant stakeholders in the sector and with other sectors where actions impact the outcomes of sustainable natural resource management.

f. Studies conducted on the quality of natural resource governance and management instruments.

g. Restoration and strengthening of traditional knowledge and practices for the sustainable management of agrobiodiversity, forests, soil, and water, as well as local structures for exchange and trade of products. In particular, support will be provided for practices with potential for local adaptation to climate change in agriculture that promote food security

h. Impact evaluations conducted and disseminated on flagship projects in this line of action to determine best practices, focusing on the key factors in each case and gender and diversity distinctions.

3. Dimension 3. The risks of the impact of climate change and natural disasters are better managed to reduce the vulnerability of agriculture

5.12 This Dimension of Success mainly addresses the challenge of agriculture's vulnerability to the impact of climate change and natural disasters. The following line of action is proposed, based on the empirical evidence and lessons learned:

5.13 **Line of action.** Build capacity to manage the risks affecting the vulnerability of agriculture.

5.14 **Activities.** To implement this lines of action, the following activities are proposed as priorities for the Bank:

a. Modernization of information systems for farmers in terms of both prices and agroclimatic information, including studies on efficient mechanisms to transfer risks associated with climate change.

b. Promotion of actions to stimulate agribusinesses development through risk management mechanisms such as hedging, options, and agricultural insurance, through financial institutions with the necessary capability and experience to offer this type of instrument.

c. Investment to support rural infrastructure, considering factors for prevention of natural disasters.

d. Impact evaluations conducted and disseminated on flagship projects in this line of action to determine best practices, focusing on the key factors in each case and gender and diversity distinctions.

4. Dimension of Success 4. Rural family incomes from agriculture rise steadily

5.15 This Dimension of Success seeks to address the challenge of the unequal impact of the growth of agriculture on rural incomes. It focuses on correcting market failures that currently impede small-scale farmers from getting to market or connecting to value chains. Although many of the lines of action under Dimension of Success 1 are expected to contribute to overcoming the market failures associated with a lack of access to rural infrastructure or agricultural services, the lines of action under the Dimension of Success 4 will prioritize attention to market failures affecting the investments made by those farmers, particularly as they relate to: (i) liquidity constraints and lack of access to credit; (ii) limited market size or absence of market opportunities; (iii) problems created by information asymmetry such as adverse selection and/or moral hazard; (iv) high transaction costs; and other factors. Synergies will be explored between these investments and social programs in rural areas, particularly where agriculture is not viable.

5.16 **Lines of action.** Two lines of action are proposed for this dimension:

a. Support efforts to overcome the constraints faced by poor, small-scale farmers, given their limited physical and human capital, scarce access to finance and risk-management instruments, and poor functioning of certain markets, with special attention to vulnerable groups such as women and indigenous people.

b. When justified, ensure that public expenditure on private goods focuses on a small number of cost-effective mechanisms of direct support through income transfers decoupled from the production of specific products, inputs, or

prices, with mechanisms for targeting actions that are operationally effective and function at reasonable cost.

5.17 **Activities.** During the period covered by this SFD, the following activities are proposed as priorities for the Bank in its country dialogues:

a. Implement cost-effective incentive mechanisms for the adoption of viable, environmentally sound technological innovations to help farmers adapt to climate change, with special attention to vulnerable groups such as women and indigenous people.

b. In coordination with the private sector, foster credit and guarantee mechanisms to finance key links in value chains, or directly finance small- and medium-scale producers' needs for working capital and/or capital investment, including funding and technical assistance for intermediary financial institutions.

c. In coordination with the private sector, make investments to support agribusinesses geared toward the transformation and agroindustrial innovation of sector products all along the value chain, as well as businesses that foster the development of business partnerships or chains, with emphasis on small- and medium-scale producers and their access to credit, basic inputs, or capital for productive investment. Invest in the modernization of infrastructure for logistics, bulking, and postharvest management.

d. Conduct and disseminate evaluations of the linkage between social protection programs and agriculture programs, to determine best practices, focusing on the most vulnerable population groups, including women and indigenous and Afro-descendant populations.

e. Impact evaluations conducted and disseminated on flagship projects in this line of action to determine best practices, focusing on the key factors in each case and gender and diversity distinctions.

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