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ARGENTINA

COUNTRY ENVIRONMENTAL ANALYSIS

PROFOR
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Acknowledgments

The report is based in the diverse challenges faced by the environment and natural resource sector in Argentina, especially those relating to new challenges in the rural economy, but also by urbanization and industrial development. Steady economic growth, increasing equality, and structural economic transformations fundamentally change the features of environmental challenges – but also how they can be managed to help reverse environmental degradation, and to demonstrate that environmental sustainability, economic growth, and shared prosperity can be mutually supportive goals.

The Argentina Country Environmental Analysis report was prepared by a team of World Bank Group staff and consultants working on sustainable development, environment and natural resources. Staff from other global practices and sectors, such as urban, DRM, energy, and agriculture, contributed importing supporting material.

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Abbreviations

ACUMAR	*Authorities of the Matanza-Riachuelo Basin - Autoridad de Cuenca Matanza Riachuelo*
ARG	*Argentina*
BAMA	*Buenos Aires Metropolitan Area*
CEA	*Country Environmental Analysis*
CIAFA	*Chamber of fertilizer and agro-chemical industry*
COED	*Cost of environmental degradation*
COFEMA	*Federal Environmental Council*
COPD	*Chronic obstructive pulmonary disease*
EIA	*Environmental Impact Assessments*
EM-DAT	*The international disasters database*
ENR	*Environment and natural resource*
EPI	*Environmental Performance Index*
FAOSTAT	*Statistics Division of the Food and Agriculture Organization*
GHG	*Greenhouse Gas*
INDEC	*National Institute of Statistics and Censuses - Instituto Nacional de Estadística y Censos de la República Argentina*
INTA	*National Agricultural Technology Institute - Instituto Nacional de Tecnología Agropecuaria*
LUCC	*Land-use or cover change*
LULUCF	*Land-use change and forestry*
MAyDS	*Ministry for Environment and Sustainable Development*
NGO	*Non-governmental organizations*
NOx	*Nitrogen oxides*
PM	*Particulate matter*
RE	*Renewable energy*
SAyDS	*Secretariat of Environment and Sustainable Development*
SIIA	*Information system on agricultural products - Sistema Integrado de Información Agropecuaria*
SO_2	*Sulfur dioxide*
WHO	*World Health Organization*

EXECUTIVE SUMMARY

This country environmental analysis (CEA) for Argentina (ARG) is a systematic, country-level diagnostic of the state of the environment and natural resource (ENR) use. It serves as an environmental quality baseline against which future trends and changes in environmental quality and associated drivers can be analyzed. Furthermore, it provides a financing and budget analysis for the ENR sector and assesses the policy and institutional framework readiness for addressing ENR issues. The main objective of this CEA is to support the government of Argentina in analyzing critical environmental constraints to sustainable growth and shared prosperity and propose broad policy actions to address them. The CEA is also a tool to engage with civil society and development partners and broaden the policy dialogue on key cross-sectoral issues associated with the country's main environmental challenges.

This CEA does not attempt to cover all challenges and is limited to the most important issues of environmental management and degradation[1]. The complexity of the environmental challenges in Argentina has increased with the transition from a rural to an industrial economy with a high degree of urbanization. Given the distinct features and response mechanisms, the analysis is separated by rural and urban environmental challenges. Interlinkages are highlighted whenever necessary. It is emphasized that additional in-depth studies are likely to be needed to further analyze various linkages and impacts of environmental degradation and that would be built on better data availability and quality.

Argentina has strongly improved its economic growth and poverty records since the 2001 financial crisis, yet development has not always been sustainable and environmental friendly. Argentina's economy, one of the largest in Latin America, is endowed with valuable natural resources. During the past decade the economy grew steadily, more people entered the middle class, and inequality lessened. Poverty has been declining since 2001 and measures for education and health show a positive trend. Developments on the environmental side, however, have not been equally positive. Deforestation has become a major environmental issue in the North of Argentina and flooding events are affecting thousands of Argentinians throughout the country every year. Air pollution, waste management and water pollution are becoming serious problems especially in the growing urban centers of Argentina, but remain only partially addressed.

Despite several successes, for example the management of Protected Areas in support of a vibrant nature-based tourism sector, the country's record on environmental management remains mixed. The number of visitors to protected areas increased by 88% between 2004 and 2013[2]. Tourism provides an important economic dividend for Argentina in terms of employment (1 million jobs), income (10% GDP), and foreign currency that should not be underestimated (MINTUR, 2014; WTTC, 2015). In contrast to these important achievements, deforestation, land degradation, air and water pollution, and the management of solid waste remain significant challenges. Argentina's score for the Environmental Performance Index (EPI)[3] is 79.84 out of 100 and the country is ranked 43 out of 180 countries. The lowest ratings (out of 180) are for biodiversity and habitat (125), fisheries (124), and forests (112).

The State of Environment and the Cost of Environmental Degradation

With economic growth, urbanization, and the emergence of a middle-class, environmental challenges have equally transitioned from being predominantly "traditional" to increasingly "modern" challenges, mainly associated with industrial agriculture and urban pollution. In the rural space, the structural shift from traditional grazing agriculture to high intensity soy cultivation carried significant environmental externalities. To date, soy production is the number one

[1] The selectivity of issues as presented in this CEA is a result of demands expressed by the former Government, but also based on availability of reliable data.

[2] MINTUR based on information from the National Parks Administration

[3] Developed by Yale University: http://epi.yale.edu/epi

export commodity (28% of all exports) and the most important agricultural product (INDEC, 2015). The structural transformation driven by high urbanization rates with 90% of Argentinians living in cities (UN WUP, 2014), growing urban population, and economic growth is widening the range of environmental challenges, for example, adding waste management, air and noise pollution as key challenges to the list of well-known environmental management issues.

The Rural Environment and Natural Resource Management

Between 2001 and 2014, Argentina lost more than 12% of its forest area, the equivalent of losing a forest the size of one football field every minute. In comparison, forest cover loss in Brazil was 7.4%, and worldwide it was 6.3%.[4] During the same period, Argentina ranked 9th as regards forest cover loss at global scale and the province of Santiago del Estero experienced the highest deforestation levels worldwide[5]. Almost all deforestation (93%) took place in northern Argentina and led to an estimated emission of GHG of roughly 1 billion tons.

The main driver of deforestation in the last few decades is the continued expansion of industrial-scale agriculture, especially for soy production, which experienced a remarkable increase in cultivated area. Deforestation for cattle production has also expanded in the region during this period. While the primary driver of deforestation is soy production, the underlying causes are related to (a) insufficient land use planning and enforcement, including insufficient funding of the "Forest Law" (*Ley 26.331 de Presupuestos Mínimos de Protección Ambiental de los Bosques Nativos*), and (b) favorable policy, market and technological conditions, including high commodity prices which have favored the expansion of soy production.

Further development of the sector should be complemented by strengthened capacity to monitor and enforce environmental laws to help ensure that associated externalities, including the negative impacts of deforestation, are minimized and considered in land use decisions. In 2007, the Forest Law (N° 26.331), introduced a requirement to identify, classify, protect and monitor natural forests and a mechanism to finance these efforts at the National and Provincial levels through the Forest Fund (Fondo Nacional para el Enriquecimiento y la Conservación de los Bosques Nativos). The Forest Fund set in motion a process of strengthening institutions and enforcement of capacities. This effort is ongoing, however insufficient funding seems to have slowed the process. Recent declines in deforestation rates may be partially attributed to the drop in commodity prices, so cannot yet be deemed as an exclusive result of the new policy.

Understanding the costs and benefits of deforestation for agricultural expansion is essential to determine the trade-offs in land-use decision-making, and these should be carefully considered. Significant costs are associated with the loss of ecosystem services and land degradation resulting from deforestation, and deforestation in the upper watersheds of the main river basins is associated with riverine flooding, which is the cause of half the economic damage in Argentina resulting from natural disasters.

The move towards industrial agriculture is associated with other challenges beyond deforestation. For example, Argentina has developed into the third largest producer of genetically modified (GMO) crops of which 86% is soy (ISAAA, 2015). This could have potential future impact on access to markets where GMOs are regarded negatively by consumers. Further, the use of agricultural chemicals associated with no-tillage agricultural production has dramatically increased. While the area under no-tillage, often termed "conservation agriculture" because it implies reduced soil erosion, increased from 14% to 73% between 1993 and today, the use of insecticide and herbicide increased 563% and 1111%[6], respectively, during the same period.

Flooding is the greatest natural disaster threat in Argentina causing 60% of all natural disasters and 95% of the economic damages[7]. While riverine flooding and urban flooding share common roots, their extent and economic impact are different. Riverine flood events predominantly occurred in Northern and Central Argentina, especially along the Parana River basin, with gradually higher concentration in Northern

[4] Calculation based on Global Forest Watch Data (2016).
[5] Sobre La Tierra (2016).
[6] This number refers to all insecticides and herbicides, not just those used in no-till agriculture.
[7] EM-DAT (2015).

Argentina. For riverine flooding, deforestation in upper watersheds, poor rural drainage infrastructure, and increased rainfalls contribute to increase the risk of flooding. Indicative overlay of maps illustrating deforestation and riverine flooding events may suggest a correlation between the spatial distribution of deforestation and flooding events.

The Urban Environment

In the urban areas, where 90% of Argentinian population reside (UN WUP, 2014), environmental challenges are dominated by air and water pollution, poor waste management, and exposure to natural hazards, especially urban floods. At present, the data, information, and management capacity to address these emerging challenges significantly lack behind the speed at which these problems impact people and the economic development capacity of the country. The poor and vulnerable are disproportionally affected by urban environmental problems. While in the past the policy debate on environmental issues has mainly focused on "green" environmental issues, "brown" environmental challenges have increased and will require greater attention in the future. Argentina's path to economic prosperity is through efficient, sustainable, and economically thriving cities.[8] While these generate agglomeration economies by concentrating ideas, talent, and knowledge, these are often constrained by market and coordination failures that cause agglomeration externalities leading to higher costs—from more expensive land to congestion and environmental degradation. Agglomeration externalities thus need to be managed so that prosperity does not come at the expense of livability.

Air pollution in Buenos Aires, Córdoba, and Mendoza are many times higher than the WHO recommended threshold. The average PM2.5 pollution in Buenos Aires exceeds the WHO recommended threshold of 10 µg/m3 almost 6-fold, Córdoba about 3-fold, and Mendoza about 2-fold. Increased use of vehicles and extreme traffic congestions are the main sources of Argentina urban air pollution. The number of circulating cars has increased by a factor of six over the last 25 years, from only 2 million vehicles in 1990 to 12 million in 2014. Emission levels are not only influenced by the number of vehicles, but also by fuel standards, quality of cars, type of vehicles on the road, and transport behavior. Almost 50% of vehicles are older than 10 years (22% older than 20 years) and 35% are diesel powered.[9] Road transport is basically the only mode of freight transport with 99% of sales value of goods transported by road (96% of transported tons by road; Sanchez et al 2007).

The cost of air pollution impacts on society is estimated at about 1.8% of GDP[10]. Ischemic heart disease, lower respiratory infections and chronic obstructive pulmonary disease (COPD) are all linked to poor air quality and are among the four leading causes of years of life lost due to premature mortality. In addition to mortality, poor health due to air pollution impacts peoples' productivity and their ability to work and take care of their families[11]. For children, reduced productivity translates into educational underperformance with long-term negative effects for economic performance and poverty alleviation. To cope, households divert limited resources towards health expenditures instead of using them for investments with returns for economic development and poverty alleviation. People suffering from chronic diseases are also less able to participate in social activities, including community and political activities that often provide the necessary framework in which economic development is embedded.

Water pollution from agriculture, industry and domestic activities is increasing in many watersheds in Argentina. Surface water is the main source of water consumption and is vulnerable to pollution from discharges of untreated wastewater and/or industrial effluents, agriculture run-offs and domestic activities. Only 65% of municipal waste water is collected and only 12% is treated before disposal. The increasing pollution of surface water is of particular concern as many regions in Argentina report high levels of arsenic contamination in groundwater. The agricultural

[8] Leveraging the Potential of Argentine Cities: A Framework for Policy Action. World Bank, 2016

[9] Asociación de Fábricas Argentinas de Componentes y Promotive S.A., 2014.

[10] Data prepared by the World Bank as part of "An Economic Assessment of Environmental Degradation in Argentina ": Bjorn Larsen, John Magne Strukova Skjelvik and Elena Golub, 2015 (unpublished). For details, see also Annex C.

[11] Impact on productivity can have different time dimensions. Sick people may be able to allocate only reduced time to productive activities over a day, week, month, or year. Health impacts may also alter the whole productive life, i.e. by changing the overall time people do not work at all and the probability of having to be taken care of by others.

sector is the largest consumer of water (75%) followed by municipalities (15%)[12].

Increased solid waste accumulation is a common externality of economic growth and consumption, especially in urban areas, and impacts citizen's quality of life. Appropriate waste management is one of the key challenges. Open dumps remain the most common mode of disposal in Argentina, particularly in poorer communities and neighborhoods. Increasing amounts of organic waste is a major source of vectors and greenhouse gas emissions. Recycling is still very limited. Hazardous waste is also on the rise (e.g. medical waste generated by increased health care service provision, and unregulated e-waste). The lack of public official statistics on agricultural waste, non-hazardous Industrial waste and construction and demolition waste makes it very difficult to assess the full extent of the issue. However, an unclean and disordered environment has a systemic impact on livability, health, property values, attractiveness for businesses and tourism, and the population's sense of security that is well documented, particularly in Buenos Aires.

Rapid urbanization and inadequate urban development are at the root of increasing urban flooding and large cities like Buenos Aires and La Plata are particularly vulnerable due to their location. In contrast to riverine flooding, urban flooding is in most cases the result of heavy rainfalls concentrated in time and location. For example, in February of 2015 Córdoba experienced 320mm of rain per square meter within twelve hours, which is about three times the average rainfall in February for the city. With urbanization and the associated paving and construction of buildings, land areas are transformed into impermeable areas where the possibilities of drainage are diminished and the water amounts in the draining systems and on the street increase[13]. In addition, when vegetation is replaced by urban infrastructure the capacity of evapotranspiration decreases[14]. Artificial barriers that are intended to protect communities in one location, often accelerate the volumes of runoff water for other communities downstream.

Buenos Aires and La Plata are located in the flood-prone, depressed Pampa region, which historically has been filled with small rivers and streams draining into the La Plata River basin. Over time, many natural runoff systems have been covered up or "tubed" and are now blocked, increasing the risk of flooding. The combination of urban flooding and riverine flooding increases the risk manifold. Housing developments that have been built in the floodplains of the Parana Delta near Buenos Aires prevent the natural runoff of water that would cushion the impact of floods, increasing the risk of urban flooding in the metropolitan area. The Hydraulic Master Plan (*Plan Director de Ordenamiento Hidráulico* - HMP) prepared in 2004 by the government of Buenos Aires city lays out a comprehensive plan for improving protection against floods based on a basin-wide approach using a variety of nonstructural and structural measures. Its ongoing implementation has already resulted in significant improvements in drainage capacity, as well as providing experience for knowledge transfer to other provinces and cities in Argentina.

The mining sector in Argentina suffers from poor environmental management and enforcement that left a legacy of harmful by-products, waste, and difficult mine closures. Mining in Argentina is a relatively new industry and the country has limited experience with mine closure and clean-up[15]. Years of lax environmental enforcement and management practices have resulted in undesirable accumulation of harmful solid and liquid wastes associated with uranium mining and processing, and the generation of waste tailings and low-grade ore[16].

Climate Change

Increasing frequency of extreme climatic events is magnifying environmental challenges and increasing the vulnerability of urban population. For example, heavier, erratic rainfalls increase the probability of urban flooding events particularly where adequate drainage systems and urban planning are lacking or

[12] AQUASTAT (FAO).

[13] If the population density increases from 0.4 habitants per hectare to 50 habitants per ha (Buenos Aires average) the time of the runoff decreases to 10 % of its initial value and the volumes increase by 1000 % (UNESCO 1987).

[14] Due to impervious surfaces like pavement and rooftops, a typical city block generates more than 5 times more runoff than a woodland area of the same size (US EPA)

[15] PRAMU project World Bank 2008

[16] It should be noted, however, that the legacy issue is not "nuclear waste," but rather large amounts of low-grade tailings with radioactivity levels typically below what is commercially viable natural uranium ore.

existing systems lack proper maintenance/implementation. Increasing temperatures are expected to put more pressure on water supplies in the more water-stressed parts of the country. Coupled with higher probability of heat wave events, increasing temperatures have adverse effects on human health and infrastructure (especially transport and power), and trigger higher demands for electricity for cooling (with a disproportionate negative impact on the poor). This implies, inter alia, additional operational costs to critical public infrastructure like hospitals and schools. Contingent on energy generation technologies and transport behavior, air pollution may also increase as a secondary effect.

Projections suggest that the country as a whole will see an increase in average temperatures and the North and Central regions will experience an increase in both rainfalls and temperatures. Until 2039, temperature will raise by 0.5-1°C, and by 2090, temperatures in the north of Argentina are projected to increase by 4°C on average, while in the south only by 1.1 °C. Regarding the projected precipitation, it seems reasonable to assume no significant changes, as the projected changes are within the margin of error. Wider and deeper sectoral data and further analysis are required to improve modeling and understanding of different impact scenarios including effects on agriculture and landscape.

Institutional Framework

Environmental governance in Argentina is multi-layered and cuts across federal, provincial and municipal levels. The current environmental governance structure is based on the distribution of powers between federal, provincial and municipal governments that was defined in the constitutional reform of 1994. The right of the Provinces to regulate natural resource use and extraction dates back to 1853 and remains a key feature of Argentina's environmental governance. To ensure a minimum threshold of environmental protection applicable nationally, the Constitutional reform empowered the national congress to enact "minimum standards" [17] while allowing Provinces to enact higher thresholds should they wish. The constitutional reform also included an explicit right to a healthy environment and procedural remedies available to citizens and NGOs when defending collective rights.

Most environmental regulatory powers are with the Provinces, and capacity and budgetary constraints reduce their effectiveness. The 1994 reform codified Provincial ownership over natural resources and provided the legal basis for most regulatory powers dealing with natural resource use and environmental protection, including the hydrocarbon deposits and fisheries within twelve miles of the coastline; with some exceptions, such as nuclear and hydro-electric energy, for which regulation is centralized. Devolution of power is common in a federal system and offers many benefits in terms of developing localized and tailored solutions to local priorities. Nonetheless, many provincial and municipal authorities lack the technical capacity to set adequate thresholds of performance or the financial resources to monitor and enforce environmental standards.

The recently established Ministry of Environment and Sustainable Development has a stronger mandate for policy development but also greater challenges to address. Following the general election in October 2015, a new Ministry for Environment and Sustainable Development (MAyDS) was created, replacing the Secretariat of Environment and Sustainable Development (SAyDS) that was previously under the jurisdiction of the Chief of the Cabinet of Ministers of the national government. Primary functions of MAyDS include environmental policy development and implementation and management of environmental affairs, including information dissemination, relationships with environment-related non-governmental organizations (NGOs), and national coordination with regard to international conventions.

Public Opinion, Budget Allocation and Priority Setting

A large majority of Argentines attribute great importance to environment and natural resource management for economic development, health and

[17] The nine "minimum standards" in force are laws on: General Environment, Hazardous Materials, Integral Management of Industrial Waste, Management and Elimination of PCBs, Management of Water, Free Access to Public Environmental Information, Protection of Native Forests, Control of Conflagration Activities, and the Protection of Glaciers.

wellbeing but see a deterioration of the environment over time. Survey results[18] indicate deforestation, waste management and water pollution are considered major national concerns, while solid waste and air pollution were perceived by respondents as the most significant environmental concerns impacting their lives directly. Citizens have a more positive perception of their local environment than they do of the global environment (for example their opinion of the status of the environment in their own town is more positive and less negative than that of the country as a whole, and that of the world). However, when it comes to trends, the majority (63%) of the population believe the status of the environment in Argentina has worsened during the last years (FVSA, 2014).

There is significant lack of trust in the government when it comes to addressing environmental issues. Only 20 % of the survey respondents (November, 2015) trust the national government to solve environmental problems compared to 41% that trust civil society organizations, while 13% trust the media and 8% trust the judiciary to resolve these challenges. Additionally, respondents seem to be unaware of actions governments are taking to address environmental problems, or believe these actions are not enough. More than 2/3 of the respondents believe that the national and local government are doing nothing or little to address environmental issues.

People's perception and understanding of the causes and impact of environmental degradation may guide policy makers on where more action or better information is needed. Citizens seem more aware of the causes and impacts of urban environmental issues and less of those affecting the rural space. However, current views and opinions on the environment may largely stem from anecdotal evidence and "hearsay" rather than the analysis of publicly available data on the state of the environment. Overall, however, public opinions provide valuable inputs for priority setting, inform the design and implementation of environmental communication strategies and monitor and evaluate on-the-ground results.

Environmental expenditures in Argentina appear low but show an upward trend. National government spending[19] for Environmental Management[20] accounts for about 1.7% of the total public spending[21], and about 0.4% of GDP[22]. By way of comparison a conservative estimate puts the cost of environmental degradation at 8.11% of GDP[23]. The level of environmental expenditure in Argentina is slightly below the level in other Latin American countries with strong environmental management (such as Costa Rica, Mexico and Chile) and clearly below that of OECD countries[24]. Given the limited data available on public spending below federal levels, these assertions only apply to federal level spending, while certain mandates for environmental management are executed at other levels (provinces, municipalities).

Federal environmental spending is focused on specific projects and activities, and while these have led to important improvements in selected areas, notably the Matanza-Riachuelo Basin, broader policy and institutional challenges persist. Almost one third of national government environmental expenditures are for the clean-up of the Matanza-Riachuelo Basin, one third for water supply and sanitation and flood control infrastructure, and only 4% for protection of native forests. The funding addressing forest management targeted a) implementation of the Forest Law[25] (42%); b) conservation and management of national protected areas (41%); and c) fire management (17%). It is worth noting that the amount allocated for the implementation of the Forest Law represented only a minor proportion of the amount provided for in the law and an indication of chronic underfunding[26].

[18] An automatized and representative telephone survey was conducted in November, 2015 following a similar survey executed in 2014.

[19] Accrued (current values).

[20] In the context of this CEA Environmental Management expenditures refer to expenditures from the national government that are classified under "Ecology and Environment" and "Water and Sanitation" in the Argentina national budget. The former category includes conservation and use of natural resources (forests, biodiversity, etc.); treatment of industrial waste; air, water and soil pollution management; the latter includes provision of drinking water, waste water management and flood management.

[21] Study on Environmental Expenditure in Argentina. September, 2015. Prepared at the request of the World Bank by Oscar Cetrángolo, Martina Chidiak, Javier Curcio and Veronica Gutman.

[22] 2013 data.

[23] This is the sum of costs of environmental degradation for the issues presented in Table A.

[24] For example, public environmental expenditures in the EU28 countries ranged between 0.2% and 1.4% of GDP in 2013 with an average estimated at 0.7%.

[25] Law 26,331 – Minimum Standards for the Environmental Protection of Native Forests.

The opportunistic funding allocation for environmental issues reflects a lack of strategic prioritization and programming in support of an objective-driven environmental agenda with clearly set activities, outputs, and outcomes. Great successes of the past such as the establishment and management of Protected Areas may be jeopardized if environmental management approaches are not fundamentally reformed towards evidence-based priority setting that guides and align the allocation of funds. This applies to both the management of environmental issues at local, domestic and regional level, as well as Argentina's commitments at the international level.

A systematic, transparent prioritization process provides a basis for discussion and exchange among political and interest groups in allocating scarce resources among numerous environmental challenges. Table A illustrates such an approach, first ranking those issues identified in the citizens' survey as being of highest national or personal concern, and then those estimated to impose higher costs on society. This analysis suggests that public expenditures are not always aligned with the key environmental issues identified on the basis of citizens' perception and costs to society. While significant resources are allocated to water pollution, which is an issue of significant concern, relatively smaller amounts are allocated to tackle deforestation and waste management, and air pollution in particular suffers from a dearth of funding. It should be noted however that budget alignments and policies in other sectors may also have a strong impact on the environment. Based on this analysis, deforestation, air pollution and waste management are identified as key areas for action, together with a concerted effort for data collection to improve targeting of resources for environmental management.

The Way Forward: Reconciling Environmental Stewardship and Economic Growth

With the mounting complexity of modern environmental challenges and an elevated institutional and political mandate for addressing environmental issues, the time is ripe for Argentina's environment and natural resources management to turn over a new leaf. The newly elected government has already taken several steps to strengthen its environmental agenda and elevate environment and natural resource management integration into political and economic decision making. The government has also taken concrete actions towards policy changes that are immediately impacting environmental management and degradation in various forms. This proactivity and openness to change will create opportunities for improving the current status of environmental management in the country – but also new challenges. The findings of this CEA should inform the change process by providing a consolidated analysis of the state of the environment in Argentina and its associated governance system. By enhancing the knowledge about environmental issues and natural resource management challenges, the CEA intends to inform the policy dialogue, prioritize actions, and facilitate decision making.

A core challenge to the new ministry will be the interpretation of its role in an environment of economic transition and restructuring. Accession to the OECD is on the Argentina's political agenda and could serve as an outstanding opportunity for the ministry to scale-up its work. As experience from other countries shows, one of the core though most challenging elements of the OECD accession process will be to elevate environment and natural resource management standards to OECD levels. This process often requires significant reforms of the environmental governance framework and may impact many other sectors that are politically and economically very important for spurring growth and development. Many reforms may be met with opposition, making the accession process lengthy, costly, and demanding.

Table 1: An Approach to Prioritization of Environ-mental and Natural Resource Management Issues

Environmental issue	Public Perception	Costs to Society[27]	Public Expenditure	Current situation	Future
Deforestation	Major issue for Argentina	Annual costs 0.74% of GDP	4 % of federal environment budget	High deforestation rate vs. forest law	Enforcement of forest law is crucial
Air Pollution	Major issue for Argentina and people	Annual costs 1.84% of GDP	No federal funds allocated or no information available	Very high levels in large cities vs. low levels in small towns	Urbanization and higher income
Waste Management	Major issue for Argentina and people	Not surveyed	5-25% of total municipal expenditure	Millions remain unserved vs. better than LAC average	Amounts of waste are increasing vs. coverage is easier in urban areas
Water Pollution	Major issue for Argentina and people	Annual costs 0.4% of GDP	46 % of federal environment budget	Improvement in Riachuelo vs. still polluted	Available data does not allow prediction
Land degradation	Not regarded as major environmental issue for Argentina and its people	Annual costs 3.56% of GDP[28]	No federal funds allocated or no information available	Conversion of forests and grazing land into cropland	Policies favoring agricultural expansion as threat
Lead Pollution	Not regarded as major environmental issue for Argentina and its people	Annual costs 0.91% of GDP	No federal funds allocated or no information available	Poverty increases exposure to lead	Available data does not allow prediction
Arsenic Pollution	Regarded as substantial factor for water pollution	Severe health impacts (skin lesions and cancer)	No federal funds allocated or no information available	High levels only in some regions	Cleaner surface water could replace arsenic groundwater
Agro-Chemicals	Regarded as substantial factor for AIR pollution	Severe health impacts and water pollution	No federal funds allocated or no information available	widely used (e.g. glyphosate) vs. still below world average	Trend is so far decreasing
Urban Flooding	Not regarded as major environmental issue for Argentina and its people	Annual costs 0.32% of GDP[29]	17 % of federal environment budget	Increasing occurrence with large damages	Urbanization and constant high precipitation
Riverine Flooding	Not regarded as major environmental issue for Argentina and its people	Annual costs 0.34% of GDP[29]	17 % of federal environment budget	Increasing occurrence	Constant high precipitation

Note: each environmental problem was evaluated and decided on what appears to be the most seriously problematic (red), problematic (yellow), not too problematic (green), and cases where it was not possible to make a statement (no color). The order of the table does not reflect an order of priorities.

The implementation of environmental policies in an advanced economy such as Argentina may require further institutional reforms beyond the establishment of a Ministry of Environment, in particular to reinforce licensing and enforcement functions. Given the increasing complexity of environmental challenges across an increasing amount of sectors and themes, a division of roles and mandates regarding regulatory and executive/enforcement powers within a governance structure might become necessary. The implementation of modern environmental policies often requires the establishment of an executive arm within national environmental governance. In that regard, and in support of their aims, environ-

[27] Data prepared by the World Bank as part of "An Economic Assessment of Environmental Degradation in Argentina ": Bjorn Larsen, John Magne Strukova Skjelvik and Elena Golub, 2015 (unpublished). For more details see also Annex C.

[28] Cost of land degradation measure the loss of value due deforestation as one important factor, alongside with the conversion of shrublands, grasslands, cropland, barren land, and woodlands into less valuable biomes. Bouza et al. 2016

[29] Costs from riverine (urban) flooding account for 49% (46%) of all natural disaster costs, which have a total annual cost of 0.7% of GDP

mental agencies commonly act as an operating authority and a licensing authority. They commonly bundle agencies that had been created prior to address specific, individual environmental management issues, for example regulatory functions within a specific watershed.

Argentina needs policy changes to foster the monitoring of environmental assets in time and place (such as land resources, forest stock, mineral resources, and biodiversity), and reduce direct pollution impacts that may influence human health and environmental quality (e.g., air quality and access to basic environmental services). Such policies would guide a transition to a more resilient and cleaner economy and present economic opportunities that contribute to sustainable growth. Many implementation mechanisms and resources for reconciling environmental sustainability with economic growth and social improvements are yet to be put in place.

Current policies need strengthening and realignment across economic sectors to take account of the loss of value of natural resources and the human health cost. Focusing on selected policy measures can help reduce forest depletion, land degradation, and air pollution and simultaneously influence behavioral change—a win-win approach. Raising the importance of environmental protection by linking it to economic development and well-being would create more opportunities for the integration of environmental management and climate change in the country's development agenda.

Strengthening the effectiveness of environmental policy would require resources to help neutralize the negative ecological consequences of economic activities that undermine the natural resource base. Total spending for environment amounts to an average of 1.7% of federal government spending. Expressed as a percentage of GDP, the public environmental expenditure amounts to 0.4% of GDP[30]. Given the amount of environmental problems that Argentina has to solve, budget resources fall short of what is needed to combat environmental degradation. Aligning environmental expenditures with policy priorities and areas of major concern such as air quality, deforestation, solid waste management is a key for achieving sustainable outcomes. Steps to align environmental policy and practice with international norms and standards as well as combine environmental and economic levers to influence polluters' behavior should be among the priorities.

An Agenda for Action

Based on the results of the CEA an indicative list of recommendations has been developed for government action. This list could serve as a blue print for addressing the issues studied in the CEA and could further benefit from a cost benefit analysis of the actions, as a follow-up to the CEA in order to prioritize, determine their sequence and allocate sufficient resources. These actions, if implemented consistently, could reinforce the sustainability profile of Argentina in a positive way.

Improve the Collection, Management, and Accessibility of Data on the Environmental and Natural Resources

- Establish comprehensive environmental data collection and monitoring systems, for example real time collection of air quality data in urban areas, water quality monitoring, or data on deforestation and land degradation.
- Improve associated data management system to ensure a comprehensive and integrated management and analysis of environmental data.
- Ensure transparency of environmental data, for example through its publication on (government) websites and online databases.
- Facilitate the usability of environmental data, for example through websites and mobile apps reporting real time air quality, [possibly integrated with hydro-met data reporting (weather reports)

Adapt Institutional Capacity and Scale-up Mandate

- The new ministry needs to implement an organizational structure embracing a wider range of environment and natural resource management challenges and needs
- Policy reforms need to go hand in hand with the institutional reforms and should also include a wider environmental agenda than before, especially addressing urban and industrial environmental degradation, and reinforcing the framework for Environmental Impact Assessment (EIA)
- OECD accession will require these reforms as a prerequisite to meet OECD standards and should serve as a catalyst for such a reform process

[30] Source: footnote 27

- The momentum of the ongoing institutional reform process may be used to reinforce licensing and enforcement functions, for example through establishment of an executive arm within national environmental governance.
- Initiate capacity building for *environmental statistics* to ensure accuracy of data collection of environmental monitoring, including for reporting to meet regional and international conventions—national statistics offices can be trained to improve measurement and provide information on the potential for using the U.N. System of Environmental-Economic Accounting.
- Strengthen the basis for policy development by adopting the methods and definitions used to generate *green accounts*, in which monetary values are attributed to natural capital and biological resources (not as the only criteria to support decisions, but as one to consider among others).

Improve air quality management

- Strengthen the current system of *air quality monitoring* by expanding air quality monitoring parameters/pollutants where the highest health impacts are observed; break down TSP emission monitoring into PM2.5 and PM10; introduce continuous monitoring for lead rather than monthly averages of discrete 20-minute measurements; monitor ground-level ozone at more stations in cities.
- Reestablish a fiscally neutral (from a public finance point of view) annual *vehicle technical inspection system* (emissions characteristic) with the necessary diagnostic equipment and technical staff; reintroduce vehicle registration and licenses to encourage adherence to emission standards and improvement of air quality.
- Reform the current *system of pollution charges* for air, water, and generation of waste by introducing meaningful economic incentives.
- Assess options to combine air quality policy with carbon emission reduction policy, e.g. through innovative licensing and carbon pricing mechanisms.

Improve solid waste management

- Better defining and quantifying environmental issues: Updating the National Plan for Solid Waste Management. Completing the Provincial Plans for all provinces in the country.
- Improving financial sustainability: Improving tariff setting through provincial guides and norms to cover additional services. Undertaking a Value Chain Study for Recycling.
- Bolstering the institutional framework: Developing implementing rules and regulations for the "Ley de Presupuestos Minimos" for Solid Waste (Ley 25.916). Developing solid waste laws for all provinces.
- Strengthening vertical coordination: Strengthen the technical assistance programs for provinces and municipalities.
- Mainstreaming land-use planning in the design of developing policies: Incorporating solid waste landfill locations as part of the planning process.
- Initiating a systematic consultation process at the regional and municipal level with public authorities and civil society: Updating the National Plan for Solid Waste Management.

Address deforestation

- While the Forest Law provides a good regulatory framework for addressing natural forest managements, specifically deforestation, there is a need to better enforce compliance with its requirements and to provide additional financial support.
- Establish a broader dialogue on the costs and benefits of agricultural expansion to clarify the trade-offs in land-use decision-making, as well as the other negative externalities of industrial agriculture, especially in the light of the need to provide economic opportunities for the 90% of the population living in urban areas.
- Gradually expand and consolidate the effective management of the zones dedicated to conservation and sustainable use under the Forest Law, to avoid further deforestation or forest degradation.
- Set national standards for Forest Law-related public information.
- Promote the implementation of existing instruments, designed to benefit the poorest forest-dependent communities.

Increase Resilience to Climate Change and Natural Hazards

- Improving environmental management is one of the best adaptation strategies to manage climate risks, and efficient measures to achieve Argentina's Nationally Determined Contributions (NDCs) through the sustainable management of natural resources are key to facilitating the transition to a low-carbon economy.

- Address urban flooding through and integrated urban-watershed management approach.
- Provide tools – or the enabling environment for private sector provision – for mitigating adverse effects on production, such as agricultural production risk insurance, but also enhance hydromet data availability to enhance adaptive capacities of agricultural production vis-à-vis climate variability.
- Likewise, expand the index-based *disaster insurance system for* flood/flash flood and mudflows to protect the most vulnerable parts of the population.
- Develop innovative polices and implement enabling frameworks for financing mechanisms that target GHG emissions across sectors.
- Enhance the monitoring of GHG emissions through the establishment of inventories.

Chapter 1
Environmental Management in Transition

Argentina has strongly improved its economic growth and poverty records since the 2001 financial crisis, yet development has not always been sustainable and environmental friendly. Argentina's economy, one of the largest in Latin America, is endowed with valuable natural resources. During the past decade the economy grew steadily, more people entered the middle class, and inequality lessened. Poverty has been declining since 2001 and measures for education and health show a positive trend. Developments on the environmental side, however, have not been equally positive. Deforestation has become a major environmental issue in the North of Argentina and flooding events are affecting thousands of Argentinians throughout the country every year. Air pollution, waste management and water pollution are becoming serious problems especially in the growing urban centers of Argentina, but remain only partially addressed.

Natural capital is estimated to contribute 14% of Argentina's national wealth. The notable performance of Argentina's system of protected areas (covering close to 5.4% of total land area (UN MDGI 2014)[31]) is key to the sustainable development of the tourism sector. It is a best practice example of how a country can derive a significant economic dividend from domestic and international tourism (1 million jobs, 10% of GDP), while at the same time conserving flagship landscapes and species (MINTUR 2014; WTTC 2015). The Forests Law #26,331 (adopted in 2007 and regulated in 2009) triggered the land use planning of 53 million hectares of natural forests and gave access to an unprecedented amount of funds to around 4,000 projects aimed at promoting the preservation, protection and sustainable use of the native forests in 20% of that area.[32] No-tillage agriculture is now practiced in more than 70% of the arable land area, a significant achievement in natural resource management (FAO AQUASTAT, 2015).

Despite several successes, the country's record on environmental management remains mixed. Loss of forest cover remains a challenge (9.7% in 2015 compared to 12.5% in 1990) mostly due to the continued expansion of industrial-scale agriculture.[33] Similarly, while key environmental health indicators have improved over time (99.1% of the population used improved drinking water sources in 2015, up from 95.6% in 1999 (FAO AQUASTAT, 2015); 96.4% used improved sanitation facilities up from 87.4% over the same period and urban population living in slums has decreased from 30.5% in 1999 to 16.7% in 2012 (OMS/UNICEF, 2015)). Argentina's score for the Environmental Performance Index (EPI) [34] is 79.84 out of 100 and the country is ranked 43 out of 180 countries. The lowest ratings (out of 180) are for biodiversity and habitat (125), fisheries (124), and forests (112).

In the rural space, the structural shift from traditional grazing agriculture to high intensity soy cultivation carried significant environmental externalities. Sheep ranching has lost importance in the Argentinian economy since the 1960s and cattle ranching

[31] UN MDGI 2014: Millenium Development Goals Indicators, available at http://mdgs.un.org/unsd/mdg/Metadata.aspx?IndicatorId=0&SeriesId=616.

[32] Implementation Status Report 2010-2015, Law No. 26,331 Minimum Standards for Environmental Protection of Native Forests, MAyDS, 2016.

[33] FAO 2015

[34] Developed by Yale University: http://epi.yale.edu/epi.

also started to decline in the last decade. By the mid-1990s, the number of sheep had decreased to less than 30% compared to 1960[35] and has remained at that level since. Wool production, the traditional backbone of the rural economy in Patagonia, vanished. Beef production, often perceived as one of Argentina's trademarks, experienced a peak in the mid-2000s, but has since dropped to only 25% of that level. At the same time, crop production increased continuously, especially soy. To date, soy production is the number one export commodity (28% of all exports) and the most important agricultural product (INDEC, 2015). This transition in the rural economy and agriculture production triggered important environmental externalities, especially deforestation in northern Argentina, and to some extent water pollution and riverine flooding.

Population growth, urbanization, and economic development create new, modern environmental challenges. Over 90% of Argentinians live in cities. The structural transformation driven by high urbanization rates, growing urban population, and economic growth is widening the range of environmental challenges, for example, adding waste, air, and noise pollution as key challenges to the list of well-known environmental management issues. Air pollution and its effects on human health are very serious and an increasing concern: the World Health Organization states that 3 of the top 4 leading causes of premature death are directly related to ambient air pollution. Air pollution also impacts the productivity of humans, cognitive skills of students, and overall learning outcomes. The extractive and industrial sectors also generate very challenging externalities in terms of technical management as well as economic impact. While many countries increasingly acknowledge these problems, Argentina still lacks the awareness and capacity to address them. One limitation is that data on these modern environmental challenges continues to be fragmented, of low quality, and difficult to use to guide policy and investment decisions.

Addressing environmental degradation through the sustainable management and conservation of natural capital is critical to ensure continued and equitable growth in Argentina. As a resource-based economy with a high urbanization rate, Argentina's environmental and natural resources degradation undermines growth and quality of life, and affects the poor. The cost of environmental health damages related to air pollution alone is estimated at about 1.8 % of GDP, while the cost of deforestation amounts to about 0.75% of GDP.[36] Of all natural disasters, riverine flooding events carry the highest economic damages (49%), followed by urban flooding (45%). (See Annex C)

Good stewardship of environment and natural resources is essential to Argentina's transition towards a modern, resilient, low-carbon economy. Adverse climate change impacts will disproportionately affect poor urban and rural households whose livelihood strategies and economic income depend heavily on the country's natural assets. Improving environmental management is one of the best adaptation strategies to manage climate risks. In line with Argentina's climate change commitments and Nationally Determined Contributions (NDC) objectives, the sustainable management of natural resources is also key to facilitating the transition towards a low-carbon economy.

Argentina is at a critical juncture. The transition to a more modern economy and OECD accession is a key objective of the newly elected government. The accession process will provide momentum for reforms of the environmental governance framework and improvement of the environment and natural resource management standards. The government has already taken steps to strengthen its environmental agenda and elevate environment and natural resource management integration into political and economic decision making. Argentina has now more than ever the opportunity to move decisively towards a more sustainable, resilient and inclusive growth.

Objectives and Scope of the Study

The main objective of this CEA is to support the government of Argentina in analyzing critical environmental constraints to sustainable growth and shared prosperity and propose broad policy actions to address them. The CEA is also a tool to engage with civil society and development partners and broaden the

[35] FAOSTAT

[36] Data prepared by the World Bank as part of "An Economic Assessment of Environmental Degradation in Argentina ": Bjorn Larsen, John Magne Strukova Skjelvik and Elena Golub, 2015 (unpublished). For details, see also Annex C.

policy dialogue on key cross-sectoral issues associated with the country's main environmental challenges.

This CEA aims at providing a summary overview of key environmental challenges and their associated social and economic impacts. It will showcase how delaying policy actions that address environmental challenges has an economic and social cost and support the government in setting its environmental priorities. Technical and economic analyses were carried out to provide new insights into environmental and natural resource management in Argentina. Secondary data and literature review completed the analysis. The limited accessibility and debatable quality and quantity of environment and natural resource data allow only for indicative results in many instances, and highlight the need to improve data collection and access to adequately inform the technical and policy dialogue on environmental management in Argentina.

This CEA is only a first step towards evidence-based environment and natural resource management in Argentina. The complexity of environmental management has increased with the many facets of environmental degradation associated with urbanization and industrial development. This CEA only develops broad evidence for priority actions. More work on governance and institutional reforms, technical analysis of pollution, flooding, and deforestation, extended economic assessments of environmental degradation, including the assessment of distributional effects, analyses of the political economy, poverty and social impacts, or economic analyses of policy reforms would be needed to fully support any transition and reform process.

Structure of the Report

This chapter has outlined the rationale for the CEA, its objective, and scope. For the presentation of the detailed analyses and recommendations the following structure has been chosen:

Chapter 2: *The State of the Environment and the Cost of Environmental Degradation* presents the main environmental challenges, their trends, and their impact on human health and natural resources. It also assesses the economic cost associated with environmental pollution and deforestation and policy and institutional aspects related to environmental and natural resource management.

Chapter 3: *Public Opinion, Government Spending and Priority Setting for Environment* presents the public perception of key environmental challenges and how the federal government prioritizes environmental expenditures. It then analyses the alignment of technical, economic, public opinion and government priorities and provides insights on the directions government could take in setting its priorities.

Chapter 4: *The Way Forward: Reconciling Environmental Stewardship and Economic Growth* summarizes key recommendations and cross-cutting themes and proposes a number of broad policy actions to minimize economic and social losses related to environmental degradation, improve the analytical underpinning of decision-making and aim to reverse the environmental degradation and increase sustainability in the long term.

Chapter 2
State of the Environment and the Cost of Environmental Degradation

This chapter discusses Argentina's main environmental challenges, their trends, their impact on human health and natural resources, the economic cost associated with environmental pollution and deforestation and the related policy and institutional aspects. The complexity of the environmental challenges in Argentina has increased with the transition from a rural to an industrial economy with a high degree of urbanization. This CEA does not attempt to cover all challenges and is limited to the most important issues of environmental management and degradation[37]. Given the distinct features and response mechanisms, the analysis is separated by rural and urban environmental challenges. Interlinkages are highlighted whenever necessary. It is emphasized that additional in-depth studies are likely to be needed to further analyze various linkages and impacts of environmental degradation and that would be built on better data availability and quality.

The Rural Environment and Natural Resources Management

Land and natural resources have been the main pillar of the country's economic development and still play a significant role in the economy thanks to the abundance of minerals and fertility of soils that produce high grain yields and meat of excellent quality. Agriculture accounts for 7-9% of GDP and 7% of jobs. Argentina is among the largest exporters of grains and oilseeds. While sheep and cattle ranching declined over time, crop production increased continuously and today soy production is the number one export commodity (28% of all exports) and the most important agricultural product. Forests and forest products are an economic asset and a source of livelihoods; in addition, forests play a critical role for carbon sequestration, biodiversity conservation, soil fertility, watershed protection, and flood prevention.

Argentina's management of its vast biodiversity through its protected areas is best practice and benefits tourism and the economy. The third country in the Americas to establish a national parks system after United States and Canada, Argentina has a system of Protected Areas that makes up close to 7% of the total land area (1.6% of territorial waters) and includes over 40 National Parks (SIB 2016). The number of national parks and protected areas visitors increased by 88% between 2003 and 2014, contributing significantly to the tourism sector which overall accounts for 10% of GDP and 5.4% of employment (MINTUR, 2014; WTTC, 2015).

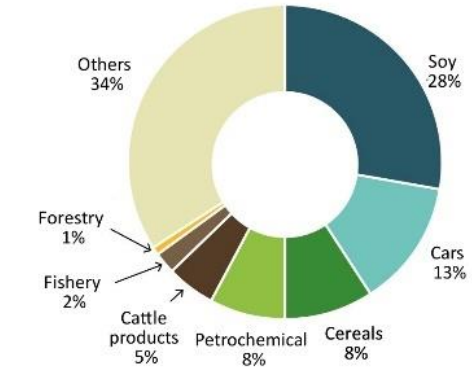
However, the structural shift from sheep and cattle ranching to industrial-scale agriculture and reliance on mining have worsened traditional environmental externalities and added new ones. Between 1990 and 2015, almost 20 % of forested area was cleared (FAO 2016), especially in northwestern Argentina, mainly for crop production, ranching and extension of urban areas[38]. The increasing reliance on large-scale agribusiness that followed the 2001 economic crisis accelerated the structural shift from traditional grazing agriculture to high intensity soy and exacerbated the negative impact on the country's natural assets. This structural shift triggered environmental externalities at much larger scale, especially deforestation in

[37] The selectivity of issues as presented in this CEA is a result of demands expressed by the former Government, but also based on availability of reliable data.

[38] FAO, 2016

northern Argentina, and is adding new environmental challenges such as agro-chemical use and pollution, water pollution and secondary effects such as riverine flooding. Similarly, the boom in extractive industries triggered by increased demand for oil, gas, and minerals brings environmental and natural resources management challenges of a larger scale that require management responses beyond local ad-hoc interventions.

Figure 1: Export shares by commodity (in %)

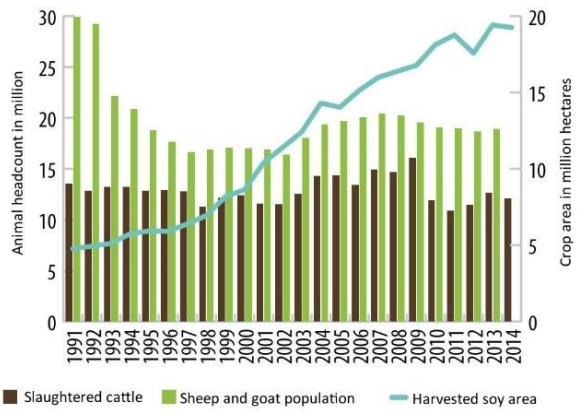


Source: INDEC

Deforestation

The total loss of ecosystem services due to land-use or cover change (LUCC) between 2001 and 2009 has been estimated at about US$70 billion[39]. Wetland degradation cost the country an additional US$3.8 billion or 1.5 % of the 2007 GDP. Cost of degradation of grazing land on milk and meat production was estimated at about US$0.586 billion or 11 % of the livestock GDP, posing a threat to the traditional form of cattle and sheep ranching. The IFPRI study also estimated the returns of reversing land degradation at about US$4 per US$ invested. Likewise, results of a cost benefit analysis show that *alternative* pasture management increased the sustainable stocking rate by 54 % and livestock productivity by 64 %.

Figure 2: Shift from traditional grazing agriculture towards crop cultivation



Source: FAOSTAT, Ministry of Agriculture

Deforestation in Northern Argentina (mostly in the Chaco eco-region) is continuing at alarming rates and the cost of deforestation is estimated at about 0.75% of GDP[40]. The Chaco eco-region covers an area of ca. 1,080,000 km² spanning across Argentina (60%), Paraguay and Bolivia. It is a large, dry forest region consisting of closed forest, open woodlands, shrub lands, and palm savannas. Between 2001 and 2014 Argentina lost ca. 50,000km² of forested areas, a size equivalent to the Province Jujuy or Costa Rica. Most of the forest loss was in Northern Argentina (45,000km², equivalent to the size of Denmark)[41]. Put differently, since 2001 Argentina has lost an average of 0.67 ha of forests (about the size of a soccer field) every minute. Despite the very high rates of forest loss in the Chaco eco-region[42] responsiveness by decision-makers in Argentina is rather limited, when compared to other countries in the region[43].

The main driver of deforestation in Northern Argentina is the expansion of industrial-scale agriculture, in particular soy production. Soy production increased by 85% in the 1980s and by 400% between 1990 and 2014; the area dedicated to soy increased almost threefold over the same period.[44] Deforestation rates in 2000–2010 were three times higher than in the 1980s[45]. Soy growing in

[39] Analysis by the International Food Policy Research Institute (IFPRI), Bouza et al. 2016

[40] See footnote 36.

[41] The Northern provinces Salta, Chaco, Formosa, Santiago del Estero, Tucuman, Jujuy, Catamarca, Corrientes and Misiones account for virtually all deforestation in Argentina

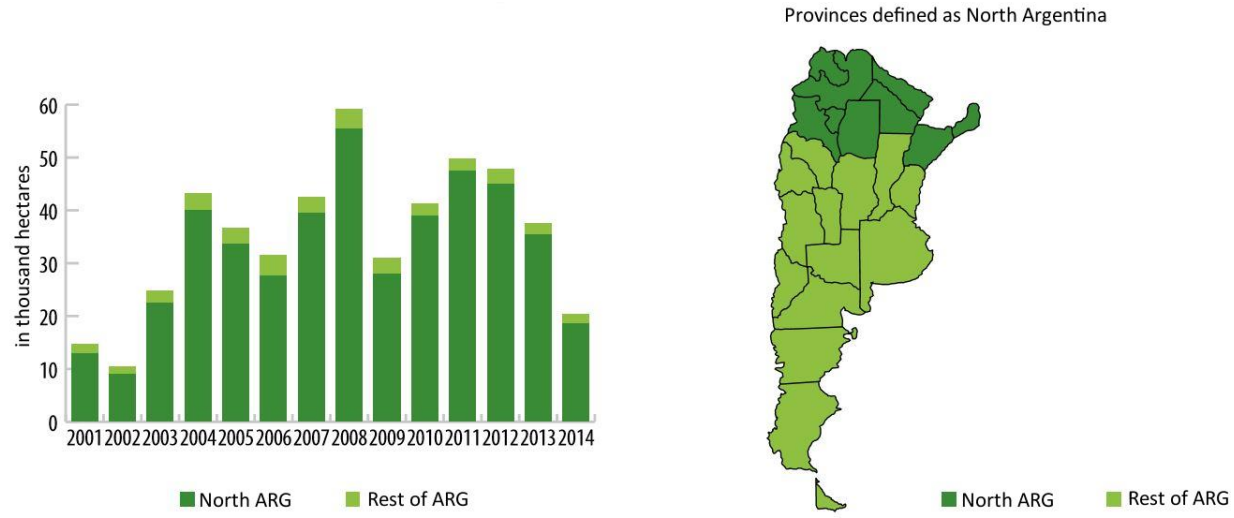
[42] Zak et al. 2008

[43] Deforestation for soybean expansion has been identified as a major environmental threat in other regions (e.g. Brazil). In Argentina, it has received less research attention and the extent of the deforestation caused by soybean expansion has not been quantified. (Grau et al. 2005)

[44] Ministry of Agriculture, Livestock and Fisheries.

[45] Piquer-Rodríguez et al., (2015)

Figure 3: Tree cover loss in Argentina between 2001 and 2014



Source: Global Forest Watch

forest lands is concentrated in regions where deforestation is a current problem – mainly Santiago del Estero, Salta, and Chaco. Between 2002 and 2014 the provinces of Corrientes and Jujuy (and La Pampa) experienced the highest relative increase in soy cultivation[46]; these regions have also a large record of deforestation. There is little doubt among researchers that the Argentina's "soy revolution"[47] and associated agricultural expansion drove deforestation and resulted in an overall loss of 22.5% of the Argentine Chaco ecoregion's forests[48].

High demand, currency devaluation, technological improvements, and weather patterns spurred the expansion of agricultural production. Starting in 2000, world market prices for grains and oilseeds started to increase and intensive and continuous cultivation became more lucrative. The introduction of transgenic soy in 1997 (Roundup Ready soybean) lowered production costs; while demand for soy increased as livestock feed and biofuel[49] boosted its price. In addition, the 2001 devaluation of the Argentine Peso incentivized export goods. The introduction of zero-tillage, a soil management technique that increases water storage capacity and lower runoff losses, opened areas that were previously closed to annual crops because of water restrictions. Between 1991 and 2008 the area under zero-tillage increased from 300,000ha to 22 million ha[50]. Such advancements enabled the transformation of previously pristine, less expensive land into potentially productive land. Northern Argentina was initially not suitable for soy plantation; crop cultivation increased only recently, taking advantage of the advances in crop production and increased rainfalls which have been reported in the last decades and which allow more rainfed cultivation in the region[51] .

While the immediate driver of deforestation is principally the extension of soy production, the underlying causes are related to (a) insufficient land use planning and enforcement thereof, including insuffi-

[46] The increase was measured as (soy cultivation area in 2014-soy cultivation area in 2002)/soy cultivation area in 2002.

[47] Mathews and Goldsztein, 2009

[48] Piquer-Rodríguez et al. 2015; Grau et al. 2005; Zak et al. 2008.

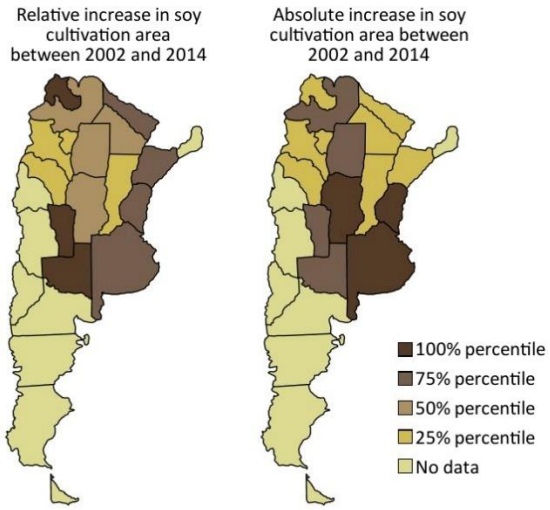
[49] Higher demand for biofuel has been spurred by the approval of ley 26 093 to promote biofuels which provides a mix of tax breaks and blending quotas, or mandates, to act as stimulus for the biofuels industry. The law calls for mandatory blends of 5 percent biodiesel and 5 percent bioethanol by 2010. In terms of tax breaks, the new law provides exemption from several taxes, including Value-Added Tax on capital goods projects associated with biofuels; income tax on biofuels production activities; and fuels excise. There are also direct subsidies paid to spur investment.

[50] Trigo et al. 2009

[51] Grau et al. 2005; Grau et al. 2008

cient funding of the forest law, and (b) favorable policy, market and agricultural conditions. Together, these conditions have favored investment in soy production. Further development of the sector should be complemented by an appropriate framework to help ensure that associated externalities, including the negative impacts of deforestation, are taken into account in investment decisions, which are otherwise not reflected in the direct benefits from soy production.

Figure 4: Soy cultivation area per province



Source: SIIA

Cattle ranching plays a secondary role in driving deforestation. Livestock ranching has decreased in importance (in relative and absolute terms) in Argentina. By the mid-1990s the number of sheep had shrunk to less than 30% of the amount in 1960 and wool production, the traditional backbone of the rural economy in the Pampas, vanished (FAOSTAT, 2015). Cattle ranching decreased overall, except in Northwestern Argentina where it has increased and correlation analysis shows that deforestation enabled the increase in the cattle stock (or vice versa).

Regression analyses[52] clearly show that deforestation is significantly and positively associated with an increase in soy cultivation. 17% of every deforested hectare in northern Argentine is associated with one hectare of soy harvest area two years later, i.e. if trees are cut down areas for soy production tend to increase. The effects for other crops are negative, insignificant or very mixed. This could indicate that farmers switched from other crops to soy and also that deforestation was foremost driven by soybean cultivation and not by other crops. An analysis on the effect of beef and crop prices on tree cover loss shows that current prices have a positive and significant effect on current deforestation while meat prices have no significant impact. These results confirm that deforestation is more likely to be driven by soy production than cattle ranching.

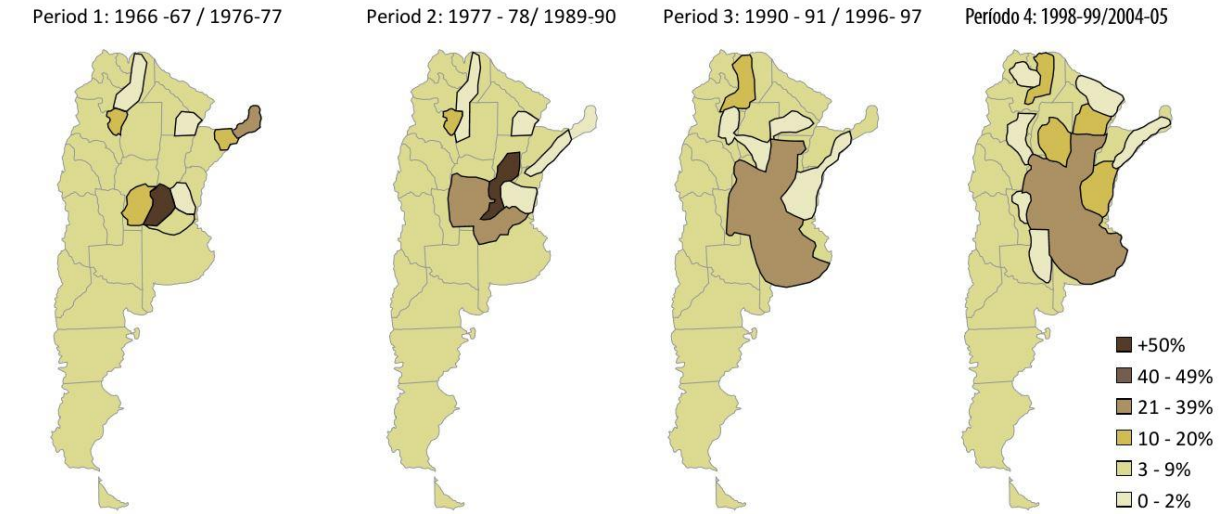
The use of forest products has a modest impact on forest loss at large scale. However, this does not exclude that in some micro-environments the harvest and consumption of wood contributes to deforestation and to forest degradation. The use of natural forests for meeting wood demand however is important, especially for the rural poor. This includes the use of wood fuels (wood, charcoal) as well as the selected use of (waste) wood for off-grid and mini-grid power generation in remote, rural areas. Argentina is a net importer of wood and other products from forest plantations. While the local production is increasing, it remains less developed than in other (neighboring) countries, such as Brazil or Chile.

The Forest Law (#26,331) provides a good regulatory framework and forest governance has improved, but implementation is hampered by inadequate funding and lack of transparency. The Forest Law of 2007 was introduced to promote conservation of natural resources, resolve and prevent environmental conflicts, and offer clear rules for investment to the private sector. Recent data shows a slowing down in the rate of deforestation, a possible indication that improved forest governance is working. However, recent declines in deforestation rates could also be attributed to the drop in commodity prices, so cannot yet be deemed an exclusive result of this policy. Additionally, the Forest Fund established by the Forest Law to compensate land owners for the conservation of their native forests and enrichment of their land is still under development. Funding currently provided through the national budget is insufficient, and information on how those resources are used is limited. Moreover, the government approach to finance the conservation fund through a tax on agricultural exports is debatable given the role that agriculture expansion plays in driving deforestation.

[52] See Annex A.

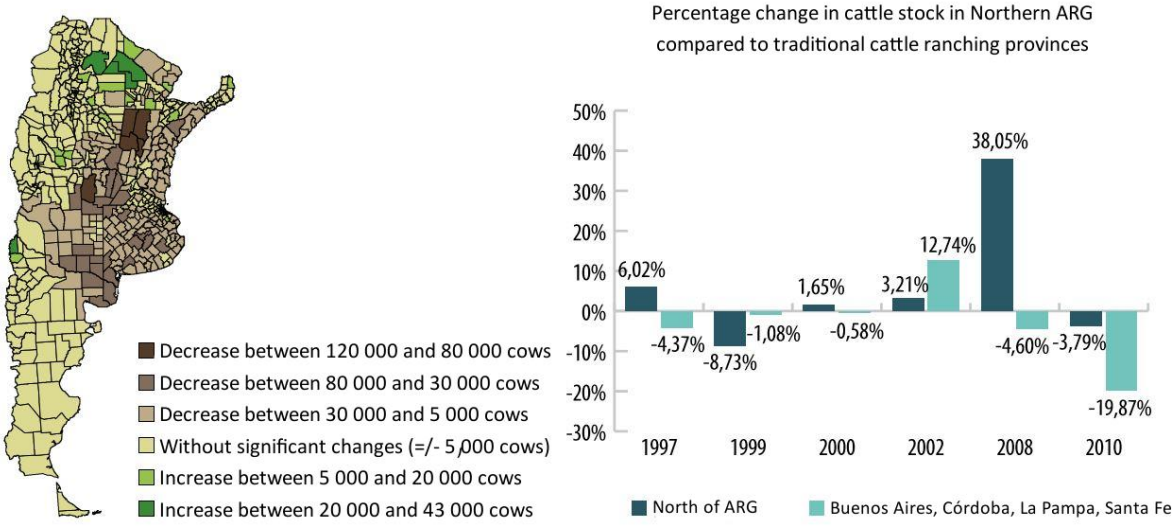
Understanding the costs and benefits of deforestation for agricultural expansion is essential to determine the trade-offs in land-use decision-making, and these should be carefully considered. Table 1 provides an indicative – and not exhaustive – list of benefits and costs that can be associated with deforestation. Significant costs are associated with the loss of ecosystem services and land degradation associated with deforestation, and as the discussion of flooding below highlights, deforestation in the upper watersheds of the main river basins is associated with riverine flooding, which is the cause of half the damage in Argentina resulting from natural disasters.

Figure 5: Distribution of regions cultivating soy over time



Source: MAyDS, Giancola et al., 2009

Figure 6: Variation in cattle stock between 2008 and 2011 and percentage change in cattle stock in Northern ARG compared to traditional cattle ranching provinces

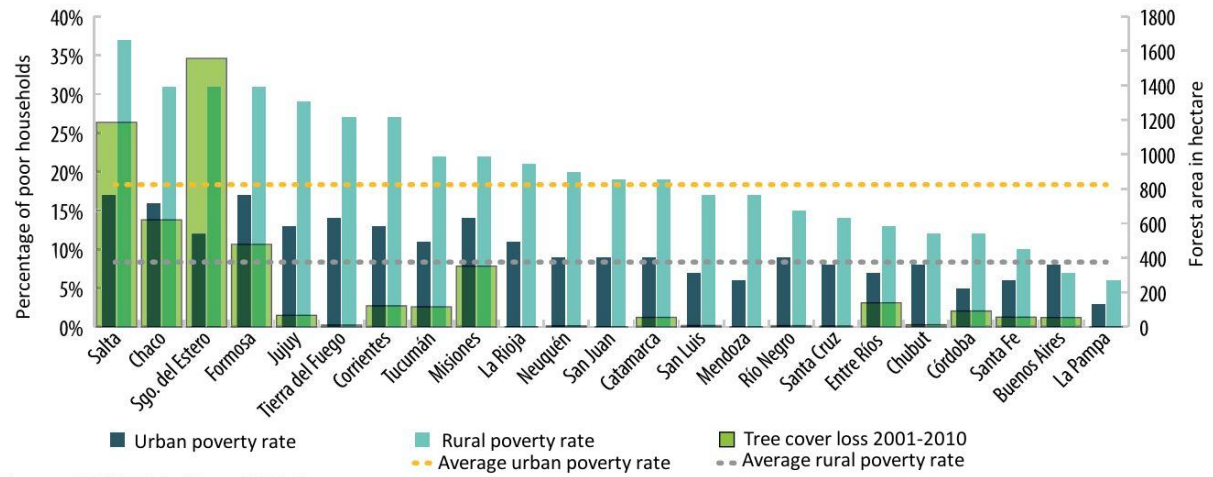


Source: INTA, SIIA.
Note: Percentage refer to the previous data point and not the previous year. This means for example the value of 38.05% in 2008 is not the annual growth rate but the cattle stock growth between 2002 and 2008

Changes in the use of natural resources have negative social impacts, especially on the most vulnerable. The gradual shift away from family farms towards industrial operations has led to conflicts over land tenure especially for indigenous communities who usually don't have titles to their lands and are vulnerable to displacement or criminal charges for squatting. The shifting agricultural frontier has forced traditional farmers to abandon their land and move into cities where they are likely to end up in poverty and marginalization if they don't find employment[53].

Deforestation affects predominantly poor regions. A comparison of 2010 census-based poverty data[54] and tree cover loss shows that deforestation took place mainly in areas with high poverty rates and that the provinces with the highest share of rural poverty (Salta, Santiago del Estero, Chaco and Formosa) have also the highest deforestation. A clear correlation between tree cover loss and poverty exists however it is very hard to isolate a single cause-effect relationship. It might be that large scale farms clear forests and push rural farmers out of the regions and into poverty. It could be that poor populations lack knowledge about the consequences of deforestation and thus do not oppose it. Data also shows that provinces with a high poverty reduction between 2001 and 2010 had predominantly high deforestation rates too. This seems to imply that higher deforestation rates contribute to higher poverty reduction. These seemingly conflicting observations highlight the importance of having a more in-depth analysis of the deforestation-poverty-agriculture nexus to inform policy development in this area.

Figure 7: Absolute tree cover loss and poverty in urban and rural areas measured as unmet basic needs in percentage



Source: INDEC, Global Forest Watch

[53] REDAF 2012

[54] The 2010 census measured poverty through an unmet basic needs indicator. Basic needs include for example the housing situation, sanitation, water access, child education and risk of loss of income.

Table 2: Qualitative Illustration of the Benefits and Costs of Deforestation

Benefits	Costs
• Increasing agricultural production of export oriented crops (especially soy) • Extending the area of cattle production • Increasing government revenues generated from tariffs and taxes of agricultural value chains • Increase in job opportunities in rural areas	• Loss of ecosystem services • Increased probability of flooding in rural and urban areas • Land degradation • Impacts on surface water availability used as principle drinking water source • Reduced availability of wood from non-plantation species • Increasing GHG emissions

Agrochemicals

The use of agro-chemicals has increased and poses risks for human health and the environment, so appropriate environmental safeguards need to be applied along its entire value chain. The use of agro-chemicals in Argentina has increased by 1000 % in the last 20 years, from 26,000 tons in 1992 to 256,000 tons in 2011 (FAOSTAT, 2015). Among the agro-chemicals, the herbicide Glyphosate accounts for 75 % of the use in 2006 compared with only 50.1 % in 1991[55]. The large use of glyphosate-based herbicide is driven by the shift in crop production to genetically modified soy that is glyphosate-resistant[56]. If not properly managed, agro-chemicals, including fertilizer, pesticides, herbicides, and fungicides, affect negatively the health of humans, animals, and ecosystems along the entire value chain, e.g. during transport, storage, application, and disposal. The World Health Organization has declared Glyphosate as probable carcinogen[57]. Moreover, fertilizers washed into waterbodies can lead to their eutrophication, while wind can carry agro-chemicals to areas where they are not desired (organic farms, for example). It is for this and other reasons that Argentina is debating the overall social and environmental costs and benefits of glyphosate-based crop production[58].

As the efficiency of the agricultural sector increased with more advanced technologies and methods, so did the use of fertilizers and pesticides. The use of agrochemicals per harvested crop area increased from approximately 0.5kg/ha in 1990- to 2.5 kg/ha in 2011. This fivefold increase continued even when in the rest of the Americas the use of pesticides started to decrease. Argentina uses today (2014) almost eight times as much fertilizers as it did in 1991. Likewise, the use of fertilizers per ha of cultivated land increased by 408% between 1991 and 2014 although it started to decrease in the past five years (CIAFA, 2015). However, the recent decrease of fertilizer consumption seems to reflect higher prices and increased price sensitivity rather than a leveling of fertilizer consumption per hectare; if prices drop, fertilizer consumption may increase again[59].

[55] Bouza et al. (2016)

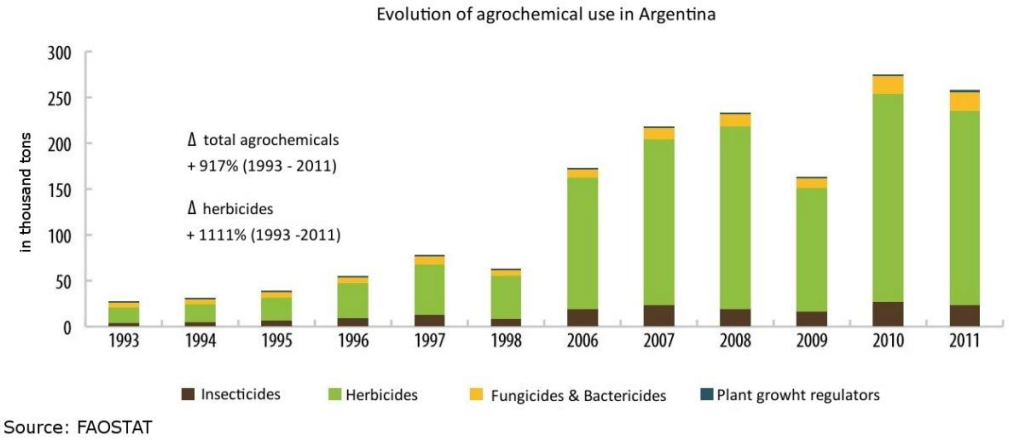
[56] Since the legalization of genetically modified soy in Argentina in 1996, Argentina has developed into the third largest producer of GMO based crops globally and soy makes up the largest share of GMO crops in the country.

[57] For a discussion on differences in the carcinogenic evaluation of glyphosate between the International Agency for Research on Cancer (IARC) and the European Food Safety Authority (EFSA) see Portier et al. (2016)

[58] The impact of glyphosate is still debated to date. While some case studies are increasingly warning about harmful effects of glyphosate on human health and the environment (Paganelli et al. 2010), other studies stress the benefits of conservation agriculture (CA) derived from the use of glyphosate and other herbicides, along with Argentina's comparative advantage of soybean production and its role in the modern global economy.

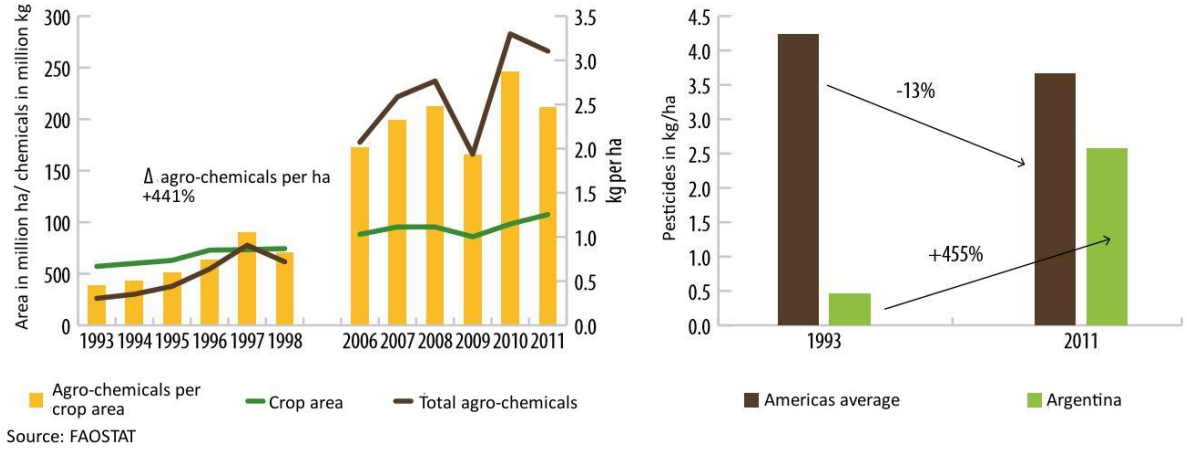
[59] Over the past five years the harvested crop areas increased without increasing the use of fertilizer per hectare. This could be interpreted as reaching a constant level of fertilizer consumption. A comparison between price levels and consumption allow a different conclusion: During the financial crisis of 2008 the fertilizer prices suddenly peaked and Argentina's fertilizer consumption dropped sharply. Since the financial crisis fertilizer prices and consumption one year later are inversely correlated (r=-0.4), while before 2008 they were positively correlated (r=0.69). This indicates two things. First, the agricultural sector has become price sensitive in the recent past and adjusts the application of fertilizers accordingly. Secondly, if prices drop in the future fertilizer consumption might increase again.

Figure 8: Agro-chemical inputs in Argentina



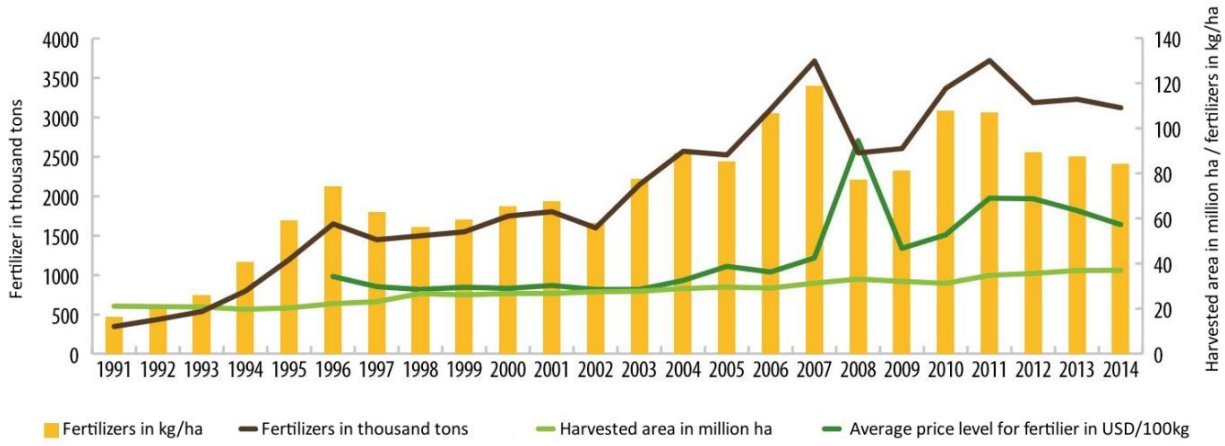
Source: FAOSTAT

Figure 9: Agro chemical use per ha cropland over time and in comparison with all American countries (including North America)



Source: FAOSTAT

Figure 10: Fertilizer use in relation to harvested crop area



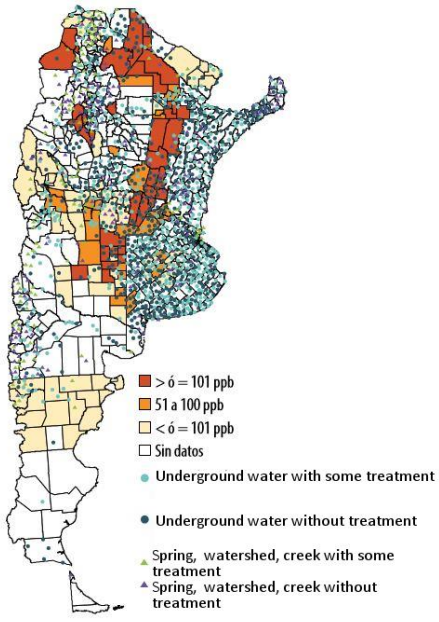
Source: CIAFA, Revista Margenes Agropecuarios 2015
Note: The average fertilizer price level is the average price of Diammonium phosphate and Granulated Urea. The price of the herbicide glyphosate has a similar trajectory and increased by more than 250% from 2007 to 2008 just to fall again by about the same amount in the next year.

Water Pollution

Many watersheds in Argentina are exposed to pollution from agriculture, industry and domestic activities. Argentina has several major river systems, including the Parana, Uruguay, and the Negro rivers. The agricultural sector is the largest consumer of water (75%) followed by municipalities (15%; FAO AQUASTAT, 2015). Surface water is the main source of water consumption and is vulnerable to pollution from discharges of untreated wastewater and/or industrial effluents, agriculture run-offs and domestic activities. Only 65% of municipal waste water is collected and only 12% is treated before disposal (FAO AQUASTAT, 2015).

High levels of arsenic contamination in groundwater poses a serious health threat and coupled with increased water pollution it creates local constraints on the availability of uncontaminated drinking water. Many regions in Argentina report high levels of arsenic water pollution. Arsenic is a natural component of the earth crust and is present in the air, water and land. Arsenic is also used industrially as an alloying agent and in the processing of glass, pigments, textiles, paper, metal adhesives, wood preservatives and ammunition. It is also used in the hide tanning process and, to a limited extent, in pesticides, feed additives and pharmaceuticals. Arsenic is highly toxic in its inorganic form and long-term exposure (by drinking or using contaminated water or eating contaminated food) can lead to chronic arsenic poisoning, skin lesions and skin cancer. Substituting ground water with surface water can help limit exposure to natural contamination. However, with increasing pollution of surface water this option is less feasible and water treatment prior to consumption becomes mandatory. Better watershed management would ensure a higher surface water quality and could be a very effective method to alleviate this problem.

Figure 11: Areas with high arsenic concentration in the groundwater (red or orange)



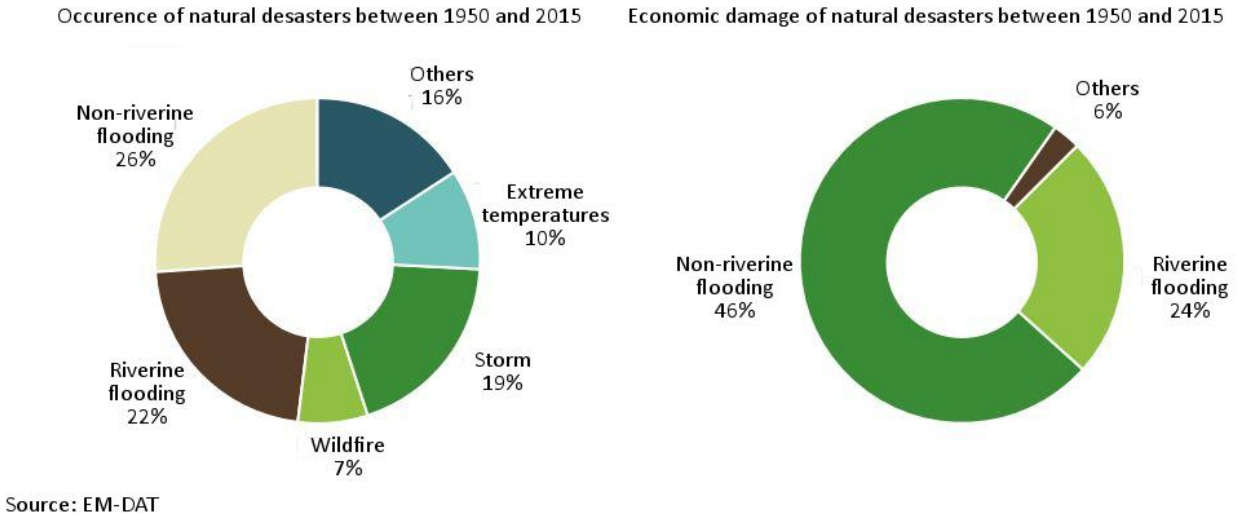
Source: ATLAS ID, Mapa educativo

Riverine Flooding

Flooding is the greatest natural disaster threat in Argentina in terms of economic damages and affected population. While riverine flooding and urban flooding share common roots, they are influenced by different causes (urban flooding, discussed later in the report, is contingent on the typology, quality and maintenance of infrastructure and the design of the city). Riverine flooding (or flood plains) occurs when heavy rainfall causes high water levels in rivers to overtop the banks and is most dangerous when people occupy flood risk areas. In the past decades, flood events predominantly occurred in Northern and Central Argentina, especially along the Parana River basin, with gradually higher concentration in Northern Argentina. About 60% of all natural disasters and 95% of the economic damages and affected population are due to flooding. Riverine flooding events carry the highest economic damages (49%), followed by urban flooding (45%; EM-DAT, 2015).

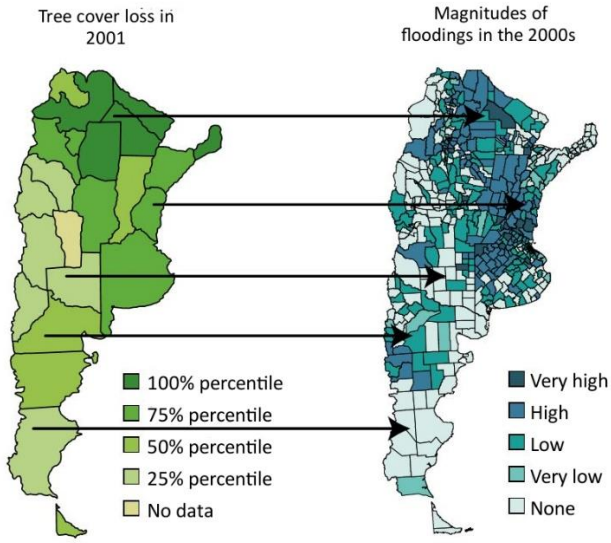
Deforestation, poor wetlands management and increased rainfalls, contribute to increase the risk of flooding. A visual comparison between spatial distribution of deforestation and flooding events suggests that higher riverine floods occur in regions with deforestation. As deforested areas are located in the upper watersheds of the main river basins, deforestation-triggered run-offs of water accumulate further downstream in higher volumes and faster pace. Downstream, drainage canals built in wetland areas that were built to reduce flood risk (locally known as canalization), changed the hydrology, led to stronger runoffs and resulted in even more flooding and sedimentation[60]. Finally, amount and intensity of rainfall grew overtime, with volume of rainfall up by 20% between 1961 and 2010 (SAyDS, 2015d).

Figure 12: Natural disaster between 1950 and 2015 in Argentina – Occurrence and total economic damages



[60] de Prada et al. 2014; Tucci 2007

Figure 13: Comparison between tree cover loss and magnitude of flooding in Argentina



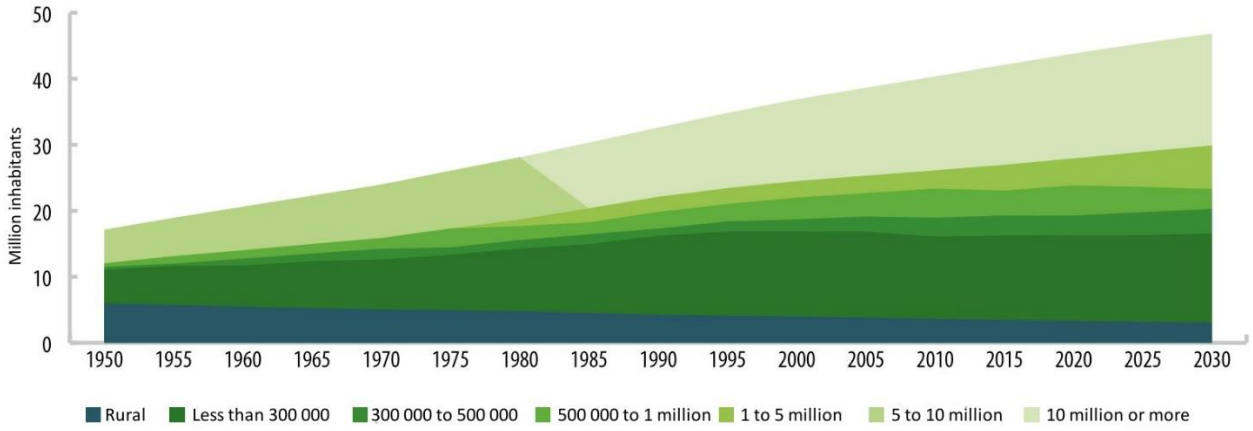
Source: Global Forest Watch, Atlas ID

Lack of land use regulations, limited enforcement capacity, and false sense of security significantly increase the risk for people. The impacts of floods on people's life, wellbeing and assets greatly depend on the degree of control of settlements in risk areas. A sequence of low flood years is often a reason to construct new buildings in flood risk areas. When a larger flood occurs, the flood damage increases and municipalities are "forced" to invest in flood protection in this area. Municipalities have little incentive to mitigate the risk by relocating people because relocation can be costly and difficult to accept, and when a major flood occurs, the national government provides financial support to the affected communities. Proper watershed management upstream and downstream can significantly decrease the probability and impact of flooding events.

Uranium mining legacies

Poor environmental management and enforcement in the mining sector have left a legacy of harmful by-products, waste, and difficult mine closures. Mining in Argentina is a relatively new industry and the country has limited experience with mine closure and clean-up[61]. Years of lax environmental enforcement and management practices have resulted in undesirable accumulation of harmful solid and liquid wastes associated with uranium mining and processing, and the generation of waste tailings and low-grade ore containing low levels of radioactivity[62].

Figure 14: Argentina - Population by size of urban settlement



Source: UN WUP 2014

[61] PRAMU project World Bank 2008

[62] It should be noted, however, that the legacy issue i s not "nuclear waste," but rather large amounts of low-grade tailings with radioactivity levels typically below what is commercially viable natural uranium ore.

The Urban Environment

Urbanization in Argentina is among the highest in Latin America and significantly higher than the global average. Over 90% of the Argentine population lives in cities, compared to nearly 80% for Latin America, the most urbanized region in the world (UN WUP, 2014). Urban population continues to grow, especially in small and medium size cities, demanding infrastructure, urban services, jobs and improvements in quality of life. Argentina's path to economic prosperity is through efficient, sustainable, and economically thriving cities.[63] While these generate agglomeration economies by concentrating ideas, talent, and knowledge, these are often constrained by market and coordination failures that cause agglomeration externalities leading to higher costs—from more expensive land to congestion and environmental degradation. Agglomeration externalities thus need to be managed so that prosperity does not come at the expense of livability.

Urbanization, coupled with economic growth and the emergence of an urban middle class with extended consumption demand, creates new environmental externalities. In 1960 about 30% of the population of Argentina lived in rural areas and another 30% lived in cities with less than 300,000 inhabitants; today less than 10% of Argentina's population lives in rural areas. Thirty percent of the Argentinian population lives in cities with more than 1 million inhabitants.[64] Since more and more people are living in urban areas, pollution of air, water, soil, and waste generation and management are becoming increasingly important issues with high costs to societ

Air Pollution

Poor air quality in urban areas has very serious health impacts on the population, especially the most vulnerable groups. Ambient air pollution is caused by a variety of pollutants, such as gases, particulate matters, and chemicals, originating from different sources[65]. While data for Argentina is limited, estimates indicate that over 100 million people in Latin America and the Caribbean are exposed to air pollution levels exceeding World Health Organization (WHO) guidelines[66]. Ischemic heart disease, Lower Respiratory Infections (LRI) and chronic obstructive pulmonary disease (COPD) are all linked to poor air quality and are among the four leading causes of years of life lost due to premature mortality. Further, as Figure 15 shows, the contribution of LRI and COPD as causes of years of life lost has significantly increased over the last twenty years. As shown in Ambient Particular Matter is the highest ranked health risk factor in Argentina that is not determined by individual behavior (such as diet, smoking, unsafe sex, or use of alcohol and drugs), but by the environment. The health effects of outdoor air pollution fall disproportionately on infants, children and the elderly. Studies in other Latin American countries have shown that poverty and low socio-economic status can increase the negative effects of ambient air pollution on health[67]. It seems plausible that poor population groups, for example in informal settlements, are more exposed to urban air pollution and less aware of the possible negative consequences.

[63] Leveraging the Potential of Argentine Cities: A Framework for Policy Action. World Bank, 2016

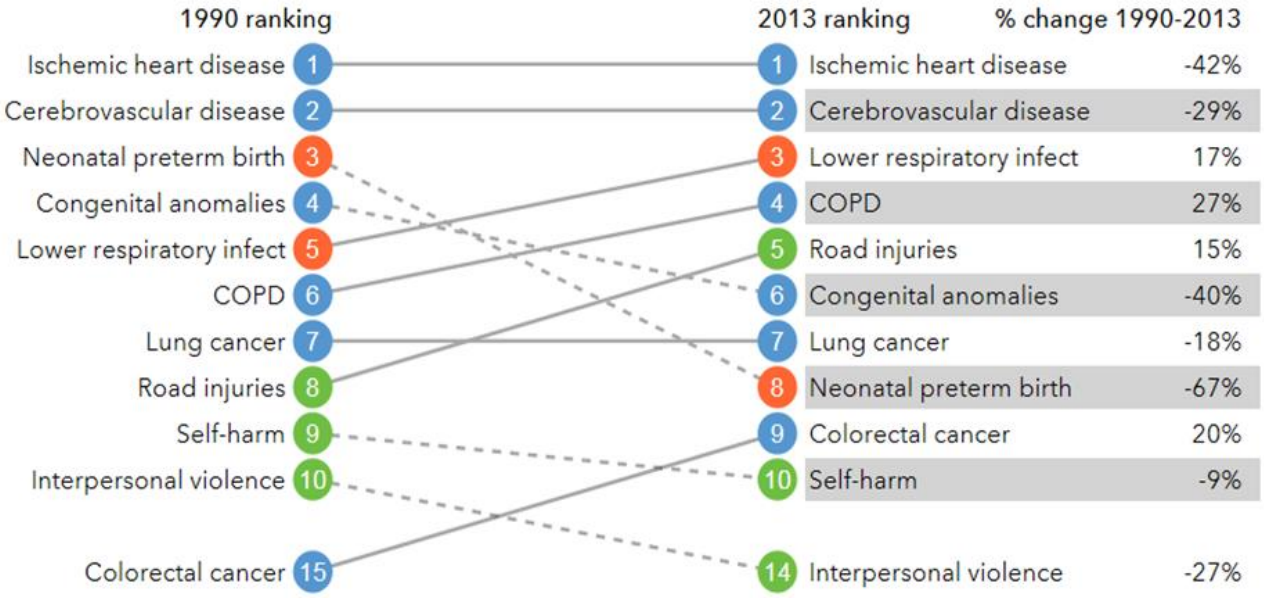
[64] Calculations based on data from UN World Urbanization Prospects.

[65] Particulate Matter (PM), Tropospheric Ozone (O3), Nitrogen Dioxide (NO2), and Sulfur Dioxide (SO2) are some of the most commonly monitored pollutants. PM in the atmosphere is mainly attributed to the combustion of fossil fuels, especially coal and diesel fuel, and is typically measured by particle size as either PM10 (particle diameter ≤ 10 microns) or as PM2.5 (particle diameter ≤ 2.5 microns). The smaller particles, the deeper they are able to penetrate into the lungs, disrupting the exchange of oxygen into the blood and causing inflammation. NO2 and SO2 are chemicals produced by the combustion of fossil fuels and play a major role in generating photochemical smog, as well as creating acid rain. Another important pollutant is lead (Pb); children especially are at risk of significant neurological and developmental damage from prolonged exposure. Pollutant impacts include health, cognitive and neurological deficits and damage to ecosystems, and cultural heritage.

[66] WHO 2005

[67] For example, high rates of PM10 air pollution caused higher mortality rates for people living in the slums in Sao Paulo and for people who did not complete primary school in Chile.

Figure 15: Leading causes of YLLs to premature death in Argentina



Increased use of vehicles and extreme traffic congestions are the main sources of Argentina urban air pollution. The transport sector is the main driver of urban air pollution. The number of circulating cars has increased by a factor of six over the last 25 years, from only 2 million vehicles in 1990 to 12 million in 2014. Emission levels are not only influenced by the number of vehicles, but also by fuel standards, quality of cars, type of vehicles on the road, and transport behavior. Most vehicles circulate in Buenos Aires. Almost 50% of vehicles are older than 10 years (22% older than 20 years) and 35% are diesel powered (AFAC 2014). Road transport is basically the only mode of freight transport with 99% of sales value of goods transported by road (96% of transported tons by road;). This indicates high truck circulation within or near urban areas, which contributes to higher emissions. Complementing the high use of private vehicles, people living in Buenos Aires also rely less on mass transport (buses, metro) compared to other Latin American cities. The use of bicycles or walking is an outstandingly disregarded mode of transportation in Buenos Aires.

Information on air quality remains limited and of uncertain quality but points to road transport and diesel vehicles as the main source of pollution. The assessment and evaluation of air quality is mainly limited to the large urban agglomerations in the region. Similarly, systematic monitoring and recording have been limited to a few air pollutants, especially particulate matter (PM) 10 and increasingly PM2.5. Information on other airborne pollutants remains limited and often erratic. In addition, air measurement often does not follow reliable protocol procedures, e.g. detectors and measurement stations are installed too high above ground or in non-representative locations, further complicating the systematic assessment of air pollution and associated impacts on health and environment. A few emissions studies done for the city of Buenos Aires and for the Buenos Aires Metropolitan Area (BAMA) give some insights on the source of particulate matters emissions, their composition and patterns. For example, a study for BAMA indicates that about 67% of PM emissions are from road transport, about 21% are from electric power plants, 5% are from industry, and 7% are from residential, public and commercial sources. Road transport is also the source of nearly 80% of nitrogen oxides (NO_x) while 70% of sulfur dioxide (SO_2) is from the electric power plants[68]. Another study estimated that PM

[68] Matranga et al, 2012

emissions from 2.4 million road vehicles in BAMA in 2006 were about 6,370 tons, of which about 91% from diesel vehicles, 5% from gasoline vehicles, and 4% from natural gas vehicles[69]. Estimates of contributions from other sources - including industry, power plants, fugitive dust from agricultural fields, re-suspended road dust, construction sites, and burning of solid waste and other biomass are unavailable. Such estimates would require an inventory of emissions from fixed sources, chemical analysis of PM, and apportionment studies[70].

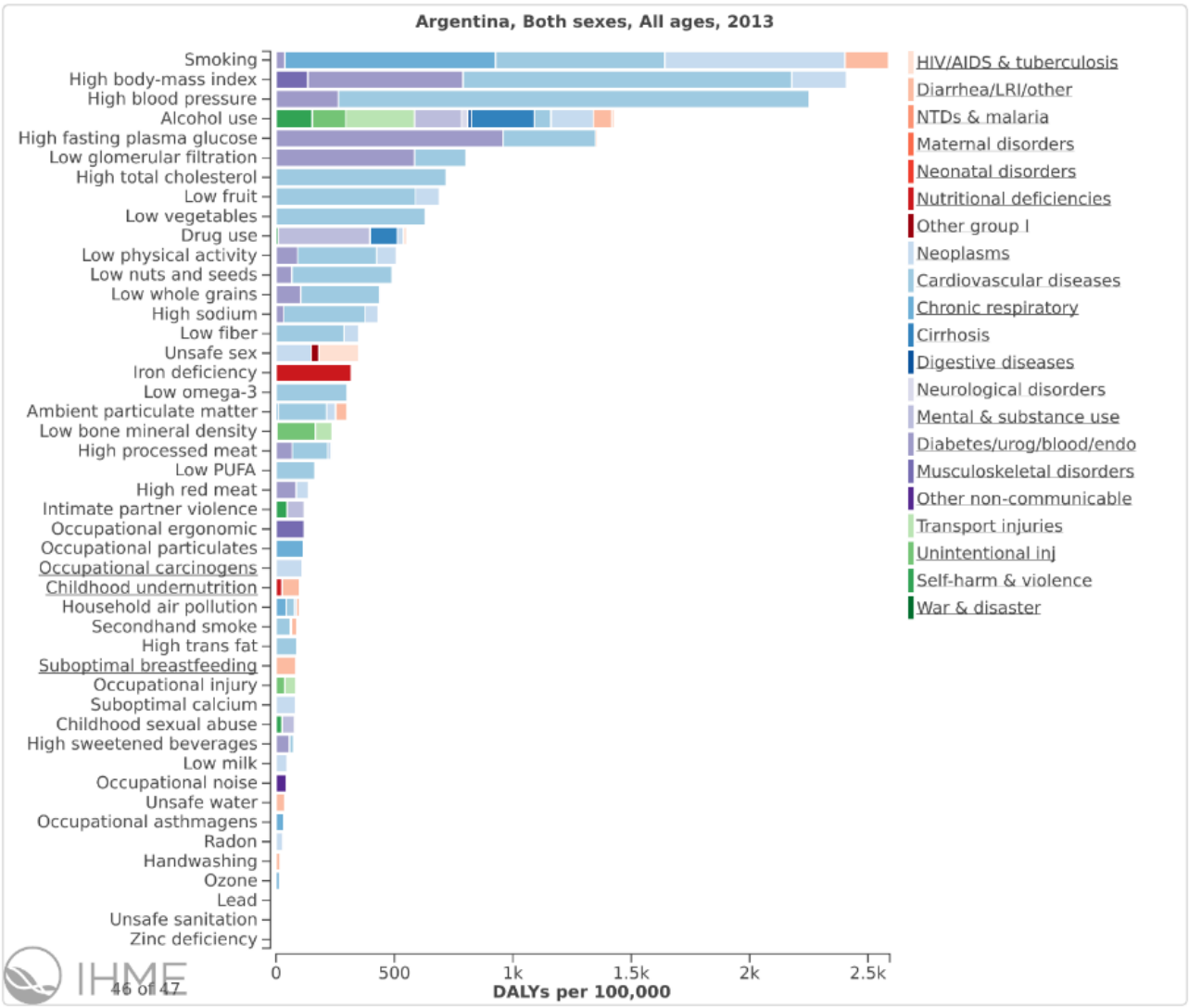
Air pollution in the main urban agglomerations is far above the WHO recommended thresholds. Using a novel modeling approach based on EDGAR (Emission Database for Global Atmospheric Research)[71] this CEA carried out an assessment of emission levels in the 5 largest urban agglomerations plus two cities with the highest growth rates during 1950-2015. According to the model, PM2.5 pollution is above the WHO recommended threshold of 10 µg/m3 in Buenos Aires (6-fold), Córdoba (3-fold), and Mendoza (2-fold). Pollution is at the WHO threshold in Rosario and below the threshold in Salta and San Salvador de Jujuy. For the cities of Neuquen-Plottier-Cipolletti, which grew in population by about 2500% between 1950 and 2015, PM2.5 pollution was extremely high in the decade 1970-1980, then gradually decreased below the threshold until 2002; current values would exceed the threshold again by about 2-3-fold. The model also estimates total NO_X emissions (from 400,000 ton/yr in Buenos Aires down to 45,000 in Córdoba and gradually smaller in the other cities), and other pollutants. Buenos Aires exceeds the levels of other cities by significant amounts. Transport remains the main emission for all pollutants except SO_2. Despite slight decreases in air pollution in large cities and acceptable levels in small cities, it seems likely that high urban growth rates and increasing traffic will contribute to higher levels of air pollution in the future (see graphs in Appendix).

[69] D'Angiola et al, 2010. About 39% of the diesel vehicle emissions were from heavy duty diesel trucks and buses, 26% were from light duty diesel trucks and diesel sport utility vehicles (SUVs), 20% from diesel passenger cars, and 6% from diesel taxies.

[70] Contributions to ambient PM2.5 from these sources also depend on wind directions and speeds**.** Wind directions in BAMA are on average from the east and southeast about 30% of the time, from the south, southwest and west about 25% of the time, from the northeast and north-northeast about 22% of the time, and from west-northwest and north-northwest about 15% of the time. Average wind speeds are 4-5 m/s. Arkouli et al (2010) found that ambient PM10 concentrations in the city of Buenos Aires were highest when the wind was from the northwest and northeast and lowest when from southeast and southwest. The difference in ambient concentrations of PM2.5, however, was much smaller.

[71] EDGAR emissions inventory is a global database for the years 1970 to 2008. Pollutants include PM, SO_2, CO, NO_x, VOC, and NH3.

Figure 16: Health Risk Factors in Argentina



Source: Global Burden of Disease

The cost of air pollution impacts on society is estimated at about 1.8 % of GDP.[72] In addition to mortality, poor health due to air pollution impacts peoples' productivity and their ability to work and take care of their families[73]. For children, reduced productivity translates into educational underperformance with long-term negative effects for economic performance and poverty alleviation. To cope, households divert limited resources towards health expenditures instead of using them for investments with returns for economic development and poverty alleviation. People suffering from chronic diseases are also less able to participate in social activities, including community and political activities that often provide the necessary framework in which economic development is

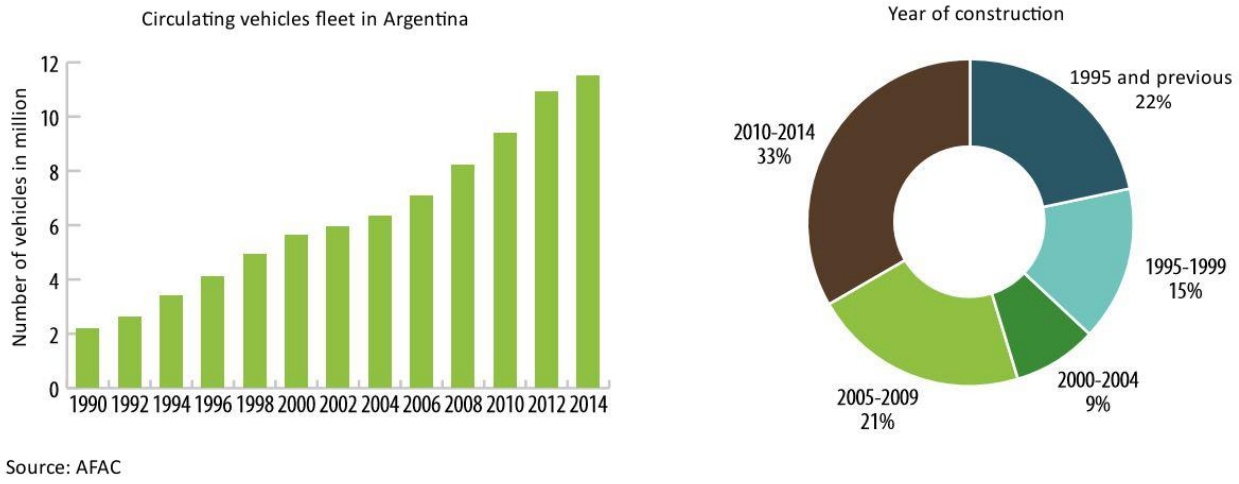
[72] See footnote 36.

[73] Impact on productivity can have different time dimensions. Sick people may be able to allocate only reduced time to productive activities over a day, week, month, or year. Health impacts may also alter the whole productive life, i.e. by changing the overall time people do not work at all and the probability of having to be taken care of by others.

embedded. Despite limited data on air pollution in urban areas beyond Buenos Aires, this CEA was able to estimate the cost associated with air pollution across Argentina at AR$ 33 - 48 billion in 2012, with a mid-point estimate of AR$ 40 billion (US$ 8.75 billion). This cost is equivalent to 1.5 – 2.2% of Argentina's GDP in 2012, with a mid-point estimate of 1.84%[74]. However, this estimation could not take into account varying inter- and intra-city ambient air pollution exposure levels and was limited by measuring ambient air pollution instead of street level exposure[75].

Poor air quality in urban areas is a global phenomenon[76] and much can be learned from other countries' experience. Health problems due to poor outdoor air quality have been among the main environmental concerns in many Latin American cities, including Mexico City, Santiago, Bogotá, Sao Paulo, Lima, and Quito. During the last two decades, several countries in Latin America have begun to deal more seriously with this environmental problem. In addition to strengthening environmental institutions and upgrading environmental measurement systems, environmental standards have been imposed throughout the region, especially for industries, new and old vehicles, and fuel quality.

Figure 17: Circulating vehicle fleet in Argentina; year of construction of the current fleet



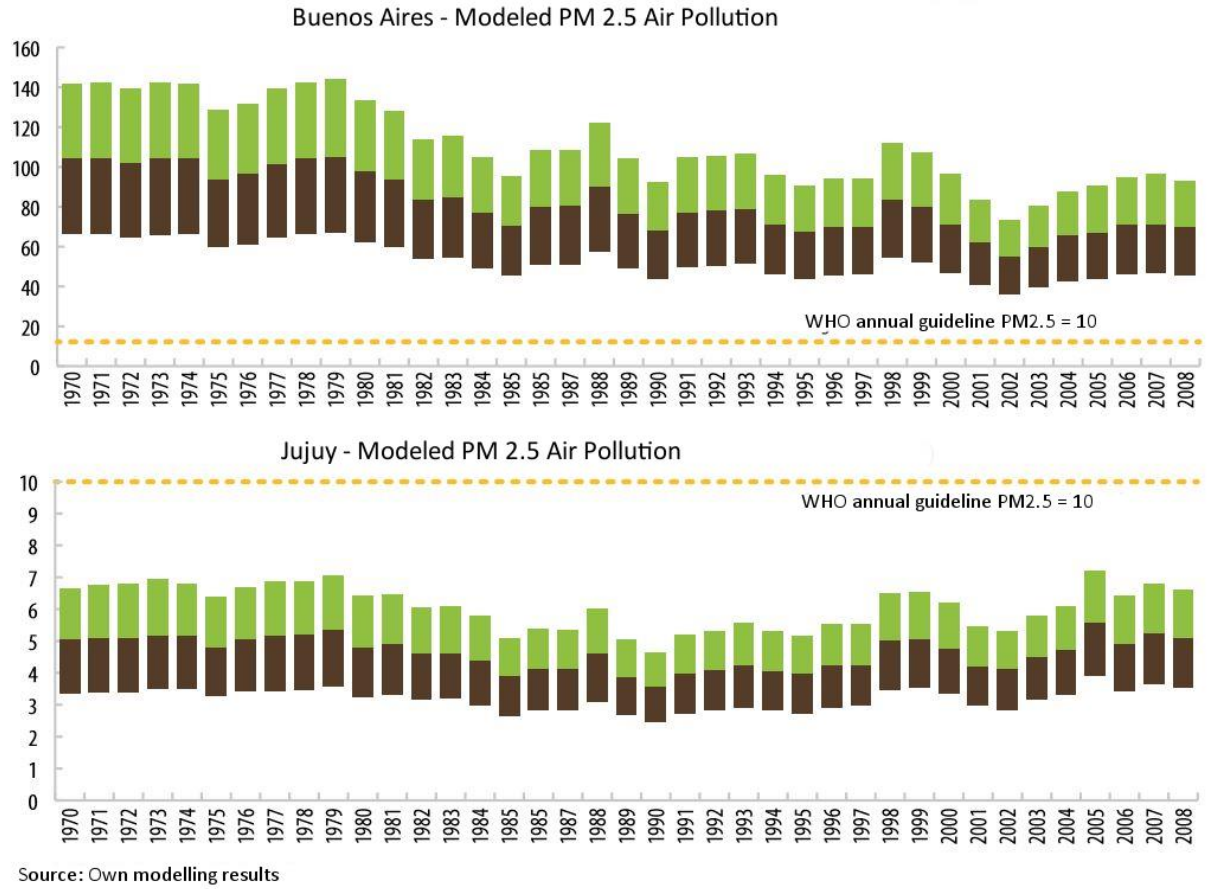
Source: AFAC

[74] See footnote 36.

[75] Recent studies have demonstrated that street level exposure and ambient air pollution levels can differ by a magnitude of 20-40% (Goel et al. 2015).

[76] The WHO reports in its latest estimates that in 2012 around seven million people died - one in eight of total global deaths – as a result of air pollution exposure (WHO GBOD 2014). This is more than double compared to previous estimates and confirms that air pollution is now the world's largest single environmental health risk. In particular, the new data reveal a stronger link between both indoor and outdoor air pollution exposure and cardiovascular diseases, such as strokes and ischemic heart disease, as well as between air pollution and cancer. This is in addition to the already established relationship air pollution's role in the development of respiratory diseases, including acute respiratory infections and chronic obstructive pulmonary diseases.

Figure 18: Modeled PM 2.5 Air Pollution in Buenos Aires and Jujuy (µg/m3)



Source: Own modelling results

Distributional impacts of air pollution are biased towards the poor segments of the population. While no analysis exists for Argentina, knowledge generated in other Latin American countries lead unequivocally to this conclusion. For Sao Paulo, for example the effect of PM10 are negatively correlated with the percentage of people with college education and high family income i.e. the higher the level of education / income, the lower the mortality risk due to air pollution. The effect of PM10 exposure is positively correlated for people living in slums, indicating the higher vulnerability of slums dwellers to air pollution[77]. Another study focusing on Sao Paulo finds larger effects of air pollution in areas of lower socio-economic status (SES) and a significant trend of increasing risk of death related to age, with effects most evident for subjects >65[78]. For Chile, a study finds higher mortality among those who did not complete primary school compared to university graduates[79]. The interaction between being old and having no primary education exacerbates the effect. A multi-city study) for Mexico City, Sao Paulo, Santiago concluded that PM10 had important short- and intermediate-term effects on mortality in the cities, but without a consistent educational level effect modifier[80]. In contrast, another study using a multi-country analysis for Chile, Mexico, Brazil finds that high ambient PM concentration increases mortality risk and risks are even higher for low SES and for infants and young children (although not consistently across all locations)[81]. A World Bank report from 2006 states more generally that exposure to air pollutants is higher around congested areas

[77] Martins et al., 2004.
[78] Gouveia, 2000.
[79] Cakmak et al., 2011.
[80] O'Neill et al., 2008.
[81] Romieu et al., 2012.

where informal and formal economic activities take place, and the most affected are the most vulnerable: the elderly, the poor, the children, and the sick[82].

Solid Waste

Increased solid waste accumulation is a common externality of economic growth and consumption, especially in urban areas. Waste disposal is the most problematic stage of the waste management cycle and open dumps remain the most common mode of disposal in Argentina, particularly in poorer communities and neighborhoods. Increasing amounts of organic waste is a major source of vectors and greenhouse gas emissions. Recycling is still very limited and the national law on household waste management does not set targets nor provides incentives to implement the waste hierarchy[83]. Hazardous waste is also on the rise (e.g. medical waste generated by increased health care service provision, and unregulated e-waste). The lack of public official statistics on agricultural waste, non-hazardous Industrial waste and construction and demolition waste makes it very difficult to assess the full extent of the issue.

Inefficiencies in solid waste collection and disposal impact citizen's quality of life and affect livability in cities. As the backdrop to most economic and residential activities in the city, an uncleanly and disordered environment has a systemic impact on livability, health, property values, attractiveness for businesses and tourism, and the population's sense of security. In Argentina, most cities have neighborhoods where open dumping areas are common and efficient collection services and urban cleaning services are lacking. The impact of this lack of cleanliness on neighborhood satisfaction and quality of life is well documented, particularly in Buenos Aires[84].

Solid waste management lags far behind other urban services. Solid waste collection coverage in Argentina is at 90%, leaving an estimated 4 million inhabitants without regular collection service[85]. Disposal service is even more deficient with over 20 million inhabitants not covered[86] and nearly 90% of the municipalities disposing their waste in open or semi-controlled dumps without adequate sanitary controls[87]. This coverage deficiency is much larger than other basic services such as water supply, sanitation and electricity which have a combined underserved population of 3,067,000[88]. Between 2001 and 2010 the growth in collection service coverage only managed to match population growth, which means relative coverage did not increase[89]. The lack of coverage is most pronounced among households located in slums, where 14.3 % of the households are not covered by the collection service and in Northern provinces like Santiago del Estero and Formosa that have coverage levels of 62.48 % and 64.04 % respectively[90].

[82] Maggiora and Lopez-Silva 2006

[83] The waste management hierarchy is an internationally accepted guide for prioritising waste management practices with the objective of achieving optimal environmental outcomes. It sets out the preferred order of waste management practices, from most to least preferred: With avoidance being the most favored (including action to reduce the amount of waste generated by households, industry and all levels of government) followed by resource recovery (including re-use, recycling, reprocessing and energy recovery, consistent with the most efficient use of the recovered resources) and disposal being the least preferred (including management of all disposal options in the most environmentally responsible manner). (EU 2010)

[84] Cruces, Ham and Tetaz (IDB, 2010) evaluated 5 neighborhoods in Buenos Aires and found that that overall neighborhood satisfaction was a determinant to happiness and that neighborhood cleanliness played a role. The survey found street and sidewalk cleaning was one of the poorer rated neighborhood characteristics and the degree of cleanliness was a statistically important determinant of neighborhood satisfaction.

[85] National Census 2010

[86] World Bank, 2015. Diagnosis on Solid waste management in Argentina. Only 64,7% of the population is covered by an adequate waste disposal system.

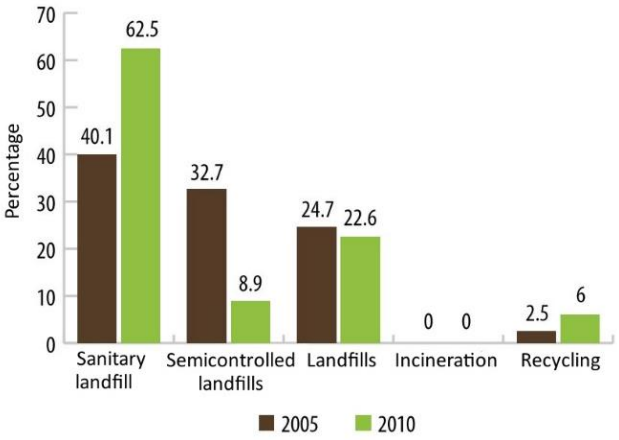
[87] Secretariat of Environment and Sustainable Development (SAyDS), 2005. *Estrategia Nacional para la Gestión Integral de Residuos Sólidos Urbanos*.

[88] Water supply: 829,000 people without access (2%), Sanitation: 1,658,000 people without access (4%), Electricity: 580,000 people without access (1%). World Bank Development Indicators.

[89] National Census 2001 and 2010

[90] EDSA 2013 and National Census 2010

Figure 19: Solid urban waste by type of disposal

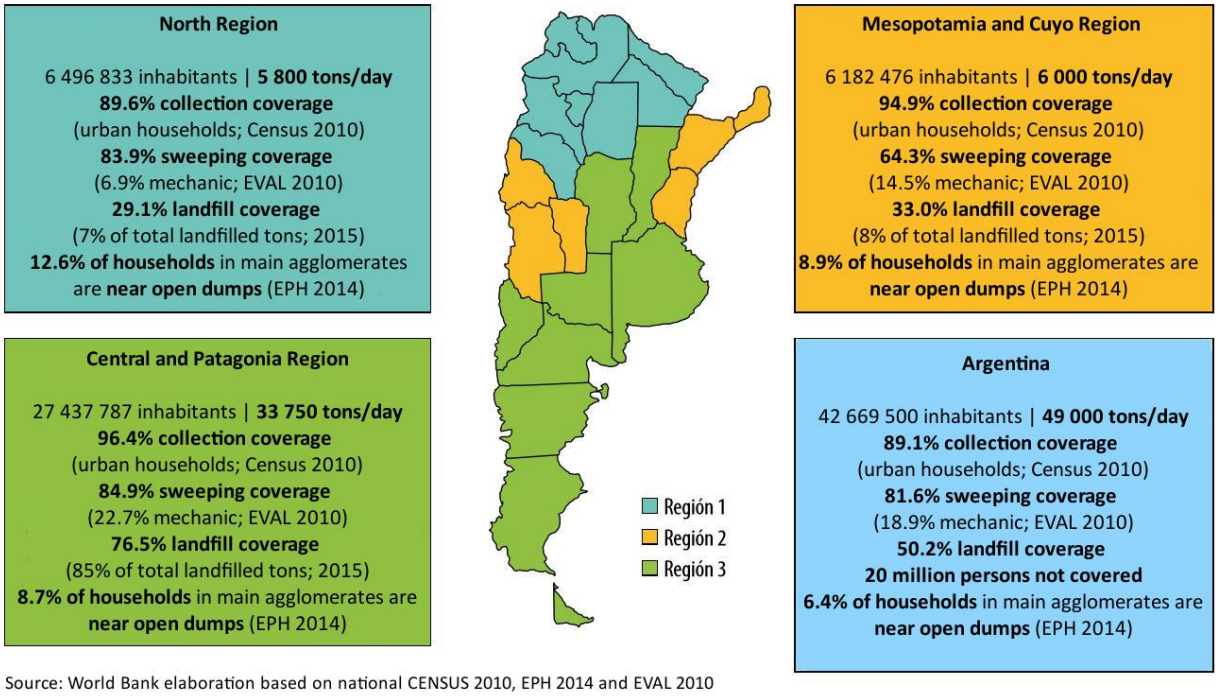


Source: Sistema de estadistica ambiental

Figure 21: Urban households not covered with waste collection by socioeconomic level (SE)

Source: World Bank elaboration based on EDSA 2010

Figure 20: Regional waste management characteristics



Source: World Bank elaboration based on national CENSUS 2010, EPH 2014 and EVAL 2010

Lack of basic waste collection and disposal services affects disproportionately the poor. There are significant regional differences in service provision and only 29% of the population in the northern regions has disposal service versus 50% nationally[91]. With 633,682 people lacking solid waste collection coverage, Greater Buenos Aires is the agglomerate with the largest absolute number of underserved population. For people situated mainly in slums the probability of not having regular collection service is 5 times higher than for any other urban citizen[92]; and the probability of having an open dumpsite 3 blocks away or less increases 4.5 times[93]. Even low income households outside of slums have better access to service (see Figure

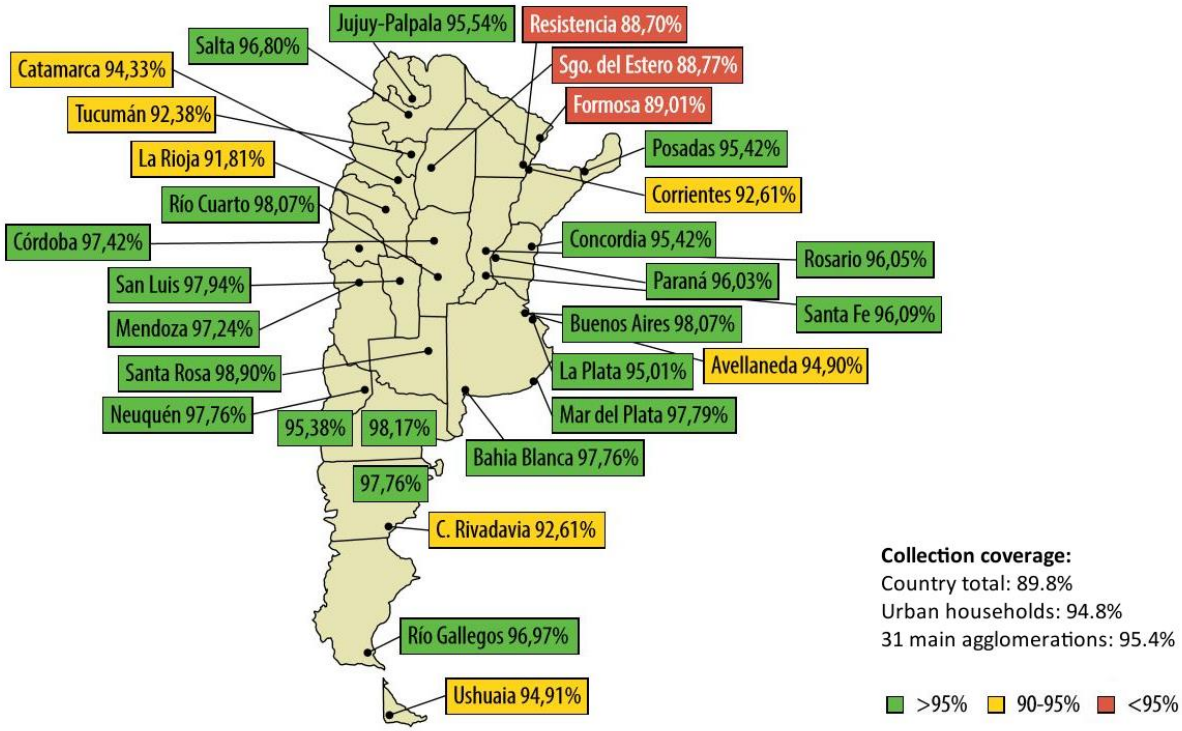
[91] Prepared by the World Bank on the basis of the 2010 Census, EPH EVAL 2014 and 2010 Nationals.

[92] EDSA, 2010

[93] The percentage of households located near open dumps is 8.8% on average for the 31 main urban agglomerates but when taking into consideration only households located in slums the percentage increases to 39.5% (EPH, 2014)

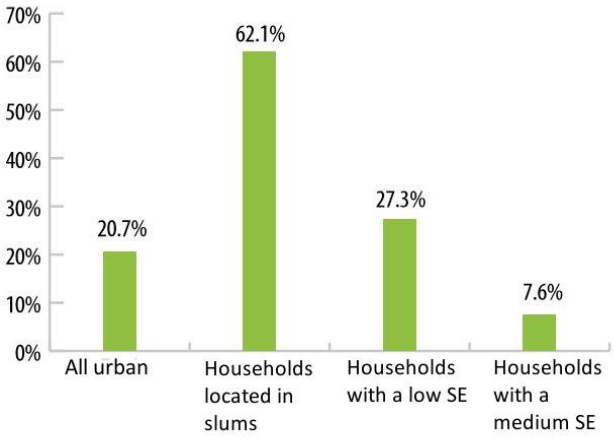
21), which highlights the particular challenges of informality and urban layout faced by slums. About 35% of people with a very low socio-economic status live close to a dumpsite.

Figure 22: Percentage of households with regular waste collection in main Argentine agglomerations

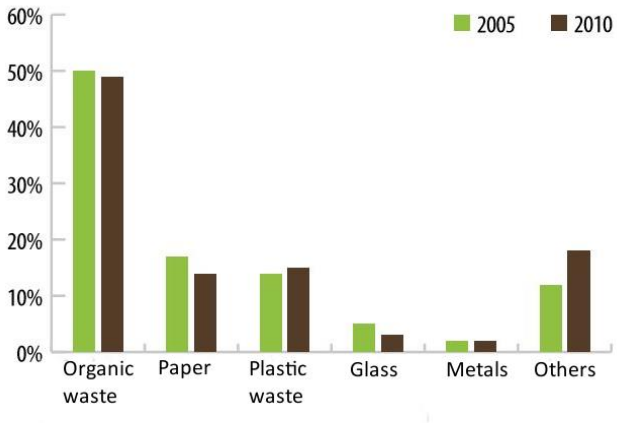


Source: World Bank calculation based on 2010 Census

Figure 23: Urban households located close to a dumpsite in % according to household characteristics (left) and waste generation by type of waste (right)



Source: World Bank calculation based on EDSA 2012



Source: Sistema de estadistica ambiental

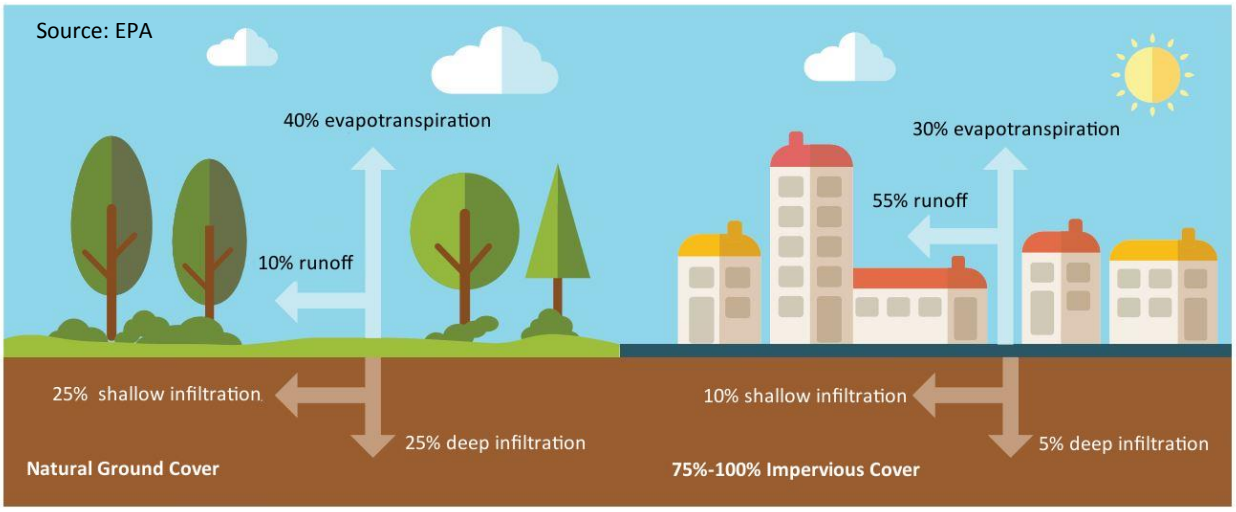
High amounts of organic waste increase the risk of vectors and are a significant cause of greenhouse gas emissions from landfills. Increased waste production and the introduction of new landfills were responsible for about 677 Gg of methane emissions in 2012, a three-fold increase since 1990. About 50% of total waste produced was organic. Food waste is the major source of vectors, odors and greenhouse gas emissions in the solid waste system. Preliminary estimates indicate that the amount of food wasted by the average Argentine is 38 kg per year (vs. 25 kg for Latin America) and the amount wasted in cities (57-97 kg) is getting closer to that of North America and Europe (115 kg). In addition, 14.5 million tons of food are lost in the agriculture processing and distribution each year. This amounts to 362 kg per person per year which is higher than any region in the World[94].

There are opportunities to reduce the negative impacts of inefficient waste management through recycling and methane capture. Facilities that collect and combust methane from landfills exist in several landfills in the country and have reduced emissions by 5.4% (UNCPB, 2015). Additional reductions in greenhouse gas emissions are possible through recycling and composting programs that exist in many parts of the country. There are, however, limitations in their impact, as source separation is at its incipient phase in most areas and most treatment plants are not running at design capacity.

Urban flooding

Rapid urbanization and inadequate urban development are at the root of increasing urban flooding. In contrast to riverine flooding, urban flooding is in most cases the result of heavy rainfalls concentrated in time and location. For example, in February of 2015 Córdoba experienced 320mm (*La Nación* Newspaper, 2015) of rain per m^2 within twelve hours, which is about three times the average rainfall in February for the city. With urbanization and the associated paving and construction of buildings, land areas are transformed into impermeable areas where the possibilities of drainage are diminished and the water amounts in the draining systems and on the street increase[95]. In addition, when vegetation is replaced by urban infrastructure the capacity of evapotranspiration decreases[96]. Moreover, artificial barriers that are intended to protect communities in one location, often increase the volumes of runoff water for other communities downstream.

Figure 24: Urbanization and the effects for runoff water



[94] Ejercicio de Estimación de Pérdidas y Desperdicios en Argentina, Ministerio de Agricultura, Ganadería y Pesca, 2016; Inventory of Food Waste Sources- Mar del Plata; Salta and Rosario, World Bank, 2016.

[95] If the population density increases from 0.4 habitants per hectare to 50 habitants per ha (Buenos Aires average) the time of the runoff decreases to 10 % of its initial value and the volumes increase by 1000 % UNESCO 1987).

[96] Due to impervious surfaces like pavement and rooftops, a typical city block generates more than 5 times more runoff than a woodland area of the same size (US EPA)

Because of their location, large cities like Buenos Aires or La Plata are particularly vulnerable to flooding. The two cities are located in the flood-prone, depressed Pampa region, which historically has been filled with small rivers and streams draining into the La Plata River basin. Over time, many natural runoff systems have been covered up or "tubed" and are now blocked, increasing the risk of flooding[97]. The combination of urban flooding and riverine flooding increases the risk manifold. In recent years more than 200 housing developments have been built in the floodplains of the Parana Delta near Buenos Aires[98]. These constructions prevent the natural runoff of water that would cushion the impact of floods, increasing the risk of urban flooding in the metropolitan area. Moreover, these constructions are themselves vulnerable to flooding since about 90 percent of the houses were built in floodplains subject to overflow from rivers and streams (IPS, 2013).

Drainage, water storage systems and non-structural measures are less expensive ways to manage urban flooding. Measures that are able to increase the permeability of the surface have proven to be very effective in preventing urban flooding. Green areas, permeable pavements or drainage systems can achieve such permeability and are ideally able to create an environment that is equally absorbent as before urbanization. Artificial barriers on the other hand have the disadvantage of giving the population a false sense of security. Besides, the water is merely transferred to communities downstream and not absorbed. So called non-structural measures encompass emergency planning and management, enforced land use planning to avoid settlements in flood prone areas, and increased preparedness via awareness campaigns.

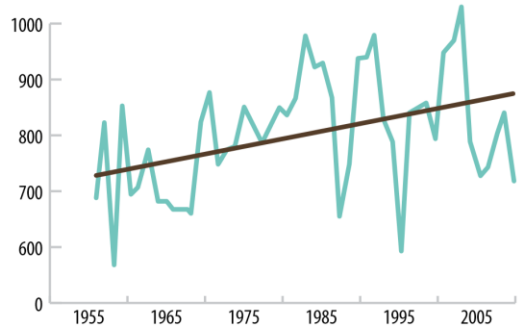
The Hydraulic Master Plan (*Plan Director de Ordenamiento Hidráulico* - HMP) prepared in 2004 by the government of Buenos Aires city is providing important experience in comprehensive planning for flood protection. Based on best practices in flood risk management, the HMP takes a basin-wide approach and details a set of nonstructural and structural measures focused on: (a) interagency coordination; (b) urban planning; (c) green-space management; (d) green and resilient infrastructure; (e) a hydro-meteorological system for forecast and warning; (f) emergency plans; and (g) infrastructure investments, such as primary and secondary drainage systems, pumping stations, and retention areas. The ongoing implementation of the HMP has already resulted in significant improvements in drainage capacity, as well as providing experience for knowledge transfer to other provinces and cities in Argentina.

Climate Change[99]

Climate Vulnerability

Increasing frequency of extreme climatic events is magnifying environmental challenges and increasing the vulnerability of urban population. Heavier, erratic rainfalls increase the probability of urban flooding events particularly where adequate drainage systems and urban planning are lacking or existing systems lack proper maintenance/implementation (World Bank 2015). Increasing temperatures are expected to put more pressure on water supplies in the more water-stressed parts of the country. Coupled with higher probability of heat wave events, increasing temperatures have adverse effects on human health and infrastructure (especially transport and power), and trigger higher demands for electricity for cooling (with a disproportionate negative impact on the poor). This implies, inter alia, additional operational costs to critical public infrastructure like hospitals and schools. Contingent on energy generation technologies and transport behavior, air pollution may also increase as a secondary effect.

Figure 25: Annual precipitation in mm in Argentina 1955-2007



Source: Gosling et al. 2010

[97] Scientific American 2013.

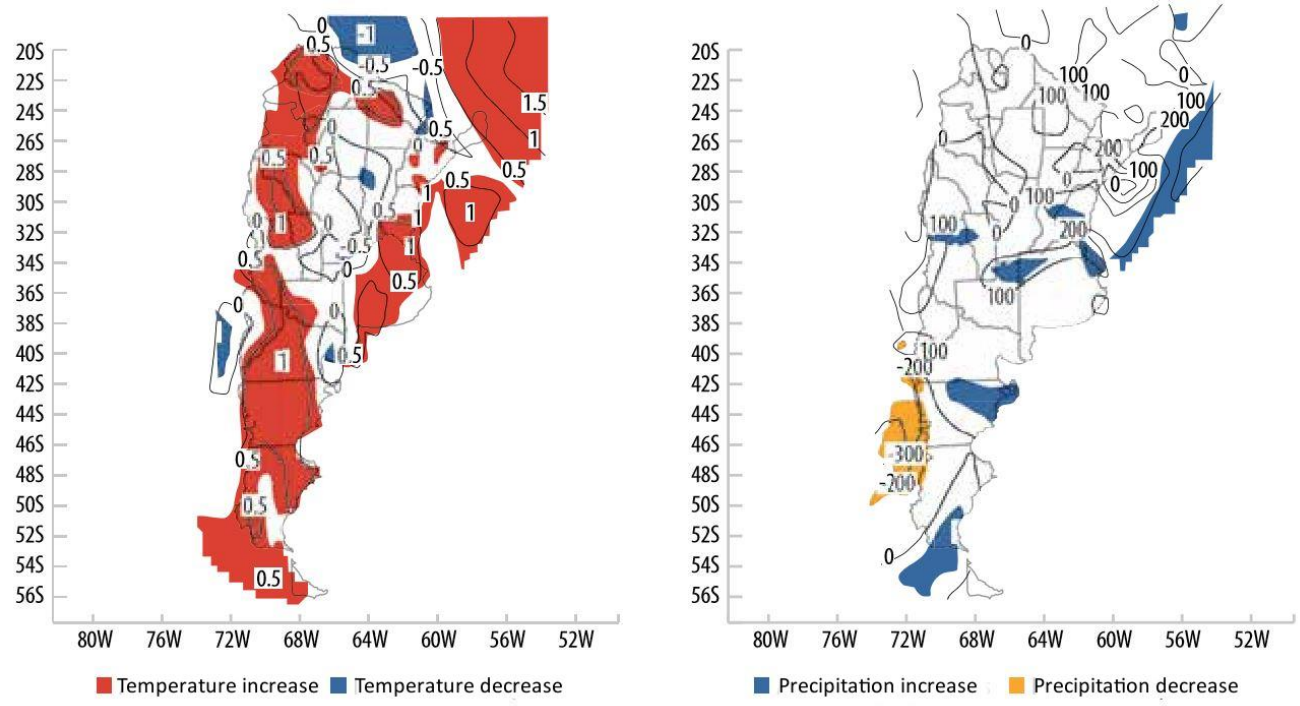
[98] IPS 2013.

[99] It is not in the scope of this CEA to evaluate and address all the challenges related to climate change. This section simply touches upon the main linkages between climate change, natural resources and environmental management.

Annual precipitation and heavy rainfall events have increased over the last fifty years, amplifying the risk of flooding. Since 1960 the average annual rainfall in the country increased by 1.9 mm or 3.5% per decade. More relevant for flooding, the share of rainfall occurring in heavy events increased by 1.7% per decade. Sudden and heavy rainfalls are more likely to cause floods than steady rain with a low intensity. Average temperatures have not changed over the last several decades although hot nights have become much more frequent. In most of Argentina the temperature rose by about to half a degree Celsius between 1960 and 2010, while in Patagonia the temperature increase reached 1° C in some areas (SAyDS, 2015b).

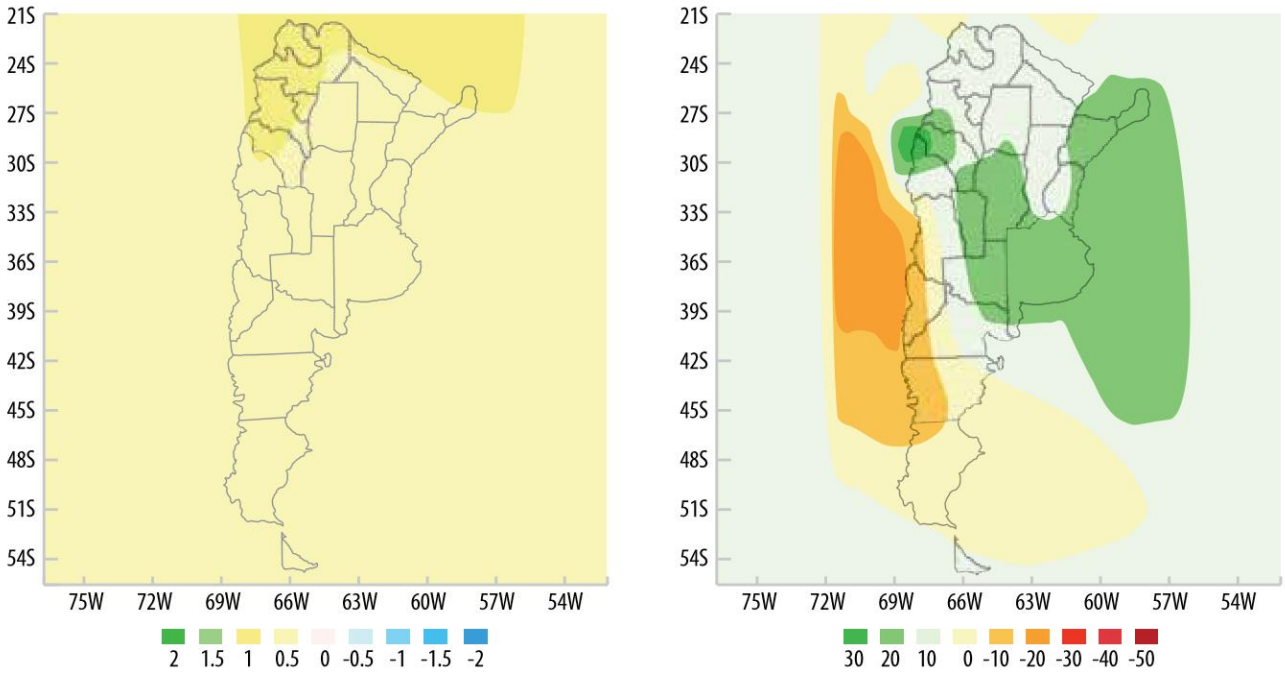
Projections suggest that the country as a whole will see an increase in average temperatures and the North and Central regions will experience an increase in both rainfalls and temperatures. Until 2039, temperature will raise by 0.5-1°C, and by 2090, temperatures in the north of Argentina are projected to increase by 4°C on average, while in the south only by 1.1 °C. Regarding the projected precipitation, it seems safe to assume no significant changes, as the projected changes are within the margin of error. Wider and deeper sectoral data and further analysis are required to improve modeling and understanding of different impact scenarios including effects on agriculture and landscape.

Figure 26: Observed change in temperatures and precipitation between 1960-2010



Source: SAyDS (2015b)

Figure 27: Projected changes in temperature and precipitation for the period of 2015-2039 compared to 1980-2005



Note: Left, change in the average annual temperature comparing the period of 2015-2039 with 1980-2005 based on CIMP5 models. Right, change in the average annual rainfall comparing the period of 2015-2039 with 1980-2005 based on CIMP5 models
Source: SAyDS (2015b)

Further land degradation might be the consequence of climate change because the incentives to convert pasture and forest land into cropland are increasing as the productivity of soy and maize will be even greater in the future. Climate change is likely to alter productivity of agricultural production substantially until 2039: the productivity of wheat is projected to decrease by roughly 13%, while the productivity of maize is predicted to increase by roughly 10% (SAyDS 2015c). Conversely, soybeans would benefit strongly from the predicted climate changes and the productivity would increase by 32.5% to 42.5%, mainly due to higher water availability during the month of February[100]. The effect of climate change on the production of meat is expected to be very negative for some areas in Corrientes, Formosa, and Chaco and very positive for dry areas in the South of Buenos Aires and Córdoba, and the North of La Pampa. However, these climate change effects occur to a lesser extent in semi intensive grazing systems (pastoralism with supplementation) and practically tend to disappear in intensive (feedlots) systems (SAyDS 2015c). As soy cultivation seems to provide even higher yields in the future, land degradation and land conversion are worrisome environmental threats.

Greenhouse Gas Emissions and Low Carbon Growth

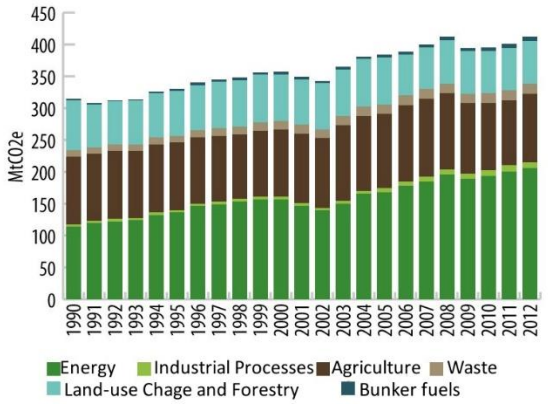
Greenhouse Gas (GHG) emissions have been steadily increasing in Argentina and the energy sector has become the main single contributor. Emissions from the energy sector represent 43% of the total GHG emissions; the agricultural sector and land-use change and forestry (LULUCF) make up almost half of Argentina's total emissions (CAIT, 2015). Energy production in Argentina is dominated by thermal energy (60 % of the total) followed by hydropower (35 %). Transport, residential, and industrial sectors use each roughly 26 % of the total energy consumption.[101]

[100] February is the month with the highest water needs for soy crops and rainfalls will increases by 50%-70% during this period.

[101] Ministry of Energy and Mining.

Recent high levels of subsidy on energy prices contributed to high GHG emissions and environmental degradation. Low energy prices disincentivise private and public entities from adopting energy efficiency measures and investing in cleaner sources of energy. They also influence consumers' behavior as regards heating, cooking, lighting, transport with a combined negative effect on the environment, particularly air pollution.

Figure 28: GHG emissions in Argentina by source



Source: CAIT

A shift towards renewable energy and enhanced environmental and natural resource management could put Argentina on a path towards low carbon growth. Future energy needs will have to be increasingly met through the development of renewable energy (RE). RE generation often relies on the sustainable provision of environmental goods and services – such as a steady flow of water, reliable provision of biomass –as direct production factors. The development of RE however can also have much larger impacts on the natural environment than conventional energy systems, for example in the context of hydroelectric developments and associated flooding and alteration of rivers and waterways; or geothermal energy development and access to forest areas. A low carbon strategy based on large-scale development of RE would need to fully integrate environmental and natural resources management considerations.

Institutions and Policy Framework

Institutional Framework[102]

Environmental governance in Argentina is multi-layered and cuts across federal, provincial and municipal levels. The current environmental governance structure is based on the distribution of powers between federal, provincial and municipal governments that was defined in the constitutional reform of 1994. The right of the Provinces to regulate natural resource use and extraction dates back to 1853 and remains a key feature of Argentina's environmental governance. To ensure a minimum threshold of environmental protection applicable nationally, the Constitutional reform empowered the national congress to enact "minimum standards" [103] while allowing Provinces to enact higher thresholds should they wish. The constitutional reform also included an explicit right to a healthy environment and procedural remedies available to citizens and NGOs when defending collective rights.

Most environmental regulatory powers are with the Provinces although capacity and budgetary constraints reduce their effectiveness. The 1994 reform codified Provincial ownership over natural resources and provided the legal basis for most regulatory powers dealing with natural resource use and environmental protection, including the hydrocarbon deposits and fisheries within twelve miles of the coastline; with some exceptions, such as nuclear and hydroelectric energy, for which regulation is centralized. Devolution of power is common in a federal system and offers many benefits in terms of developing localized and tailored solutions to local priorities. Nonetheless, many provincial and municipal authorities lack the technical capacity to set adequate thresholds of performance or the financial resources to monitor and enforce environmental standards.

The recently established Ministry of Environment and Sustainable Development has a stronger man-

[102] The institutional framework for environmental management is likely to change over several months following the 2015 elections and a further institutional review with regard to environment and natural resource management may need to be conducted in the near- to medium-term future.

[103] The nine "minimum standards" in force are laws on: General Environment, Hazardous Materials, Integral Management of Industrial Waste, Management and Elimination of PCBs, Management of Water, Free Access to Public Environmental Information, Protection of Native Forests, Control of Conflagration Activities, and the Protection of Glaciers.

date for policy development but also greater challenges to address. Following the general election in October 2015, a new Ministry for Environment and Sustainable Development (MAyDS) was created, replacing the Secretariat of Environment and Sustainable Development (SAyDS) that was previously under the jurisdiction of the Chief of the Cabinet of Ministers of the national government. Primary functions of MAyDS include environmental policy development and implementation and management of environmental affairs, including information dissemination, relationships with environment-related non-governmental organizations (NGOs), and national coordination with regard to international conventions. While specific priorities and detailed organizational features of MAyDS are still being developed by the new administration, the broader competencies have been identified and include[104]:

- Prioritization of environment and sustainable development objectives, as well as design and implementation of public policies to address them;
- Institutional coordination on environmental matters;
- Administration of environmental public information;
- Inventory, conservation, restoration and sustainable use of renewable and non-renewable natural resources;
- Development of environmental land use planning and environmental quality legal frameworks;
- Promotion of sustainable use of water resources, forests, wildlife and soil preservation;
- Supervision of the National Parks Administration, and regulation and administration of national forests, parks, reserves, protected areas and natural monuments;
- Promotion of sustainable development of urban settlements;
- Environmental control, enforcement and pollution prevention;
- Regulation of the development of biotechnology;
- Promotion of new technologies and instruments to protect the environment and address climate change;
- Prevention and attention to natural emergencies and climate-related catastrophes.

The creation of a ministry of environment and sustainable development signals the increasing attention that Argentinian policy and decision makers are expected to give to environmental policies. It also recognizes that sustainable development is about systemic transformation of production, consumption, and behavioral patterns that aim to preserve the countries' natural capital. The most immediate challenge is for the Ministry to define its priorities over the full spectrum of environmental issues and align the organizational structure, human capacity and financial resources accordingly. Additionally, the Ministry would need to play a stronger role in working with provinces and municipalities to address environmental management weaknesses at sub-national level. It would also need to reach out to other sectors of the economy and society that play a critical role for long-term environmental sustainability, particularly those sectors whose policies (e.g. agriculture, mining, etc.) could be conflicting with the goals of the new ministry.

Institutional coordination is weak and lacks formalized collaboration mechanisms and dedicated resources. The Federal Environmental Council (COFEMA) is a mechanism for environmental policy coordination between the Federal and Provincial governments. COFEMA comprises representatives from the MAyDS and representatives of agencies from the City of Buenos Aires and 23 Provinces. Although politically influential, COFEMA lacks formal regulatory powers to ensure compliance with its resolutions. Secondly, the absence of dedicated resources to fund COFEMA's mandate has historically inhibited its effectiveness. Thirdly, COFEMA's mandate is limited by the existence of separate Federal Councils for Mining, Fisheries or Agriculture and the absence of an effective coordination and collaboration mechanism that provides a holistic approach to tackle cross-cutting environment and natural resources policy issues such as disaster risk management or water resource management. The coordination problem resulting from overlapping mandates is compounded by insufficient dedicated resources at the national and subnational level, as well as technical capacity constraints. With the establishment of MAyDS there is the opportunity

[104] The decree that created the Ministry contains the full description of its competencies. http://www.ambiente.gob.ar/?idseccion=6

to address legacy governance and capacity gaps and establish a robust and dedicated integrated environmental system

Some overlaps in oversight of environmental matters exist also in the legislative sphere. The lower Chamber of Deputies and the upper Chamber of the Senate have legislative functions on issues relating to environment and natural resources through various committees, including the Committee on Natural Resources and Conservation of the Human Environment (Deputies), and the Committee for Natural Resources and Sustainable Development (Senate). Some degree of overlap exists with other sectoral and cross-sectoral committees in both chambers including those related to Mining, Energy and Fuels, Economy, Regional Development, Agriculture and Livestock, Housing, Land Use, and Tourism.

For the specific case of water resource governance, improvements have been achieved in selected watersheds, but broader institutional challenges persist. Water quality standards by type of use are clearly set in the national law on hazardous waste management (in its regulatory decree). However, the approach is not based on the carrying capacity of each waterbody and each jurisdiction sets forth the uses and limits within its own territory. A notable exception is the Matanza-Riachuelo watershed whose inter-jurisdictional management authority ACUMAR is mandated to implement a comprehensive plan of pollution control and environmental recovery for the basin. Other inter-jurisdictional basin commissions exist but have limited monitoring and enforcement capacity. The Sali-Dulce Basin commission, for example, monitors and reports water quality parameters but the information has not been updated since July 2011. Similar weaknesses affect COMIREC, the Reconquista Basin Commission. Institutional and governance issues - including an outdated water sector legal and regulatory framework, limited capacity in water management at the central and provincial levels, outdated procedures for water resources planning, a deficient water resources monitoring network and lack of appropriate incentives for conservation and efficient use of the resource base and for reducing pollution - affect the government ability to manage watersheds more effectively.

Policy Framework

Argentina's Environmental Management Framework is built on constitutional, legislative, and judicial action and while institutionally complex, has been effective in a number of areas. Chief among them is the Protected Areas agenda, which has underpinned the sustainable development of the tourism sector through a National Parks system. National programs related to climate change, desertification and urban solid waste management have been, in some ways, equally effective, as illustrated by their institutional continuity over the last two decades. The unifying factor for the effectiveness of these individual programs is the availability of dedicated external finance from international conventions or multilateral financial institutions, which served to build up relevant capacity at an early stage and ensure programmatic continuity in the absence of national resources.

The predominant use of "command and control" policy measures is increasingly accompanied by more effective economic instruments. Argentina's environmental governance framework is mostly "command-and-control", whereby active state regulation is favored over economic-based instruments. While this may be beneficial when regulating a discrete number of activities, "command-and-control" policies are subject to high transaction and enforcement costs when applied over a larger scale[105]. Market- or economic-based incentives are generally more effective for environment and natural resources management and have been successfully used in several cases in Argentina, both at national and sub-national level. For example, for water use, many provinces have applied or intend to apply fees and charges based on consumption to incentivize a more efficient use of the resource. Also, the Native Forest Protection Law (26,331) recognizes the concept of payment of ecosystem services and compensation to landowners to maintain native forests functionality and avoid conversion for agriculture or livestock production.

[105] The efficiency of individual instruments varies depending on the specific issue under regulation, although in general economic instruments and incentives are considered to be more efficient, especially when regulating issues at scale (for example, vehicular emissions). Direct government regulation or "command-and-control" instruments are often easier to design and implement, especially when used to regulate a discrete number of identifiable and observable sources of potential environmental degradation (for example, outflow from metallurgical industrial operations).

The hazardous waste charge introduced under the 1992 Hazard Waste Law (24,051) was designed as an incentive to reduce high level waste generation and increase levels of reuse. These approaches could be scaled up nationally or mainstreamed across all Provinces.

The practical implementation of environmental policies has been increasingly influenced by a series of judicial actions and decisions, including by the Supreme Court. The Judiciary has played an increasingly important role in interpreting and mandating practical implementation of environmental legislation, including "minimum standard" legislation enacted pursuant to the 1994 Constitutional Reform and the General Environmental Law (No. 25.675), as well as broader issues of institutional transparency in environmental governance. Examples of judiciary interventions include mandating environmental impact assessments for mining and forestry projects, and defining the need for restoration of degraded environments; mandating the establishment of multi-jurisdictional watershed management authorities to restore, clean up and rehabilitate critical river basin such as the Matanza-Riachuelo river in Buenos Aires; mandating the establishment of performance indicators and an information system accessible to all interested parties to enhance transparency in environmental management.

However, lack of evidence-based priority setting, multi-year programming and an open stakeholder engagement process limits the effectiveness of environmental policy design, implementation, monitoring and enforcement. Currently environmental policy making is not supported by evidence-based priority identification and there is no capacity to translate priorities into programmatic or multi-year work programs. This is partly an issue of analytical gaps, particularly data gaps on the extent of environmental degradation across natural resource sectors, which could support robust evidence-based policy design. It is also a factor of resource constraints in terms of human and financial capacity at the various levels of policy-making. It furthermore has to do with stakeholder inclusion, whereby there are few or ineffective mechanisms in place for groups most impacted by environmental degradation to engage in policy planning processes in an open and transparent way. These factors combine to impact the effectiveness of policy making upstream at the design level, but also downstream, when it comes to monitoring, evaluation, and enforcement.

Improved environmental practices and procedures would also enhance the effectiveness and sustainability of policy decision-making. The primary law related to project Environmental Impact Assessment (EIA) is the General Environmental Law (*Ley General del Ambiente*, No. 25675) and the associated Law on Access to Environmental Public Information (*Ley de Libre Acceso a la Información Pública Ambiental*). There are also additional federal laws related to water and waste management, and associated with specific sectors (for example mining, electricity, oil and gas, forestry) that include environmental assessment provisions. While the federal environmental framework requires that the relevant authorities (provinces and sectors) conduct EIAs for projects with significant impacts, there are no regulations at the federal level that establish minimum standards for EIAs to guide the basic requirements for the use of this instrument across all provinces and sectors.[106] Nevertheless, there are instances of non-legally binding application of international good practice in the domestic context: the oil industry, for example, has complied with EIA provisions elaborated by the Secretariat of Energy[107]; the mining industry, subject to the Provincial laws in which they operate; and selected Provinces that have been more proactive than others in requiring EIAs. EIA is also a criterion for external multi-lateral finance, in line with the donor's operating policies.[108]

EIAs in Argentina have largely been used as procedural permitting tools to allow major projects to move forward, rather than as tools to guide project design through impact assessment and stakeholder buy-in. Compared to international best practice, a number of short-comings are apparent, including (i) a lack of adequate screening to identify the projects that should be subject to EIA, (ii) limited public participation, (iii) lack of standardized criteria to evaluate the EIA, and (iv) weak monitoring to ensure that the mitigation measures proposed by the EIA are implemented. Another example is the negligible use of cost-benefit analysis to evaluate proposed interventions and ensure that the social, environmental and financial benefits outweigh the costs. Frequently,

[106] Argentine Republic's Environmental and Social Regulatory Framework, World Bank, 2014

[107] Nonna (2002) INECE Conference Paper

[108] ibid

there is an uneven level of economic and practical justification for the policies to be implemented, or assessment of the regulatory impacts for both the public sector in terms of enforcement capabilities and for the private sector in terms of feasibility as regards compliance. These weaknesses hamper policy effectiveness and sustainability of the regulatory framework at both national and subnational levels.

Chapter 3

Public Opinion, Government Spending and Priority Setting for Environment

Public Perception of the Environment and Associated Challenges

A large majority of Argentines attributes great importance to environment and natural resource management for economic development, health and wellbeing but see a deterioration of the environment over time. Results from an automatized and representative telephone survey conducted in November, 2015 and a similar survey carried out in 2014 show that almost 90% of the Argentine citizens believe that natural resources are important for the economic development of the country, and 91% believe that pollution and other environmental problems have significant impact on people's health and wellbeing. Citizens have a more positive perception of their local environment than the global environment (for example their opinion of the status of the environment in their own town is more positive and less negative than that of the country as a whole, and that of the world). However, when it comes to trends, the majority (63%) of the population believe the status of the environment in Argentina has worsened during the latest years[109].

Deforestation, waste management and water pollution are considered major concerns for the Argentine society while solid waste and air pollution are perceived to affect people the most. The three most often mentioned main environmental problems were "Deforestation" (25%), "Solid Waste" (20%), and "Water Pollution" (19%), followed by "Air pollution" (13%) "Noise" and "Lead" (6% each). However, when asked about the main environmental problem that affects the surveyed people or their families directly, the respondents chose "Solid Waste" (25%), "Air Pollution" (24%), "Water Pollution" (16%), "Noise" (14%), while about 10 % chose "Deforestation"[110]. In a highly urbanized society like Argentina's, urban environmental problems are much more visible to citizens; it is therefore remarkable that almost a quarter of the people considers deforestation as the main environmental problem faced by the country and show such a high level of awareness about Argentina's huge loss of forest cover. The difference in the prioritization of the various issues shows how perception can be influenced through communication and the availability of visual information. On the other hand, problems as noise and lead exposure remain almost invisible to society, irrespective of the high costs they have on health.

There is significant lack of trust in the government when it comes to addressing environmental issues. Only 20 % of the respondents trust the national government to solve environmental problems compared to 41% that trust civil society organizations. Noticeable also the role of the media (chosen by 13% of the respondents) and the judiciary (8%). Additionally, people seem to be unaware of what governments are actually doing to address environmental problems, or believe what they do is not enough. More than 2/3 of the respondents believe that the national and local governments are doing nothing or little to address environmental issues. In general, the better educated

[109] FVSA, 2014

[110] It is worth mentioning that the fact that some problems have not been selected as "the main environmental problem", does not mean that the people don't care about them. For example, although climate change was not prioritized in this survey among the main environmental problems faced by Argentina and its citizens or their families, a previous survey conducted the year before, adjudged it to be at the top of the ranking when it came to the environmental issues which Argentine citizens "follow more attentively" (FVSA, 2014).

the participants were, the less positive (and the more negative) their perception was regarding the importance the environmental issues get in the national government's political agenda, and regarding how much the national government is doing to solve the environmental problems. Access to internet was also a factor regarding a less positive perception about the importance given to environmental issues in the national government's political agenda.

People's perception and understanding of the causes and impact of environmental degradation may serve as guidance to policy makers on where more action or better information is needed. Citizens seem more aware of the causes and impacts of urban environmental issues and less of those affecting the rural space. On solid waste management, for example, half of the respondents specified that "people's behavior" was the main problem, while 26% indicated the "use of open pit dumps, the abandoned dumps or the wrong management of urban solid waste" as the main problem, and 12% chose the "insufficient or total lack of waste collection systems".

However, current views and opinions on the environment may largely stem from anecdotal evidence and "hearsay" rather than the analysis of data on the state of the environment. For air pollution, more than 40% of the surveyed indicated that the "intensive use of agrochemicals" was the main issue while more than one third indicated that "pollution from factories or industries" was the main problem. As this perception is consistent with the increase in the use of agro-chemicals and fertilizer and the increase in media coverage of alleged cases of poisoning due to aerial spraying of pesticides close to urban areas, it is not clear whether this answer is driven by the media or vice-versa. As regards transport, the survey results indicate that people do not perceive increasing traffic as a major environmental concern, although the data analysis demonstrated that the number of circulating vehicles has almost doubled during the last decade with significant air pollution and health impacts.

Table 3: Results for a public opinion survey on Argentina's main environmental problems

Argentina's main environmental problems		Environmental problems that affect themselves or their families		Who do you trust in solving these issues		How much is the national Gov't doing to solve these issues? (Nov 15)	
Answer	**In %**	**Answer**	**In %**	**Answer**	**In %**	**Answer**	**In %**
Deforestation	24.6	Waste management	25.4	NGOs	41	A lot	8
Waste management	20.3	Air pollution	24.2	Federal Government	20	Something	10
Water pollution	19.2	Water pollution	16.2	Media	13	Very little	40
Air pollution	12.6	Noise	13.6	Justice System	8	Nothing	37
Noise	5.7	Deforestation	9.9	Int'l Organizations	4	No answer	5
Lead pollution	5.7	Lead pollution	4.1	Citizens	4		
Extinction of species	0.7	Climate change	1.0	The municipality	2		
Climate change	1.2	Land degradation	0.8	Provincial Government	1		
Land degradation	0.7	Natural disasters	0.6	The opposition	1		
Natural disasters	0.2	Extinction of species	0.1				
Others	1.9	Others	1.1	Others	3		
No answer	6.6	No answer	3.1	No answer	4		

Source: Own survey

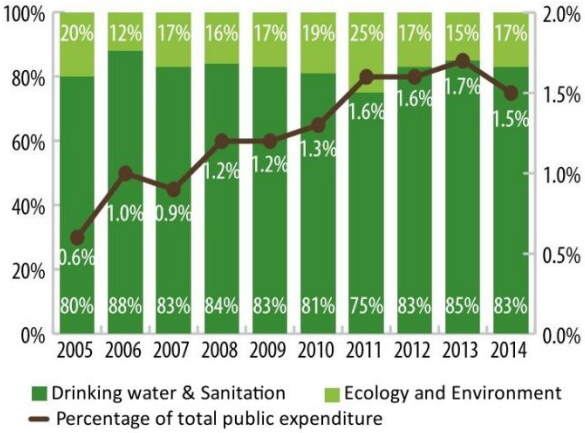
On water pollution, no single issue stood out and people's opinions varied significantly (from "poor sewage and sanitation systems" to "arsenic contamination", "agrochemicals", "municipal waste", etc. Similarly,

for deforestation, opinions ranged from "overuse of wood" to "cattle ranching", "conversion of forestlands to monocultures" to "infrastructure that show that land use change (mainly due to the expansion of agriculture) is the main driver of deforestation in Argentina. Overall, public opinions provide valuable inputs for priority setting, inform the design and implementation of environmental communication strategies and monitor and evaluate on-the-ground results.

Public Expenditures for Environment

Environmental expenditures in Argentina appear low but show an upward trend. National government spending for Environmental Management accounts for about 1.7% of the total public spending, and about 0.4% of GDP. By way of comparison a conservative estimate puts the cost of environmental degradation at 8.11% of GDP. The level of environmental expenditure in Argentina is slightly below the level in other Latin American countries with strong environmental management (such as Costa Rica, Mexico and Chile) and clearly below that of OECD countries. It should be noted that comparisons are difficult to make because Argentina lacks disaggregated data. As a consequence, spending from provinces and municipalities have not been included to avoid double counting the transfers from national to local government[111]; expenditures made by non-environmental agencies but related to environment (environmental health, research and development, marine resource protection, etc.) are also excluded, providing a somehow conservative estimates of the expenditure levels.

Figure 29: National Government Spending on Environmental Management. Composition (2005-2014)



More revealing is the trend in environmental spending which increased steadily throughout the last ten years and reached its peak in 2014. The steepest increase occurred in expenditures for environmental management, and water and sanitation in particular which account for 0.3% of GDP and are mainly capital expenses (73%) while the increase in environmental protection expenditures was more uneven, contained and mostly for current expenses. Domestic funding is prevalent in both environmental protection (94%) and water and sanitation (83%).

Almost one third of national government environmental expenditures are for the clean-up of the Matanza-Riachuelo Basin, one third for water supply and sanitation and flood control infrastructure, and only 4% for protection of the ecosystems[112]. The Integrated Cleanup Plan for the Matanza-Riachuelo Basin (PISA)[113], established the need to clean the river banks, eradicate and repair the environmental effects

[111] Provincial expenditures for water and sanitation and other urban services was estimated at 0.33% of GDP in 2013. Municipalities spend between 5% and 25% of total municipal expenditures on Solid Waste Management (SWM) service. Unfortunately, it is not possible to estimate how much of this spending should be included in the category of "Environmental Protection Expenditure".

[112] Due to the little information available at the required level of disaggregation the review of public expenditures was limited to four areas: deforestation, lead exposure, lack of water and sanitation, natural disasters. These four areas accounted for more than 66% of the national total spending for Environmental Management and 0.26% of GDP in 2013. Arranged differently, spending on natural resources and disasters (floods) management amounted to 0.08% of GDP, and spending connected with environmental health stood at 0.18% of GDP.

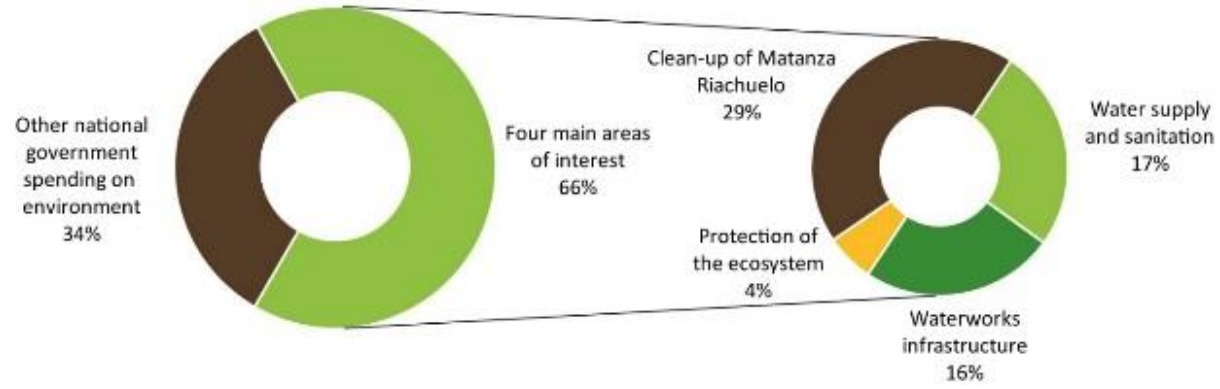
[113] The PISA was prepared by a tripartite basin authority (ACUMAR) based on a mandate set forth in a Supreme Court ruling. Around five million people live in the area of the Matanza-Riachuelo basin which includes three jurisdictions (National Government, Buenos Aires city - CABA - and Buenos Aires Province). High levels of lead in blood were detected in the basin's area, particularly among children. This is because there are many garbage dumps and areas in which machinery and vehicles have been abandoned and disassembled, which has led to a high concentration of lead and other heavy metals in the ground.

of landfills and abandoned plots of land; relocate families and provide drinking water and sanitation. In 2013, 29% of the national government budget for environment was allocated to clean up the pollution legacy in this basin, out of which 57% was to upgrade slums and expand the drinking water and sanitation infrastructure. About 17% of environmental expenditures targeted water supply and sanitation, mainly through subsidies for the supply of drinking water and sewerage services. Flood control investments accounted for 17% of the total environmental expenditures at the national level, of which 42% was earmarked for transfers to the provinces and municipalities, and 37% for work.

Finally, activities addressing deforestation and protection of the ecosystems, and particularly native forests, accounted for 4% of the national government expenditures for environment. These funds were mainly targeted to: a) implementation of the Forest Law[114] (42%); conservation and management of national protected areas (41%); and fire management (17%). It is worth noting that the amount allocated for the implementation of the Forest Law represented only a minor proportion of the amount provided for in the law and an indication of chronic underfunding[115].

The lack of clearly-defined policy goals and disaggregated expenditure data makes it very difficult to evaluate the alignment of environmental expenditures with environmental priorities. Argentina has not outlined a strategic plan for sustainable development and has not defined environmental policy goals. The only "Report on the Status of the Environment" produced by the National Government in 2012 (SAyDS, 2012) was published in fulfillment of the annual reporting requirement established by the General Law on the Environment (Law 25,675). It offers a broad range of environmental statistics and indicators but does not identify the main problems nor does it state the objectives for improvement in the future. It also presents the environmental legal framework for Argentina but does not offer an assessment of its enforcement effectiveness and does not forecast the impact of the surveyed initiatives on the future evolution of environmental issues. Partial information on

Figure 30: Public Environmental Expenditure in four areas of interest



Source: Prepared by the World Bank based on information from AGN and the investemnt account mecon.gov.ar

[114] Law 26,331 – Minimum Standards for the Environmental Protection of Native Forests.

[115] According to Resolution No.: 281/2014 from the Federal Environment Council, "the relevant budget national laws established funds from: The year 2010 was allocated $ 94,000,000.00 representing 9.86% of the total amount stipulated in the law; The year 2011 was allocated $ 230,000,000.00, representing 6.93% of the total amount stipulated in the law; The year 2012 was allocated $ 271,331,524.00, representing 6.62% of the total amount stipulated in the law; 2013 was allocated $ 230,000,000.00, representing 5.98% of the total amount stipulated in the law; 2014 was allocated $ 230,000,000.00, representing 5.96% of the total amount stipulated in the law. " According to the status of implementation report of Law 26.331 to July 2014 (SAyDS, 2014), the amounts allocated to FNECBN of items assigned by the National Budget to the National Fund for the Enrichment and Natives Forests Conservation were: 2010, $ 94,563,095; 2011, $ 230,000,000; 2012, $ 245,467,244; 2013, $ 218,735,000; and 2014, $ 222,000,000.

environmental priorities can only be acquired from other sources, such as the national budget and studies carried out outside government. When national plans and law provisions exist, there is no information available on the amounts of resources allocated to implement them[116].

Partial delivery of allocated funds limits environmental expenditure effectiveness and efficiency. At aggregate level, actual environmental expenditures and programs delivery have been around 70-80%, and the delivery of the integrated clean-up of the Matanza-Riachuelo basin has been estimated at only 50-70%[117]. The overall level of fulfillment of program goals is monitored as part of the government budget evaluation process and is in line with the rate of delivery at aggregate level; however, at disaggregate level many programs have difficulty achieving their goals especially if they have established multiple targets. Partial effectiveness and efficiency would suggest that oversight and management of expenditures is weak and needs greater efforts to monitor and measure outcomes. Limited efficiency and effectiveness are also the result of dispersion of funds among different institutions that do not follow any clearly established strategic priorities in allocating and using them.

In addition, the increase in environmental management expenditures after 2001 due to energy and water supply subsidies promoted overuse of scarce resources and increased pollution. Public expenditure related to energy subsidies or transfers to the private sector was estimated in the order of AR$ 27.5 billion pesos in 2013, an amount which doubled the national government's spending under the category of environmental management. Fuel and water supply subsidies[118] promoted the use of electricity, fuel and water, and the measures taken to respond to the increasing demand fostered the use of more polluting sources of energy[119]. Restructuring electricity and water rates to better reflect costs not only allows a more rational use of the resources, it also releases funds that can be channeled towards investments aligned with environmental policy goals, including the promotion of renewable sources of energy. A neutral reform of fiscal revenue that increases electricity rates to reduce GHG emissions while simultaneously reducing payroll or labor income taxes has been implemented in several countries in the last decade and a half (mainly in Europe), with the aim of improving environmental performance and contributing to socio-oeconomic development (by reducing distortions that penalize employment)[120].

Identification of Priorities and Budget Allocation

With the many prevailing and emerging environmental management challenges, it will be necessary for the Government of Argentina to systemize the approach to assessing their relative importance. A systematic, transparent prioritization is an important starting point to inform and accelerate this

[116] For example, there is no information available on the amount allocated to implementing the "National Plan of Action to Combat Desertification", and to other actions to curb soil erosion and degradation; no disaggregated figures allowing an assessment of how much is allocated to the conversion programs for those industries that pollute the environment and for other sources such as transport, particularly as regards air polluting emissions; no information on public spending for hazardous or household waste management (which is mainly managed at the municipal level) since there are no consolidated statistics on municipal expenditure; no information about the amount specifically targeted to protecting fish stocks, and the implementation of the "National Action Plan to prevent, discourage and eliminate illegal fishing"; no information on the amount assigned to enforcing the "Law on Glaciers"[116] which calls for an inventory of glaciers in all provinces along the Andes mountain range; no amount assigned to follow-up, evaluate and control the environmental impact of extractive industries, such as hydrocarbons or mining, and large infrastructure works; no information on spending for regulation and oversight of nuclear activities (linked to prevention of technological risks); no information about the money allocated to coordination of land use planning and zoning policies, although it is one of the basic instruments of the environmental policy for preventing other risks.

[117] Study on Environmental Expenditure in Argentina. September, 2015. Prepared at the request of the World Bank for Oscar Cetrángolo, Martina Chidiak, Javier Curcio and Veronica Gutman.

[118] Distortions in the rates paid by users of the drinking water and sewer, electricity, and fuel for public transport services, especially in Buenos Aires City and 24 districts in Buenos Aires Province (located in the areas surrounding the city and lodging 1/3 of the country's inhabitants).

[119] Argentina has started to import fuel with high Sulphur contents, thus introducing the problem of acid rain which did not exist before, particularly in the areas surrounding electric power plants near the downtown district of Buenos Aires city.

[120] OECD, 2001

process, especially providing a basis for discussion and exchange among political and interest groups. Using a simple "traffic-light" approach where three different color codes (green, yellow, red) represent different levels of importance of different parameters of environmental challenges, table 4 exemplifies such a simple though effective prioritization approach. It should be noted that given the analytical boundaries of the CEA as regards sectoral consideration, not all possibly relevant sectors are included in this exemplified prioritization exercise.

With a changing economic, social, and environmental context, the relative importance of environmental management challenges are expected to alter correspondingly. To a large extend, the prioritization is a political process, where different groups and stakeholders are likely to place different weights on different environmental issues. However, a systemized approach and presentation of the arguments that lead to the prioritization results will enhance the substance on which a political discourse can be built on. With this in mind, the exemplified prioritization as presented in Table 3 first ranks those issues identified in the citizens' survey described above as being of highest national or personal concern, and then ranks those estimated to impose higher costs on society. In the cases of deforestation and air pollution, this public perception of concern coincides with estimates of significant costs to society, whereas for waste management and water pollution these costs have either not been estimated, or are relatively smaller.[121]

Prioritization is necessary to align management challenges with budget allocations and institutional capacities.[122] In this regard, the analysis indicates that public expenditures do not always align with the key environmental issues identified on the basis of citizens' perception of important areas of intervention and costs to society. While significant resources are allocated to address water pollution, which is an issue of significant concern, relatively smaller amounts are allocated to tackle deforestation and waste management, and air pollution in particular suffers from a dearth of funding. At the same time, it should be noted however that budget alignments and policies in other sectors may have a strong impact on the environment; in particular, policies in the transport sector may have strong impact on urban air pollution. Based on this analysis, deforestation, air pollution and waste management are identified as key areas for action, together with a concerted effort for data collection to improve targeting of resources for environmental management.

[121] The cost of land degradation measures the loss of value due to deforestation as a major factor, along with the conversion the scrubland, grassland, farmland, moors and forests biome in less valuable (Bouza et al., 2016).

[122] The cost of river flooding represents 49% of the cost Total annual natural disasters (0.7% of GDP), while the cost urban flooding means 46%.

Table 4: An Approach to Prioritization of Environment and Natural Resource Management Issues

Environmental issue	Public Perception	Costs to Society[123]	Public Expenditure	Current situation	Future
Deforestation	Major issue for Argentina	Annual costs 0.74% of GDP	4 % of federal environment budget	High deforestation rate vs. forest law	Enforcement of forest law is crucial
Air Pollution	Major issue for Argentina and people	Annual costs 1.84% of GDP	No federal funds allocated or no information available	Very high levels in large cities vs. low levels in small towns	Urbanization and higher income
Waste Management	Major issue for Argentina and people	Not surveyed	5-25% of total municipal expenditure	Millions remain unserved vs. better than LAC average	Amounts of waste are increasing vs. coverage is easier in urban areas
Water Pollution	Major issue for Argentina and people	Annual costs 0.4% of GDP	46 % of federal environment budget	Improvement in Riachuelo vs. still polluted	Available data does not allow prediction
Land degradation	Not regarded as major environmental issue for Argentina and its people	Annual costs 3.56% of GDP	No federal funds allocated or no information available	Conversion of forests and grazing land into cropland	Policies favoring agricultural expansion as threat
Lead Pollution	Not regarded as major environmental issue for Argentina and its people	Annual costs 0.91% of GDP	No federal funds allocated or no information available	Poverty increases exposure to lead	Available data does not allow prediction
Arsenic Pollution	Regarded as substantial factor for water pollution	Severe health impacts (skin lesions and cancer)	No federal funds allocated or no information available	High levels only in some regions	Cleaner surface water could replace arsenic groundwater
Agro-Chemicals	Regarded as substantial factor for AIR pollution	Severe health impacts and water pollution	No federal funds allocated or no information available	widely used (e.g. glyphosate) vs. still below world average	Trend is so far decreasing
Urban Flooding	Not regarded as major environmental issue for Argentina and its people	Annual costs 0.32% of GDP	17 % of federal environment budget	Increasing occurrence with large damages	Urbanization and constant high precipitation
Riverine Flooding	Not regarded as major environmental issue for Argentina and its people	Annual costs 0.34% of GDP	17 % of federal environment budget	Increasing occurrence	Constant high precipitation

Note: Each environmental problem was evaluated by deciding on what seemed to be seriously problematic (red), somewhat problematic (orange), not too problematic (green), and no statement possible (no color). The ordering of the table does not reflect a set order of priorities.

[123] Data prepared by the World Bank as part of "An Economic Assessment of Environmental Degradation in Argentina ": Bjorn Larsen, John Magne Strukova Skjelvik and Elena Golub, 2015 (unpublished). For more details see also Annex C.

Chapter 4
The Way Forward: Reconciling Environmental Stewardship and Economic Growth

The time is ripe for the environment and natural resources sector in Argentina to turn over a new leaf. The newly elected government has already taken several steps to strengthen its environmental agenda and elevate environment and natural resource management integration into political and economic decision making. The government has also taken concrete actions towards policy changes that are immediately impacting environmental management and degradation in various forms. This proactivity and openness to change will create opportunities for improving the current status of environmental management in the country – but also new challenges. The findings of this CEA can inform the change process by providing a consolidated (although partial, due to public information constraints) analysis of the state of the environment in Argentina and its associated governance system. By enhancing the knowledge about environmental issues and natural resource management challenges, the CEA intends to inform the policy dialogue, prioritize actions, and facilitate decision making.

A New Political Mandate

One of the first actions of the new government was to raise the political and institutional profile of the environmental agenda by establishing a Ministry of Environment and Sustainable Development. This important step was one of the key recommendations emerging from the CEA institutional analysis. The very challenge of this new institutional set-up will now be to match it with effective and efficient organizational reforms that respond to the issues and priorities set forth in this CEA, among others. It will be important to translate the *de jure* reinforcement of the environmental mandate into *de facto* implementation, results, and impact. First and foremost this will be contingent on the allocation and proper administration of financial and human resources available to the ministry. Second, as demonstrated in this CEA, the power of the new institutional set-up will need to extend beyond the federal level as there are many aspects of environment and natural resource management that need to be addressed and managed at sub-national levels including municipalities (e.g. solid waste management). Backed by its elevated mandate, the ministry will need to play a convening role and embrace various levels of the public administration as well as other ministries and sectors. Civil society groups and business and industrial organizations will also need to be included in the new dialogue.

A core challenge to the new ministry will be the interpretation of its role in an environment of economic transition and restructuring. If, for example, Argentina continues to build on the exploitation of its natural resources for economic growth and development the government would need to provide an effective and efficient regulatory framework that safeguards environmental concerns while facilitating the achievement of its broader societal development objectives. The ministry of environment has to become a trusted partner that other sectors within and outside government can turn to for the joint development and implementation of solutions that will make Argentina a clean, green, and resilient country for all.

Accession to the OECD is on Argentina's political agenda and could serve as an outstanding opportunity for the ministry to scale up its work. As experience from other countries shows, one of the core though most challenging elements of the OECD accession process will be to elevate environment and natural resource management standards to OECD levels. This process often requires significant reforms of the environmental governance framework and may im-

pact many other sectors that are politically and economically very important for spurring growth and development. Many reforms may be met with opposition, making the accession process lengthy, costly, and demanding.

The new mandate will also come with extended responsibilities. Part and parcel of the ministry's mandate is the responsibility to comprehensively embrace all environmental issues. The brown environment agenda – extractives, pollution, and waste management – in particular is very challenging and should be of highest priority. Further, a ministry needs to proactively use its new mandate to develop new areas of engagement. For example, serving as a facilitator of renewable energy development and investments by offering water(shed), biomass, land management and impact management solutions. This would, in fact, also align with the ministry's mandate to lead the dialogue on Climate Change, both nationally and internationally.

The Opportunity of Institutional Reforms

The implementation of environmental policies in an advanced economy such as Argentina may require further institutional reforms beyond the establishment of a Ministry of Environment, in particular to reinforce licensing and enforcement functions. Given the increasing complexity of environmental challenges across an increasing amount of sectors and themes, a division of roles and mandates regards regulatory (policy design and evaluation) and executive/enforcement powers within a governance structure might become necessary. The implementation of modern environmental policies often requires the establishment of an executive arm within national environmental governance. In that regard, and in support of their aims, environmental agencies commonly act as an operating authority, and a licensing authority. They commonly bundle agencies that had been created prior to address specific, individual environmental management issues, for example regulatory functions within a specific watershed.

As the public opinion survey of this CEA demonstrated, and in line with OECD accession requirements, environmental issues need to receive increasing attention from Argentine policy and decision makers, recognizing that sustainable development is about a profound change of policies that drive systemic transformation of production, consumption, and behavioral patterns. These environmental policies can have a transformational effect if they focus on environmental quality, reducing negative environmental health impacts, strengthening natural resources capital, and promoting innovation. The conclusions summarized in this chapter are based on the best evidence that could be mobilized to describe the country's underlying environmental concerns, the cost of environmental-health damage, and its impact on economic growth and citizens' perception.

The new ministry will have to demonstrate a clearer commitment to environmental stewardship, responsible natural resource management and sustainable development. Environmental challenges and associated externalities are likely to undermine the basis of economic growth and sectors, such as agriculture and forestry, which support vital economic and environmental functions. The central finding of this CEA is that deforestation, air pollution, and poor wastewater management are threat to agricultural productivity, human health, flood prevention and control and biodiversity. They are key areas that should be addressed in the near future.

The impacts of environmental degradation affect human health and decrease economic opportunities of the poor. Unlike other structural changes, environmental policy reforms would need to be tailored to address challenges that cut across various sectors and have broader socioeconomic effects. For example, industrial scale agriculture – while providing important income opportunities for Argentina at large, lead to deforestation, flooding, and soil erosion and degradation. The related extensive and possibly improper use of agro-chemicals cause environmental health hazards along its entire use chain: transport, application, storage, and disposal.

Increasingly important for the environmental degradation agenda in Argentina are urban environmental issues. The loss of value due to poor air quality, untreated waste, urban floods, and associated disease and mortality are not (yet) calculated in the standard definition of the GDP. The economic impacts of environmental degradation go beyond annual GDP loss. Environmental health-related illnesses are now the top 4 ranked illnesses in Argentina measured in YLL due to premature death. Other impacts of pollution related environmental degradation are lower productivity, higher health service expenses crowding out other household investments, and decreased cogni-

tive and learning abilities among children with lifelong effects for the individual and the economy as a whole. Limited by poor data quality and availability, a COED analysis for air pollution estimates costs comparable to about 3% of GDP in 2012.

The benefits of deregulation in the agricultural and extractives sectors should be adequately weighed against the repercussions on the environment and public health. There is a risk that the cost of environmental degradation could fall disproportionately on certain populations, low-income groups, and households and localities that depend on local natural resources. In addition to the toll on children's health and developmental abilities, many studies found that the vulnerability to air pollution is higher for poor people. In Argentina, slum populations are more exposed to waste pollution as they reside often close to open dumpsites. To address the health risks of high-risk groups, policy interventions such as those aiming to decrease air pollution, enforce quality waste management, control water pollution, and bolster education and awareness are more than necessary. Yet, such policies might not suffice as policies in other sectors also influence environmental outcomes. For example, policies in the transport sector could have strong impacts on urban air pollution. Likewise, agricultural expansion could create higher deforestation or more waste in rural areas.

Linking Environmental Stewardship with Growth and Economic Development

Poor groups, who lack access to decision-making processes, are most vulnerable to the effects of natural disasters, as they have limited adaptive capacity. Particular attention to increasing the adaptive capacity of the bottom 40% would help to reduce the shock effects on the economy. Natural disasters affect the population all along the income distribution, but mostly poor populations in the lowest quintiles of income and consumption since they often reside in flood prone areas that are cheaper or not occupied. Enforced land-use planning and management could prevent such unnecessary high exposure to flood risks by regulating the informal settlements and providing secure alternatives, but also by supporting the management of water run-off and infiltration from the upper parts of the catchments.

In the absence of interventions to improve environmental quality or mitigate natural disasters, there are significant risks that could undermine economic growth and result in physical depletion of capital stock and natural assets. Investing in preventing natural disasters that are linked to environmental degradation, and reducing the vulnerability of poor populations would take Argentina on a path to economic growth that is socially and environmentally sustainable. Various measures could increase the adaptation capacity to natural disasters, such as reducing forest loss, combating soil erosion, better planning of human settlements and land use, and introducing post-disaster coping mechanisms for poor people. The immediate focus would be to improve coordination at the institutional level, improve weather hazard early warning systems and response to drought-affected farmers.

Argentina needs policy changes to foster the social monitoring and better governance of environmental assets in time and place (such as land resources, forest stock, mineral resources, and biodiversity), and reduce direct pollution impacts that may influence human health and environmental quality (e.g., air quality and access to basic environmental services). Such policies would guide a transition to a more resilient and cleaner economy and present economic opportunities that contribute to sustainable growth. Many implementation mechanisms and resources for reconciling environmental sustainability with economic growth and social improvements are yet to be put in place.

Current policies need strengthening and realignment across economic sectors to take account of the loss of natural capital and the human health cost. Focusing on selected policy measures can help reduce forest depletion, land degradation, and air pollution and simultaneously influence behavioral change; a win-win approach. Raising the importance of environmental protection by linking it to economic development and well-being would create more opportunities for the integration of environmental management and climate change mitigation and adaptation measures in the country's development agenda.

Strengthening the effectiveness of environmental policy would require resources to help neutralize the negative ecological consequences of economic activities that undermine the natural resource base. Total national (federal) spending for environment amounts to an average of 1.7% of federal government spending. Expressed as a percentage of GDP, the national (federal) public environmental expenditure amounts to 0.4% of GDP. Given the amount of environmental

problems that Argentina has to solve, budget resources fall short of what is needed to combat environmental degradation. Aligning environmental expenditures with policy priorities and areas of major concern such as air quality, deforestation, solid waste management is a key for achieving sustainable outcomes. Steps to align environmental policy and practice with international norms and standards as well as combine environmental and economic levers to influence polluters' behavior should be among the priorities.

The Way Forward

Based on the results of the CEA, an indicative list of recommendations has been developed for government action. This list could serve as a blue print for addressing the issues studied in the CEA and could further benefit from a cost-benefit and distributional analysis of the actions, as a follow-up to the CEA in order to prioritize, determine their sequence and allocate sufficient resources. These actions, if implemented consistently, could reinforce the sustainability profile of Argentina in a positive way.

Improve the Collection, Management, and Accessibility of Data on the Environmental and Natural Resources

- Establish comprehensive environmental data collection and monitoring systems, for example real time collection of air quality data in urban areas, water quality monitoring, or data on deforestation and land degradation.
- Improve associated data management system to ensure a comprehensive and integrated management and analysis of environmental data.
- Ensure transparency of environmental data, for example through its publication on (government) websites and online databases.
- Facilitate the usability of environmental data, for example through websites and mobile apps reporting real time air quality, possibly integrated with hydro-met data reporting (weather reports)

Adapt Institutional Capacity and Scale-up Mandate

- The new ministry needs to implement an organizational structure embracing a wider range of environment and natural resource management challenges and needs, based on an explicit prioritization.
- Policy reforms need to go hand in hand with the institutional reforms and should also include a wider environmental agenda than before, especially addressing urban and industrial environmental degradation.
- OECD accession would require these reforms as a prerequisite to meet OECD standards and should serve as a catalyst for such a reform process.
- The momentum of the ongoing institutional reform process may be used to reinforce licensing and enforcement functions, for example through establishment of an executive arm within national environmental governance.
- Initiate capacity building for *environmental statistics* to ensure accuracy of data collection of environmental monitoring, including for reporting to meet regional and international conventions—national statistics offices can be trained to improve measurement and provide information on the potential for using the U.N. System of Environmental-Economic Accounting.
- Strengthen the basis for policy development by adopting the methods and definitions used to generate *green accounts*, in which monetary values are attributed to natural capital and biological resources.

Improve air quality management

- Strengthen the current system of *air quality monitoring* by expanding air quality monitoring parameters/pollutants where the highest health impacts are observed; for example, break down TSP emission monitoring into PM2.5 and PM10; introduce continuous monitoring for lead rather than monthly averages of discrete 20-minute measurements; monitor ground-level ozone at more stations in cities.
- Reestablish a fiscally neutral (from a public finance point of view) annual *vehicle technical inspection system* (emissions characteristic) with the necessary diagnostic equipment and technical staff; reintroduce vehicle registration and licenses to encourage adherence to emission standards and improvement of air quality.
- Reform the current *system of pollution charges* for air, water, and generation of waste by introducing meaningful economic incentives.

- Assess options to combine air quality policy with carbon emission reduction policy, e.g. through innovative licensing and carbon pricing mechanisms.

Improve solid waste management

- Better define and quantify waste management issues and proposed solutions: Updating the National Plan for Solid Waste Management. Completing the Provincial Plans for all provinces in the country.
- Improve financial sustainability*:* Improving tariff setting through provincial guides and norms to cover additional services. Undertaking a Value Chain Study for Recycling.
- Bolster the institutional framework*:* Developing implementing rules and regulations for the "Ley de Presupuestos Mínimos" for Solid Waste (Ley 25.916). Developing solid waste laws for all provinces.
- Strengthen vertical coordination: Strengthen the technical assistance programs for provinces and municipalities.
- Mainstream land-use planning in the design of developing policies: Incorporating solid waste landfill locations as part of the planning process.
- Initiate a systematic consultation process at the regional and municipal level with public authorities and civil society: Updating the National Plan for Solid Waste Management.

Address deforestation

- While the Forest Law provides a good regulatory framework for addressing natural forest management, specifically deforestation, there is a need to better enforce compliance with its requirements and to provide additional financial support, and monitor the achieved impacts.
- Establish a broader dialogue on the costs and benefits of agricultural expansion to clarify the trade-offs in land-use decision-making, as well as the other negative externalities of industrial agriculture, especially in the light of the need to provide economic opportunities for the 90% of the population living in urban areas.
- Gradually expand and consolidate the effective management of the zones dedicated to conservation and sustainable use under the forest law, to avoid further deforestation or forest degradation.
- Set national standards for Forest Law-related public information.
- Promote the implementation of existing instruments, designed to benefit the poorest forest-dependent communities.

Increase Resilience to Climate Change and Natural Hazards

- Improving environmental management is one of the best adaptation strategies to manage climate risks, and efficient measures to achieve Argentina's Nationally Determined Contributions (NDCs) through the sustainable management of natural resources are key to facilitating the transition to a low-carbon economy.
- Address urban flooding through and integrated urban-watershed management approach.
- Provide tools – or the enabling environment for private sector provision – for mitigating adverse effects on production, such as agricultural production risk insurance, but also enhance hydromet data availability to enhance adaptive capacities of agricultural production vis-à-vis climate variability.
- Likewise, expand the index-based *disaster insurance system for* flood/flash flood and mudflows to protect the most vulnerable parts of the population.
- Develop innovative polices and implement enabling frameworks for financing mechanisms that target GHG emissions across sectors.
- Enhance the monitoring of GHG emissions through the establishment of inventories.

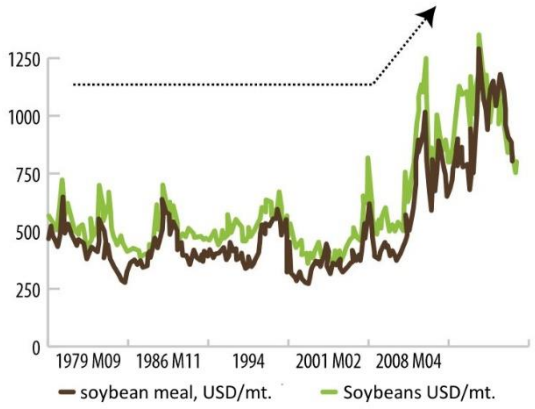
Which policies and actions are the most effective, economically efficient, administratively feasible, and politically acceptable to resolve Argentina's current environmental degradation problems? Countries that have addressed similar problems and improved environmental management systems have created an enabling governance framework through coordination and cooperation among various stakeholders and through clear regulatory mandates. Incentives for behavioral changes need to be supported by strong implementation mechanisms and regular evaluation. Successful strategies to mitigate environmental degradation have to incorporate quantitative targets in the national laws and programs across sectors. Argentina should take advantage of the international cooperation and financing that can be a major

source for transfer of new environmental management "know-how," efficiency improvements, and knowledge of clean development. The OECD accession agenda should provide new and catalytic moment to such a process.

Between 2001 and 2014 Argentina lost ca. 50,000km² of forest areas, which is about the size of the Province Jujuy or Costa Rica. In Northern Argentina 45,000km² were lost over the same period. The question is *what caused such high levels of deforestation?*

Researchers find that deforestation in northern Argentina is in large part driven by expansion of soy and cattle production (Piquer-Rodríguez et al. 2015; Grau et al. 2005; Zak et al. 2008). Forest areas are transformed into crop or pastureland. Deforestation rates in 2000–2010 were up to three times higher than in the 1980s according to Piquer-Rodríguez et al. (2015). Argentina's soy production increased by more than 400 % between 1990 and 2014. The area dedicated to soy production increased almost threefold over the same period. These developments in the soy sector are displayed in Figure 31. Some authors say that Argentina "engineered a soy revolution over the past 15 years" (Mathews and Goldsztein 2009)

Figure 31: Development of world market soy prices



Source: Global Economic Monitor (GEM) commodities

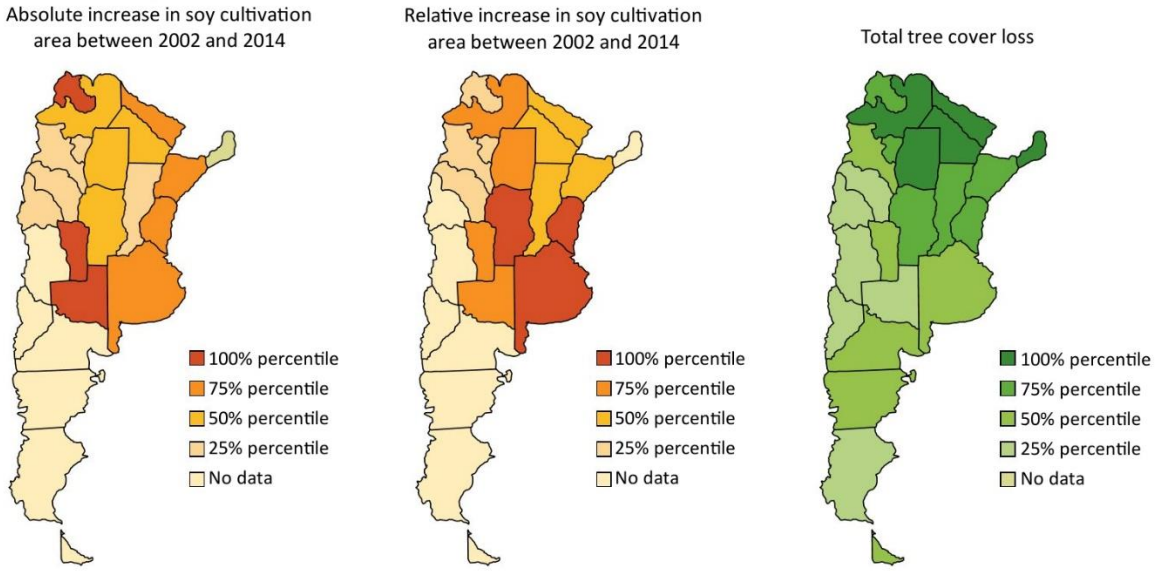
Among the factors enabling the expansion of soy are the introduction of transgenic soy, the application of zero-tillage, higher world market prices and a favorable exchange rate. The literature mentions the introduction of transgenic soy in 1997 (Roundup Ready soybean) as a major reason for soy expansion in Argentina. It came up as a solution for weed control - one of the biggest challenges in farm management (Pengue 2005). Production costs prior to 1997 were approximately US$ 245 ha, but in 1997 they dropped to US$ 220 ha with the introduction of glyphosate-resistant transgenic cultivars (Grau et al. 2005). Since roundup ready has not been patented in Argentina, prices are lower than in other countries, which gives Argentina an additional comparative advantage on the input costs (Tomei and Upham 2009). Another reason for the soy expansion were certainly the increased world market prices for soy due to higher demand for soy as livestock feed and biofuel (McAlpine et al. 2009). During the 1980's and 1990's the world market price for soy has been rather constant (see Figure 32). Locally, the demand for biofuel has been further spurred by actions of the Argentine government in 2007, when ley 26 093 to promote biofuels was approved. The Biofuels Law provides a mix of tax breaks and blending quotas, or mandates, to act as stimulus for the biofuels industry[124]. (Mathews and Goldsztein 2009).

The introduction of zero-tillage in Argentina opened areas previously closed to annual crops because of water restrictions. Soils under zero-tillage have a higher infiltration rate and water storage capacity and lower runoff losses than tilled soils (Zak et al. 2008). Between 1991 and 2008 the area under zero-tillage increased from 300,000ha to 22 million ha (Trigo et al. 2009). Such advancements converted previously pristine land into potentially productive land and it is likely that farms expanded towards areas where land was less expensive[125].

[124] The law calls for mandatory blends of 5 percent biodiesel and 5 percent bioethanol by 2010. In terms of tax breaks, the new law provides exemption from several taxes, including Value-Added Tax on capital goods projects associated with biofuels; income tax on biofuels production activities; and fuels excise. There are also direct subsidies paid to spur investment.

[125] For example one ha in northern Cordoba cost US $270 compared to US $2058 per ha in the Pampas region in 1990 (Zak et al. 2008).

Figure 32: Distribution of soy cultivation areas and total tree cover loss in Argentina (2002-2014)



Source: Own elaboration based on SIIA

Finally, Argentina improved its competitiveness with the departure from a 1:1 peg to the US-Dollar in 2001 (convertibilidad) and the subsequent pronounced devaluations of the Argentine Peso. These exchange rate changes made Argentine exports much cheaper and increased the incentives for farmers to produce to export goods like soy instead of other locally consumed primary products (e.g beef). The increasing importance of soy production in Argentina is also reflected in Argentinian exports. Today soy products constitute the largest share of Argentinian exports and represent ca. 28% of all exports and Argentina is the third largest exporter of soy after the US and Brazil (FAOSTAT 2015)

Figure 33 shows that tree cover loss is most pronounced in regions where soy cultivation is also concentrated – mainly Santiago del Estero, Salta, and Chaco. Between 2002 and 2014 the highest relative increase in soy cultivation area were reported in the provinces of Corrientes and Jujuy (and La Pampa)[126]. Again these regions have a large record of deforestation, too.

The role of cattle ranching

Argentina was and still is known for its beef production and consumption. However, over the last years the importance of cattle ranching has decreased, especially internationally. Within the beef exporting countries Argentina is only ranked on position 12 behind Brazil, Paraguay, and Uruguay (United States Department of Agriculture, 2016). Not long ago Argentina was the third largest exporter of beef worldwide.

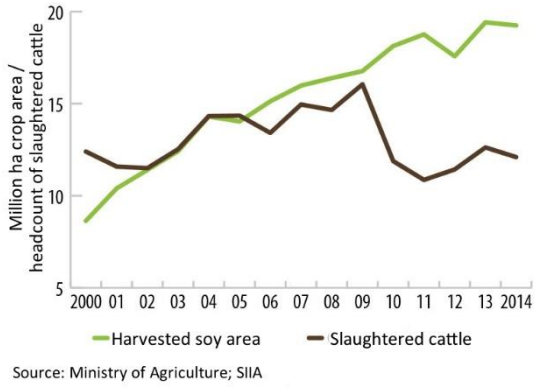
The reason behind the decline in production and exportation are very likely export restrictions. In 2006 the Argentine government implemented export restriction on beef in order to keep the local prices low. The restrictions included a 180 days export ban on beef and an increased export tax of 15% (from 5%). As a consequence cattle ranching became less attractive and ranches have apparently reduced its production.

In general, agricultural production seems to be shifting away from beef production towards soy production. Figure 33 contrasts the tendencies in the soy production and cattle production. (The intersection of the two lines is arbitrary and allows no

[126] The increase was measured as („soy cultivation area in 2014"-„soy cultivation area in 2002")/"soy cultivation area in 2002".

causal interpretation because it depends on the scale of both variables.) This tendency is not only of concern for cattle ranchers or because soy expansion drives deforestation. From an environmentally point of view monoculture cultivation (e.g. soy) is more harmful for the environment and the biodiversity than pasturing.

Figure 33: Opposing trends – soy and beef production in Argentina between 2000 and 2014



Source: Ministry of Agriculture; SIIA

In light of the presented data it appears necessary to verify if trees in northern Argentine were removed to cultivate soy or not. **In order to verify this shows that, as expected, deforestation is significantly and positively associated with an increase in soy cultivation throughout all examined time lags, yet, the most pronounced effects occur two years after the deforestation.** The effect for other crops is fundamentally different: In some cases the effect is negative and about twenty times larger (e.g. sunflower) or mixed and about the same size (e.g. maize). Only for soy we can derive a clear and consistent relation throughout all periods. This is an indication that farmers switched from other crops to soy and also that deforestation was foremost driven by soybean cultivation and not by other crops.

In a next step we analyze whether changing crop prices induce tree cover loss. Results are shown in Table 6[127]. **For all analyzed crops we find that current prices have a positive and significant effect on current deforestation. In contrast to crop prices, beef prices are never statistical significant and seem not to be the driver of deforestation**.

hypothesis, we run an ordinary least square (OLS) and a fixed-effects regression of the tree cover loss in northern Argentine on the harvested area in the region. All of the following analysis should be considered with caution as small sample sizes and the lack of adequate control variables might bias the results.

If the hypothesis is correct the effect of harvested area should be positive and significant because deforestation enabled production. Harvested area is modeled with four different time lags to account for the fact that deforestation and soy harvest might not take place in the same year as the conversion from a deforested area into cropland is not immediate. We also control for maize, wheat and sunflower, which are other important crops in Argentina. **In a** next step we analyze whether changing crop prices induce tree cover loss. Results are shown in Table 6. For all analyzed crops we find that current prices have **a positive and significant effect on current deforestation. In contrast to crop prices, beef prices are never statistical significant and seem not to be the driver of deforestation.**

[127] The small sample size is a serious threat to validity. Since prices are world market prices we can only analyze the effect on aggregate for Argentina and not derive any conclusions at provincial level. Better data could help to improve the robustness of these results and remain a task for future research.

Table 5: The effect of agricultural cultivation on tree cover loss in northern Argentina

	(1)	(2)	(3)	(4)
	Tree Cover Loss in Northern ARG			
	t	t-1	t-2	t-3
Harvested Soy area	0.137***	0.152***	0.187***	0.124***
	(0.016)	(0.023)	(0.025)	(0.030)
Harvested Sunflower area	-0.091	-2.057***	-2.499***	-2.431***
	(0.395)	(0.537)	(0.597)	(0.602)
Harvested Wheat area	0.179***	0.118	-0.094	0.017
	(0.056)	(0.076)	(0.077)	(0.073)
Harvested Maiz area	-0.079*	0.043	0.106*	0.221***
	(0.040)	(0.057)	(0.062)	(0.071)
Constant	-1249.708	753.078	-636.549	-3498.912
	(5142.046)	(7061.349)	(7147.485)	(6654.048)
Observations	76	74	73	72
Adjusted R^2	0.915	0.845	0.833	0.840

Northern ARG include: Salta, Jujuy, Formosa, Chaco, Tucuman, Santiago del Estero, Corrientes, Misiones & Catamarca Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Ex-ante we would have expected to find an even stronger relation for lagged prices on current deforestation, because it seems unlikely that farmers are able to react immediately to price changes. Surprisingly, lagged effects are not statistically significant, yet still positive. A possible explanation for the price responses is that prices and tree cover losses are annual averages and farmers might respond with a delay of only a couple of months, which appears in the data as an immediate response. Beef prices might not be relevant for deforestation because most of Argentine beef is consumed in Argentina and not exported and we only use international beef prices.

For further verification of our hypothesis that soy cultivation was a driver of deforestation in Argentina, we run two panel data regressions, using provincial fixed-effects[128]. In the first two columns of we regress several explanatory variables on tree cover loss and control for a one year lag in crop cultivation[129]. We would expect harvested soy area and/or the soy price to have a positive and significant impact on the tree cover loss. In fact, we see in column 1 that these two variables have the expected signs and the harvested soy area variable is the only significant variable alongside with harvested wheat area. In column 2 we use the "future" harvested crop area (forward lag) instead of the current crop area to model that it needs time to transform a recently deforested area into cropland. **In this regression the harvested crop area variables are all insignificant[130]. Yet, soy price is the only significant predictor in this setting, which once again suggests that soy cultivation drives deforestation.**

As a robust test in column 3 we run the regression in the "opposite direction". We want to know if tree cover loss, crop prices or general agricultural suitability (measured through harvested area of

[128] Fixed-effects allow to control for unobservable variables like cultural factors or difference in business practices across companies; or variables that change over time but not across entities (i.e. national policies, federal regulations etc.). It accounts for individual heterogeneity and thereby circumvents one source of bias in OLS-regressions.

[129] Ideally, we would have wanted to include the number of cows per provinces as well, but these numbers were only available for some years at provincial level. Better data could help to improve the robustness of these results and remain a task for future research.

[130] Soy area is now negative, yet, given its very low value and insignificance this variable can be disregarded

Table 6: Fixed-effects regression to explain tree cover loss in Argentina

	(1)	(2)	(3)
	Tree cover loss	Tree cover loss	Soy area
Harvested soy area	**0.010***		
	(0.006)		
Harvested maize area	-0.024		**1.096*****
	(0.016)		**(0.177)**
Harvested wheat area	**0.029****		**-1.532*****
	(0.012)		**(0.094)**
Tree cover loss			**1.530***
			(0.895)
Beef price	-3739.400	10923.876	-5.25e+04
	(5121.732)	(8784.059)	(62466.005)
Soybean price	86.156	**123.705****	219.276
	(53.677)	**(55.615)**	(659.364)
Wheat price (US_HRW)	14.007	110.230	640.944
	(69.286)	(81.772)	(844.193)
Maize price	11.236	-197.701	-117.974
	(76.033)	(123.569)	(927.777)
Exchange rate	-2578.519	-6919.059	**-2.34e+05***
	(10878.778)	(10834.065)	**(1.32e+05)**
Harvested soy area (t+1)		-0.001	
		(0.007)	
Harvested maize area (t+1)		-0.010	
		(0.016)	
Harvested wheat area (t+1)		0.014	
		(0.013)	
Year FE	Yes	Yes	Yes
Observations	207	193	207
Adjusted R^2	0.044	0.038	0.704

Standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

other crops) can explain the expansion of soy area. The estimator for tree cover loss is positive and significant. **This suggest that tree cover loss is a good predictor for expansion of soy area.** Interestingly soy seems to replace wheat or vice-versa because the estimator for wheat is negative and highly significant. Maize seems to expand alongside with soy as the estimator is close to one and highly significant, too.

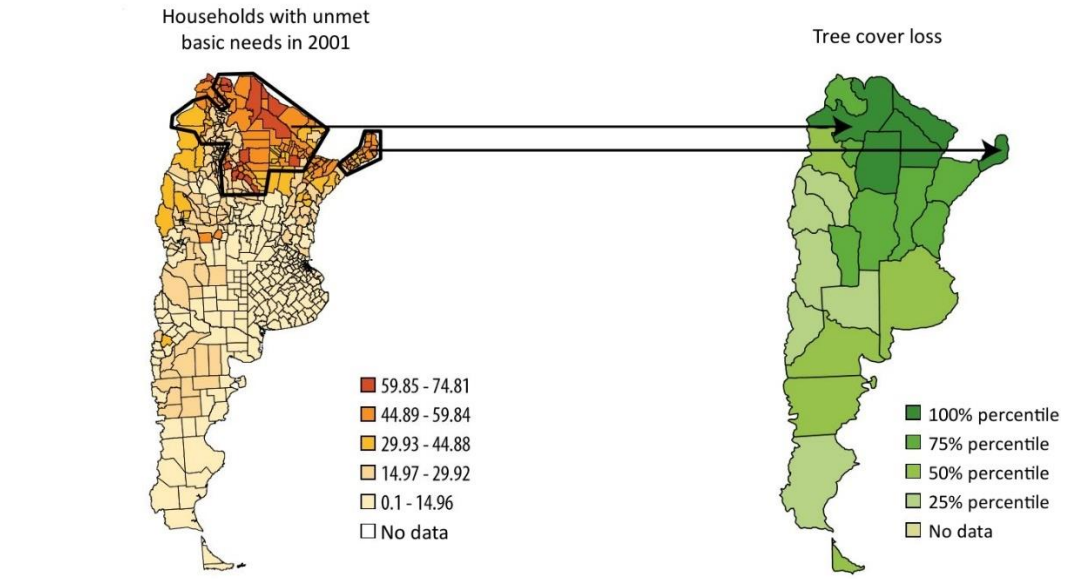
Poverty Dimension

Deforestation has not only impacts on the environment, wildlife and biodiversity. It is likely to affect over proportionally the poorest and most vulnerable populations. Poverty data from the 2010 census[131] suggests that poverty levels are very high in regions were deforestation is high as well. From Figure 34 we can see that deforestation took place mainly in regions with high poverty incidence. This is confirmed by the graph in Figure 35 which contrasts rural and urban poverty with tree cover loss. The four provinces with the highest share of rural poverty experienced also the highest deforestation.

Despite this seemingly clear evidence, it is hard, if not impossible, to isolate a single causal channel. Large scale farms might clear forests and push rural farmers out of the regions and into poverty. Poor

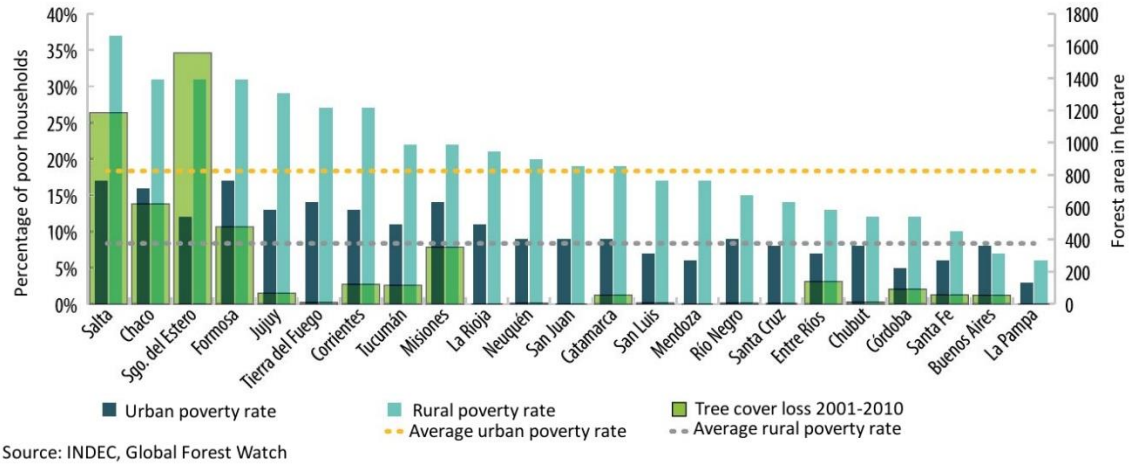
[131] The 2010 census measured poverty through an unmet basic needs indicator. Basic needs include for example the housing situation, sanitation, water access, child education and risk of loss of income.

Figure 34: Geographical distribution and intensity of the unmet basic needs and total tree cover loss 2002-2014



Source: INDEC 2001

Figure 35: Absolute tree cover loss and poverty in urban and rural areas measured as unmet basic needs in percentage



Source: INDEC, Global Forest Watch

populations could also have less scope for lobbying against deforestation or they lack knowledge about the consequences of deforestation and thus do not oppose. As a consequence, it could just be easier to clear forests in areas with less "resistant" populations. It could also be the case that the region is so poor because it had large forest areas, which could not be used for farming and thereby limited the possibilities of income generation from agriculture for the population.

The ex SAyDS noted that extraction of phosphorus is alarmingly high in the Chaco eco-region [132] and that people have been displaced as a consequence of the shifting agricultural frontier. The report states that traditional farmers abandoned their

[132] Las mayores extracciones de fósforo se registran hoy en el noroeste de Córdoba, el sur de Santiago del Estero, sur de Santa Fe y todo el norte bonaerense, con valores superiores a los 14 kilos por hectárea. "En la región chaqueña, área de gran expansión de la soja, los altos niveles de fósforo de los suelos están bajando abruptamente porque nadie fertiliza (SAyDS).

land and moved into cities, where they tried to find employment and if not, likely ended up in poverty and marginalization. [133]

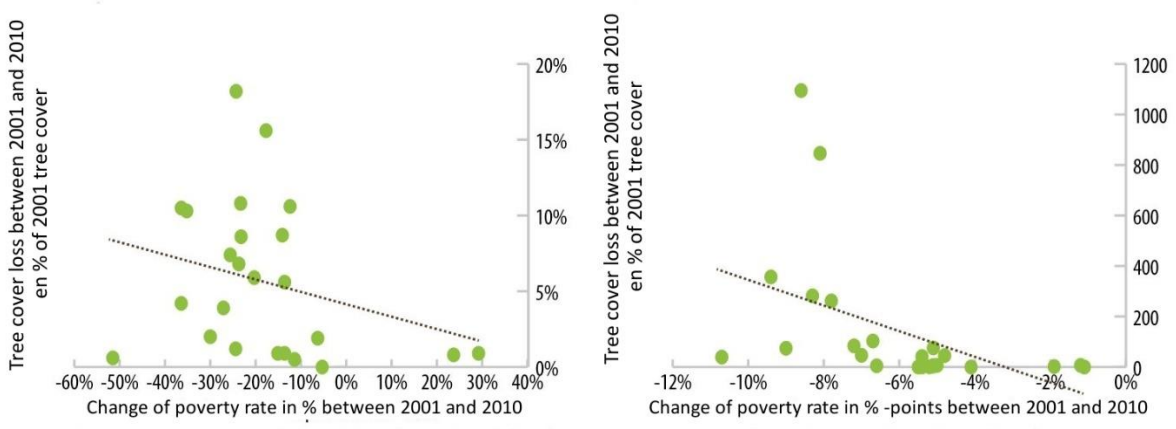
The first two rows of show the correlation between poverty changes and tree cover loss. The coefficients are negative showing that tree cover loss is associated with a poverty reduction between 2001 and 2010. Table 7 provides a graphical representation of the highlighted cells. The downward sloping trend line indicates that the higher the tree cover loss the higher the poverty reduction. This, however, does not imply any causal positive impact of deforestation on poverty reduction.

When examining poverty reductions (in percentage point decreases) it is much more likely to be able to find large decreases for regions with initial high levels of poverty like in Jujuy, Chaco, or Corrientes (>20 % of the households had unmet basic needs) than for initially rather rich provinces like La Pampa or Santa Cruz (< 10% of the households had unmet basic needs). The last row of the table puts tree cover loss in relation to rural poverty. Here it becomes very obvious that the amount of hectares of forest area lost is strongly correlated with rural poverty. Once again this does not imply causation[134].

Table 7: Correlation Matrix for tree cover loss and change in poverty

	Total tree cover loss 2001-2010	Tree cover loss 2001-2011 in % of 2001 tree cover
Change of poverty in %	0.02	-0.29
Change of poverty rate in %-points	-0.47	-0.42
Rural poverty rate in 2010	0.63	0.20

Figure 36: Tree cover change and poverty change between 2001 and 2010



Source: INDEC: Global Forest Watch
Note: The change of poverty rate measures the 2010 poverty rate in percentage of the 2001 poverty rate. Tree cover is measured in hectare of lost forest cover over the same time period.

[133] La descontrolada "agriculturización" motivada por el cultivo de soja, fue desplazando a los productores e hizo que abandonaran sus chacras, tambos, y pequeñas producciones regionales de alto interés social, que daban fisonomía a un campo diversificado y con una sólida estructura socio-cultural y que debieran refugiarse en los centros poblados, mudando de actividad los que pudieron y los que no padecen el desempleo, la pobreza y la marginalidad (SAyDS).

[134] The correlation coefficient for the relative tree cover loss is smaller probably due to provinces like San Luis that have a extremely small initial tree cover and therefore every hectare of tree cover loss weighs heavily.

Annex B: Summary of environmental issues in Argentina – status quo, guidelines, and trends

Table 8: Summary of environmental issues in Argentina – status quo, guidelines, and trends

Environmental issue	Current situation	Guideline values	Stats	Trend
Air Pollution	- High pollution levels in Buenos Aires and Córdoba	PM2.5 10 µg/m3 PM10 20 µg/m3 NO2 40 µg/m3 SO2 20 µg/m3 (All WHO)	PM2.5 levels BsAs 50-90 Córdoba 20-40 Rosario 8-16 Mendoza 14-24 Salta 3-5 Jujuy 3.5-6.5 Neuquen 20-40	- Increased urbanization combined with higher wealth and lower oil are likely to increase air pollution - Three of the top 4 leading causes of Years Life Lost (YLL) to premature death are directly related to ambient air pollution (Ischemic heart disease, lower respiratory infections, and chronic obstructive pulmonary disease) - The incidence of people with lower respiratory infections and chronic obstructive pulmonary disease has increased in absolute terms since 1990
Deforestation	- Very high deforestation rates in the last 15 years - Since 2001 ARG lost every minute one soccer field of forest areas (0.67ha)	Deforestation rates 2001-2014 - Global: 6.33% - South America: 6.24 % (Global Forest Watch)	All data from Global Forest watch for 2001-2014 period - Argentina deforestation rate: 12.6% - Only 12 countries worldwide had a higher deforestation rate than ARG (excluding countries with a forest coverage smaller than 10 km2) - 8 % of all South American deforestation took place in ARG - 2% of the global deforestation took place in ARG - Globally, ARG is ranked #9 in terms of lost forest area (absolute terms) only Brazil cut down more trees in South America than Argentina	- Deforestation has slowed down in the recent years, probably as a consequence of the Forest Law - Forest fund shrank and conservation incentives might be shrinking as a consequence - Tax policies favoring soy production is a potential threat to forest conservation
Land degradation	- Land degradation is lower than in the LAC average - Intensive soy cultivation converted grassland into cropland, which will accelerate land degradation even though zero tillage is applied. (intensive herbicide use is another negative side effect)		-460,000 hectares are estimated to be currently affected by salinization o sodicity.	- Tax policies favoring soy production are likely to increase land degradation by monoculture cultivation
Waste Management	- Solid waste collection coverage: 90%, - Collection service coverage did not improve since 2001 -	Organic waste: World Bank - OECD=27 % - LAC & upper middle income=54% Waste collection rate - OECD ~98 % - LAC ~78 % - upper middle income ~85 %	Generation - 50% of waste is organic - 82% have regularly swept streets - only 50 % have their waste disposed adequately Collection rate - 90% of the households have their waste collected - Lack of coverage is most pronounced in slums (14.3%) and in Northern provinces e.g. Santiago del Estero (37%) Formosa (36 %) - Among the covered households, 71,9% have their waste collected more than 5 times per week (LAC avg= 45,6%)	- Amounts of waste are increasing, hazardous waste quantities continuously increase, threefold increase of waste production since 1990

<table>
<tr><td></td><td></td><td></td><td><u>Disposal</u>
- 20 million inhabitants not covered with disposal service
- Lack of coverage is most pronounced in slums (14.3%) and in Northern provinces e.g. Santiago del Estero (37%) Formosa (36 %)
- 62% of slums and 27% of low income households are located close to an open dumpsite
- The installed capacity of mechanized waste treatment plants can cover only 17,7% of the generated waste</td><td></td></tr>
<tr><td>Urban Flooding</td><td>- Floodings have become a major problem in Argentina due to urbanization and increased rainfalls
- Rainfalls increased by about 20% since 1960.</td><td></td><td></td><td>- Increased urbanization combined with higher rainfall intensity and deforestation is likely to increase the probability of floodings</td></tr>
<tr><td>Riverine Flooding</td><td>- Floodings occurred more often in the North region in the last decade as opposed to the decade before (1990s)</td><td></td><td></td><td>- Increased rainfalls in the North and central regions due to climate change are likely to increase the occurrence of riverine flooding events</td></tr>
<tr><td>Arsenic Pollution</td><td>- High levels of natural arsenic water pollution have been reported in different regions of Argentina
- Arsenic water pollution is attributed to industrial production (e.g. textiles, paper, wood preservatives).</td><td>limit of arsenic in drinking-water: 10 µg/litre (WHO)</td><td>- 87% of the Buenos Aires provincial territory has groundwater with arsenic > 50 µg/litre (Auge et al. 2013.)
- In North Argentina the lowest values found range between 130-200 µg/litre (source: Conicet)
<table><tr><th>Location in Buenos Aires</th><th>Arsenic concentration</th><th>Source</th></tr><tr><td>Escobar</td><td>11-90 µg/litre</td><td>Heredia et al 2005</td></tr><tr><td>Mercedes</td><td>10-55 µg/litre</td><td>Puntoriero et al 2015</td></tr><tr><td>Roque Perez</td><td>15-65 µg/litre</td><td>Puntoriero et al 2015</td></tr><tr><td>Junin</td><td>10-140 µg/litre</td><td>Puntoriero et al 2015</td></tr><tr><td>Bahia Blanca</td><td>7-170 µg/litre</td><td>Paoloni et al 2009</td></tr><tr><td>Chasico</td><td>36-166 µg/litre</td><td>Puntoriero et al 2015</td></tr></table></td><td>- Polluted surface water will maintain the demand to use arsenic groundwater</td></tr>
</table>

Lead Pollution	- It is estimated that you can find BLL of ≥ 2 µg/dL in: ○ 59% of children under five ○ 58% of adult females ○ 78% of adult males	BLL of ≥ 5 µg/dL (CDC)	Own study - 59% of children <5 year and 58% of adult females, and 78% of adult males have a BLL of ≥ 2 µg/dL La Plata: Geometric mean blood lead level: 4.26 µg/dL - 10.8% blood lead levels >10 µg/dL (Disalvo, Liliana, et al. 2009) Villa 20: Distribution of lead blood levels: - 68,9% <7µg/dL - 17,9 % 7-10 µg/dL - 13,8% >10µg/dL (farn.org.ar) Córdoba - mean BLL levels of 2.58 ± 0.30 µg/dl (Martínez, S. A., et al. 2012) Matanza Riachuelo: - 25% of the children have BLL > 5 µg/dl (ACUMAR Evaluación Integral de Salud en Áreas de Riesgo)	
…in paint		- Upper limit of 600 ppm lead in paint in ARG - (90 ppm in the US)	- 23 % percent of a the tested paints (sample of 30) had lead levels greater than 600 ppm - Average level was 17,000 ppm (2.83 times the legal limit) - Only one out of 30 cans carried a label with information on the lead level in the paint	
Water pollution		- Generally accepted min DO >= 4 - 5 mg/l. (water-research.net) - nitrate-nitrogen max. 10 mg/L - nitrite-nitrogen max. 1 mg/L (EPA)		- Situation in the cuenca Matanza-Riachuelo has improved substantially, yet it still is one of the most polluted river basins worldwide and more work is still needed
Agro-Chemicals	- Agro chemicals are widely used especially the herbicide glyphosate in soy plantations	- Americas and South Am pesticide use (2011): 3.67 kg/ha - Fertilizer use: 1.92 kg/ha - (FAOSTAT)	- Pesticide use: 2.57 kg/ha - Fertilizer Use: 0.044kg/ha	- Pesticides and herbicides use increased between 1993 and 2011 by more than 1000 % - Agro chemicals per harvested crop area increased by 441 % from 0.457 kg/ha in 1993 to 2.475 kg/ha in 2011 - the use of fertilizers increased by about 826.00% between 1991 and 2013 - fertilizers in kg/ha cropland increased by 429.50%between 1991 and 2013

Annex C: Summary of environmental issues in Argentina – cost of environmental degradation, public opinion, and public expenditure

Table 9: Summary of environmental issues in Argentina – cost of environmental degradation, public opinion, and public expenditure

Environmental issue	Cost of environmental degradation	Public Opinion	Public expenditure
Air Pollution	- 1/8 of all deaths worldwide are the result of air pollution. All ambient air pollution - Cost of air pollution impacts on society is estimated at about 1.84% of GDP	- 24.2 % (top 2 answer) of Argentines see air pollution as the environmental problem that affects themselves the most; 19.2% see air pollution as Argentina's main environmental problem	
Deforestation	- Deforestation took mainly place in poor regions of the country - Total mean annual deforestation cost is estimated at about US$ 3.6 billion or 0.75% of GDP.	- 25% of Argentines see deforestation as Argentina's main environmental problem, yet only 9.9% think it affects their lives.	- 4 % of national government spending on environmental expenditure
Land degradation	- Annual costs 3.56% of GDP - Costs for loss of ecosystem services 2001-2009 USD 70 bn i.e. annual cost of 3.25% GDP (IFPRI 2016) - Wetland degradation cost US$3.8 billion = 1.5 % GDP. - Degradation of grazing land USD 0.586 bn or 11 % of the livestock GDP - Estimated rate of return for actions to prevent LUCC vs no action is 1:4	- Land degradation is not perceived as a big environmental problem by the public - 0.7% and 0.8% mentioned land degradation as main environmental problem	- Expenditure in agriculture R&D
Waste Management	- Solid waste generated 677 Gg of methane in 2012; many open dumpsite are located closely to slums therefore the negative effects are likely to be more pronounced for the poorest parts of the population	- Highly important issue in the public opinion Waste is the most important challenge that affects the lives of the population - Combining both survey categories it is the most relevant environmental issue (faced by country 20.3%; and that affects the surveyed 25.4%) - 76% of the households are satisfied with waste management (Proyecto GIRSU-SAyDS, 2014).	- 5-25% of total municipal expenditure on solid waste management service (great variety) - USD31-USD76 per capita for waste management
Urban Flooding	- The computed expected annual cost of all floods is about US$3.4 billion or 0.7% of GDP in 2012 - Urban flooding events carry the second highest economic damages (45%) of all natural disasters → annual costs 0.32% of GDP - Flooding is the greatest natural disaster threat in Argentina in terms of economic damages and affected population. From all natural disasters in Argentina 94% of all economic damages and 96% of the affected population are related to flooding events. -	- Natural disasters are not perceived as a major environmental issue (only 0.2 % mentioned it)	- 17% of national government spending on environmental expenditure
Riverine Flooding	- See above - Riverine flooding events carry the highest economic damages (49%) of all natural disasters→ Annual costs 0.34% of GDP	- See above	- See above
Arsenic Pollution	- Long-term exposure to inorganic arsenic can lead to chronic arsenic poisoning, skin lesions and skin cancer. - A study for Argentina show that exposure to arsenic at high concentrations in drinking-water is associated with lung cancer (WHO	- Of those who think that water pollution is affecting them the most, 17% did so because of the "natural contamination of underground water (e.g. due to the presence of arsenic)" as a main concern	

	http://www.who.int/water_sanitation_health/dwq/chemicals/arsenic.pdf)		
Lead Pollution	- Annual costs 0.91% of GDP - Total annual losses of IQ-points among children under five years of age in Argentina are estimated at 381 – 858 thousand with a mid-point estimate of 620 thousand estimated annual cost of IQ loss is AR$ 7.1 – 20.0bn (i.e. 0.33–0.92% of Argentina's GDP) - BLL of ≥ 2 µg/dL among adults is estimated to increase the risk of ischemic heart disease, cerebrovascular disease (stroke), and other vascular diseases by 2-4% estimated premature deaths (2,082 individuals) and 6.5 – 12.9 million days of illness lead to annual estimated health cost of AR$ 6.2 - 7.1 billion (= 0.33% GDP Argentina)	- Citizens show low concern about this topic	
…in paint	- lead pollution causes annual loses of 9.78 bn int. USD in Argentina ~ 1.36% Argentina GDP (NYU Medical School)		
Water pollution	- It is estimated that 989 individuals died prematurely from inadequate household water, sanitation and hygiene in 2012 - It is estimated that 16-19 million cases of diarrheal disease occurred from inadequate household water, sanitation and hygiene in 2012 - Annual cost of these health effects is estimated at AR$ 8.3 – 8.9 billion in 2012 (0.40% of Argentina's GDP in 2012).	- Water pollution is the top 3 answer in both categories: Argentina's main environmental problems (19.2 %) and problems that affect themselves (16.2%)	- In 2013, 29% of the National Government's Spending on Environmental Management was allocated to cleaning up the pollution legacy Cuenca Matanza Riachuelo - In 2013, 17% of the National Government's Spending on Environmental Management was targeted to specific investment projects related to drinking water and sanitation infrastructure
Agro-Chemicals	- Hazardous health effects and polluted watersheds are likely risks when people get in contact with glyphosate or if the herbicide is washed into the watersheds	- Of those who think that water pollution is affecting them the most, 14% indicated the problem is related to the "intensive use of agrochemicals".	-

Annex D: Argentina CEA EDGAR Emission Summary for 7 Cities (Buenos Aires, Córdoba, Rosario, Mendoza, Salta, Neuquén, San Salvador de Jujuy)

Figure 37: Modeled PM2.5 concentrations(mg/m3)

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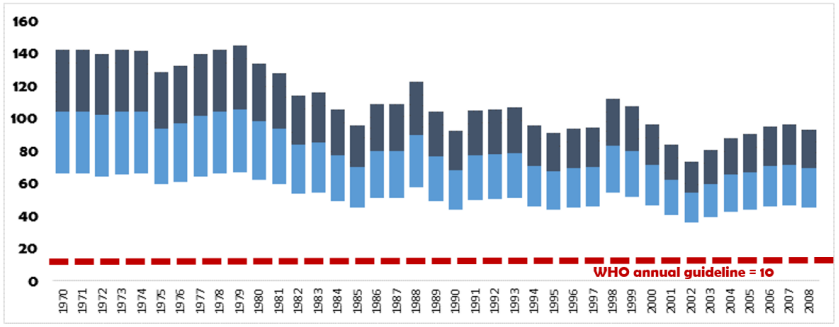
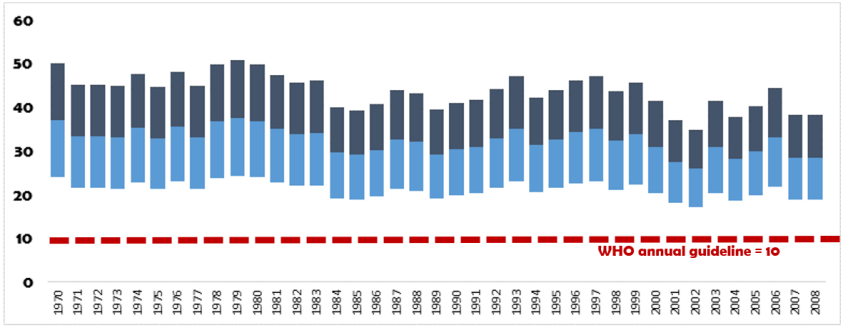
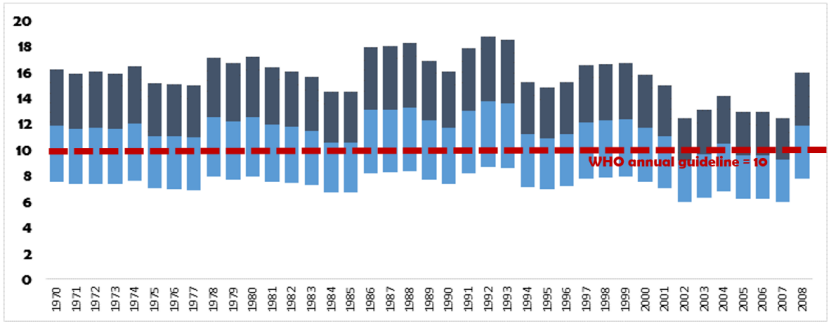


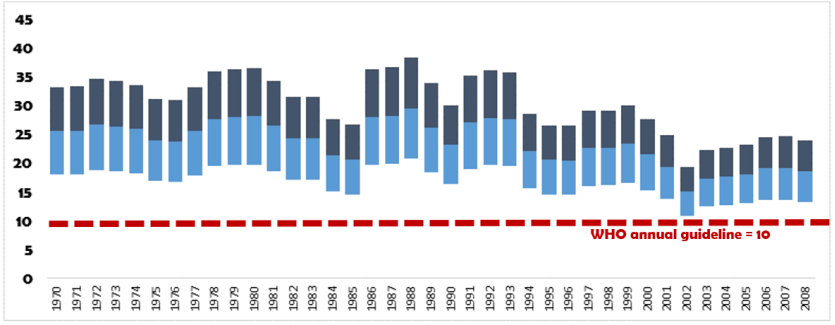
Córdoba:



Rosario:



Mendoza:



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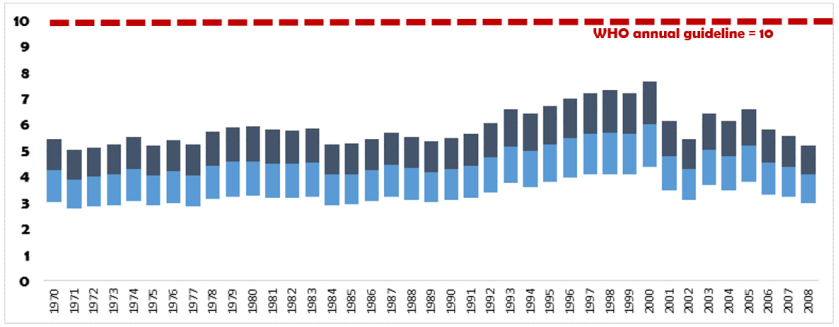
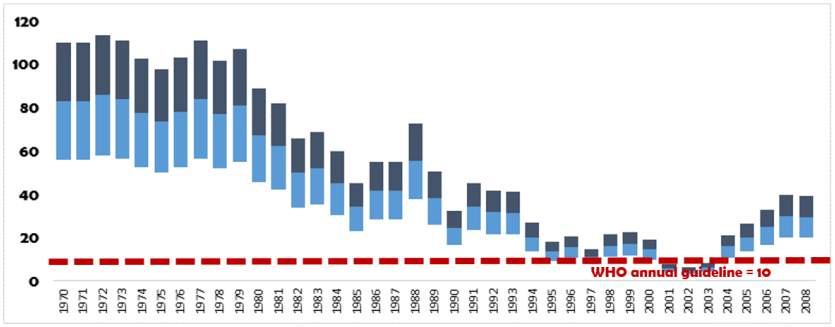


Neuquén-Plottier-Cipolletti:



San Salvador de Jujuy

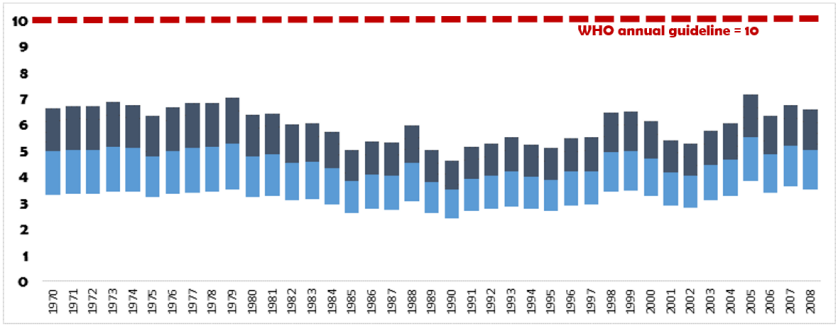
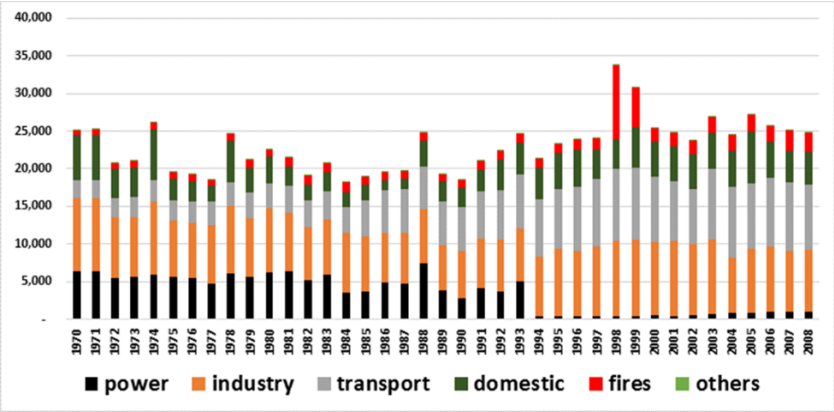


Figure 38: PM10 Emissions (sum of emissions from all grids covering the urban airshed)

Buenos Aires:



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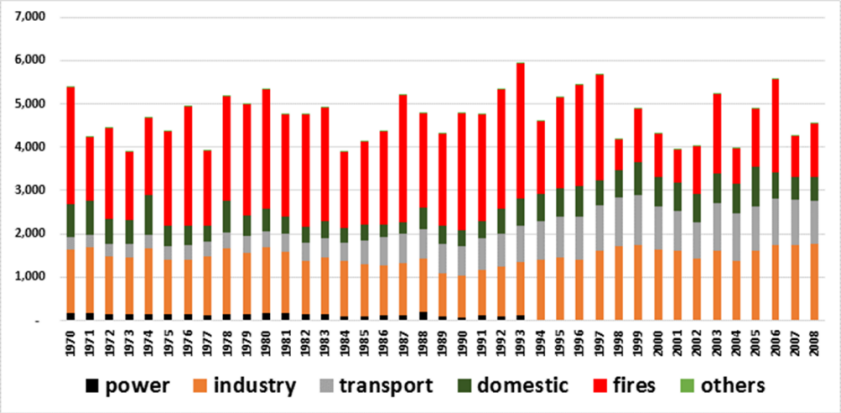
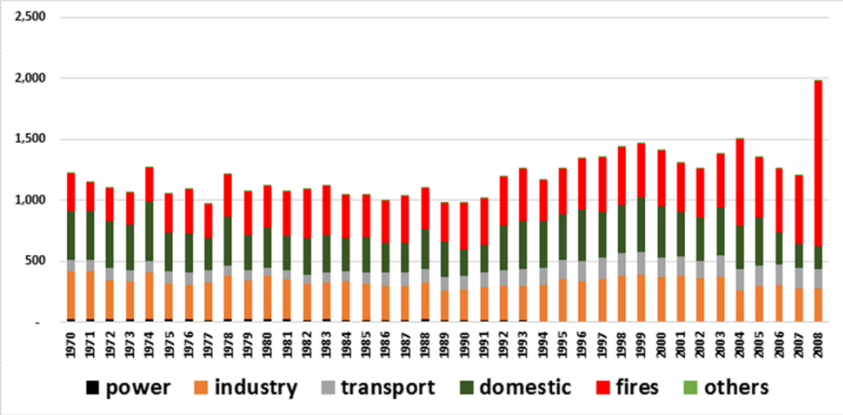
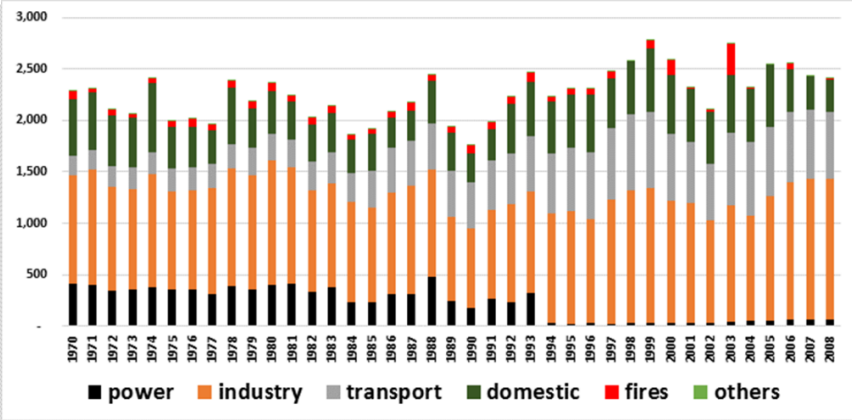


Rosario:



Mendoza:



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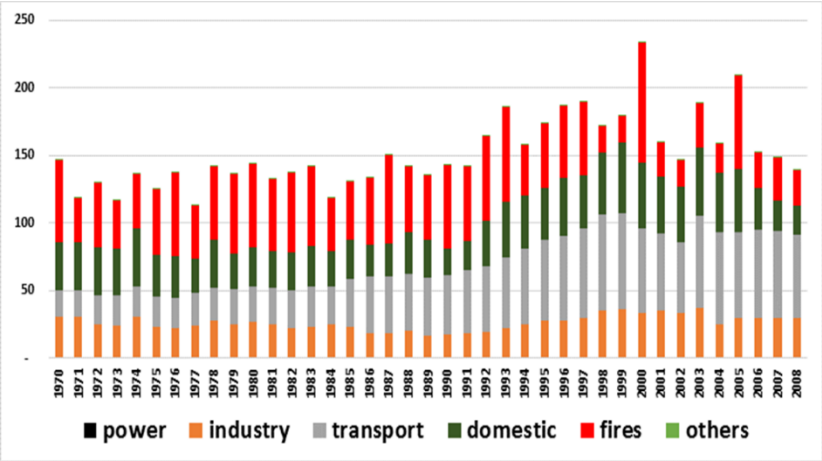
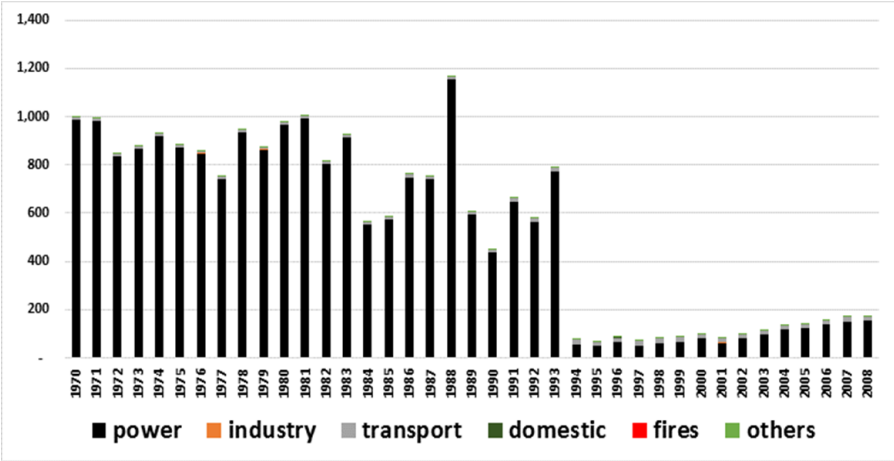


Neuquén-Plottier-Cipolletti:



San Salvador de Jujuy:

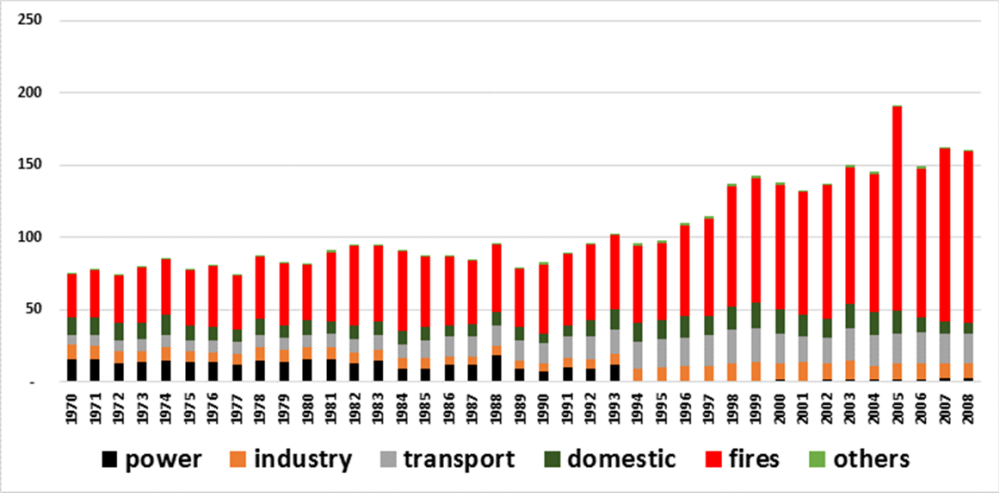
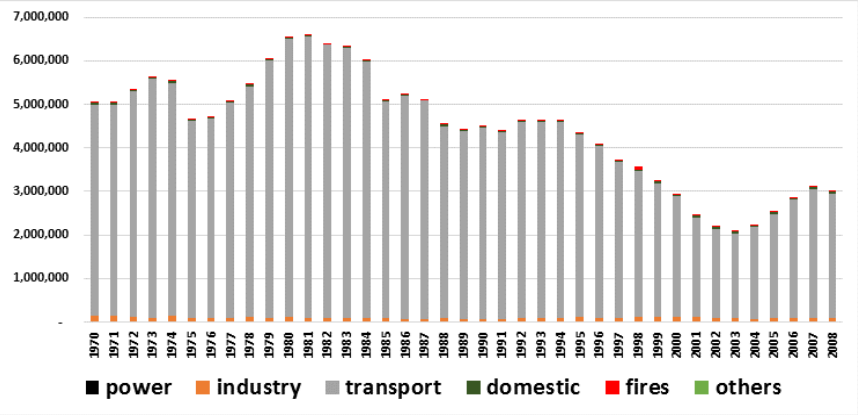
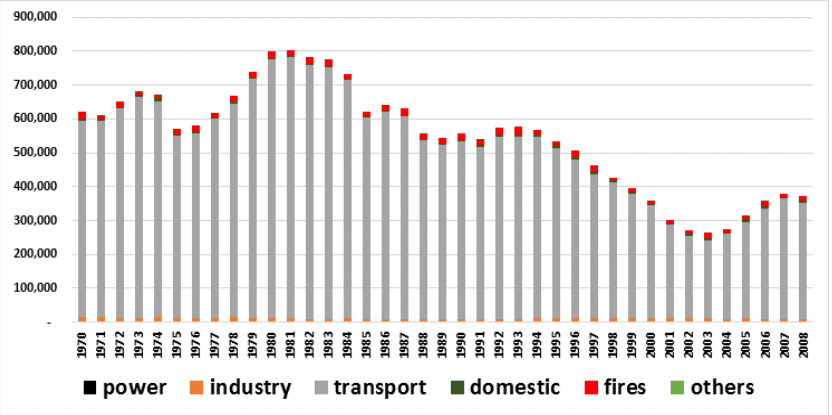


Figure 39: CO Emissions

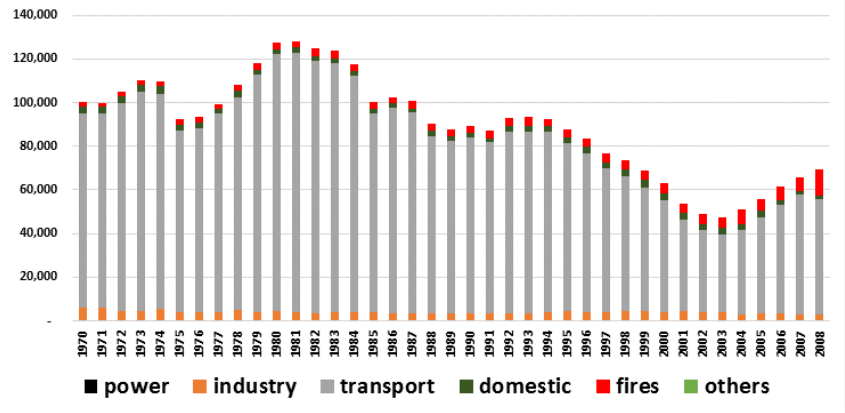
Buenos Aires:



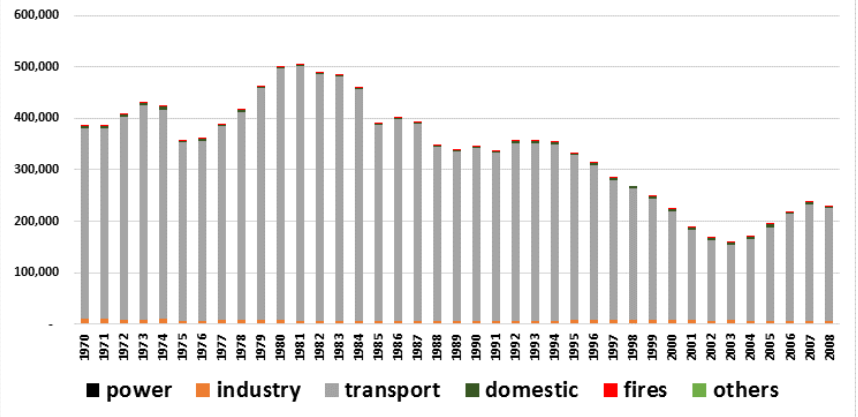
Córdoba*:*



Rosario:



Mendoza:



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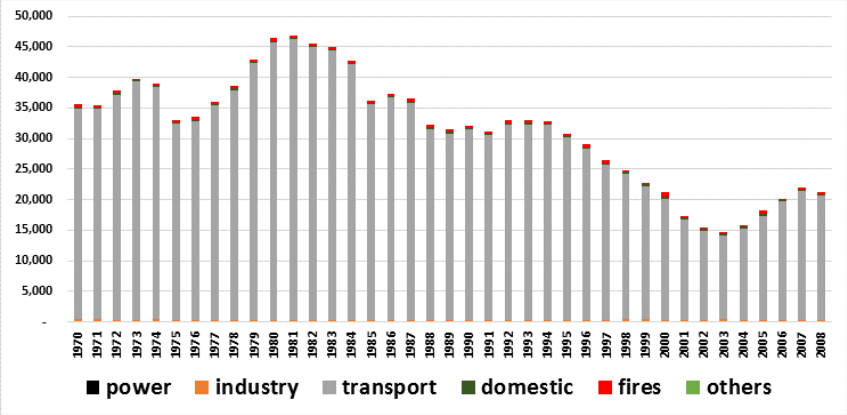


Neuquén-Plottier-Cipolletti:

San Salvador de Jujuy:

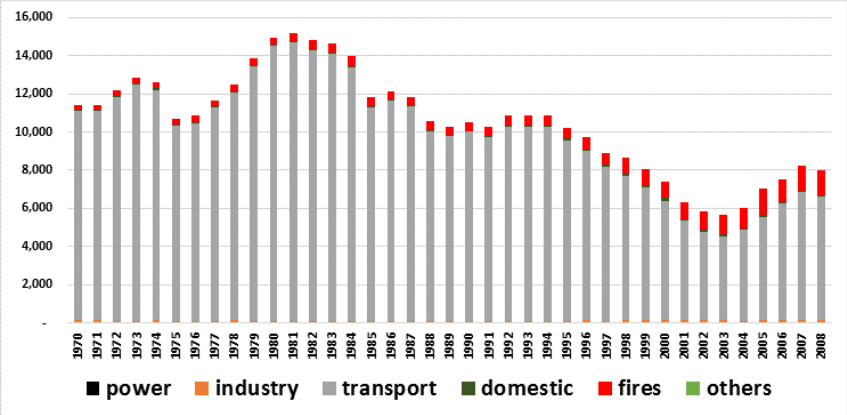
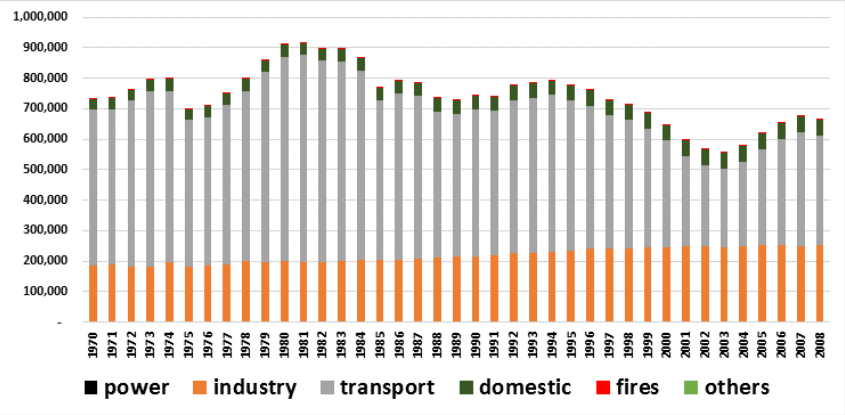


Figure 40: NMVOC emissions (tons/year)

Buenos Aires:



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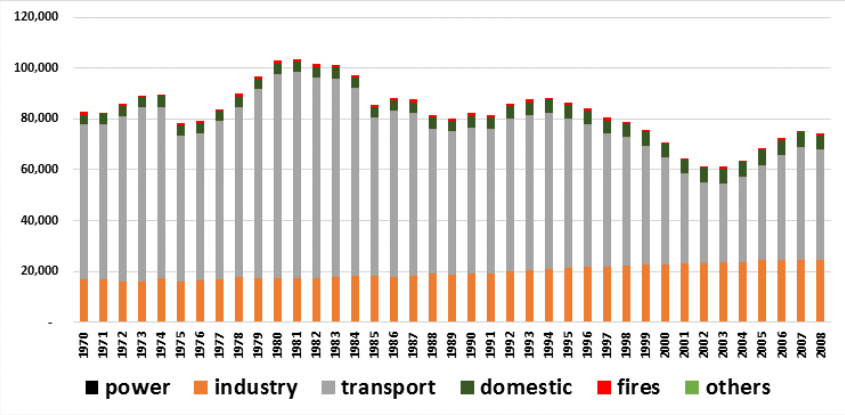
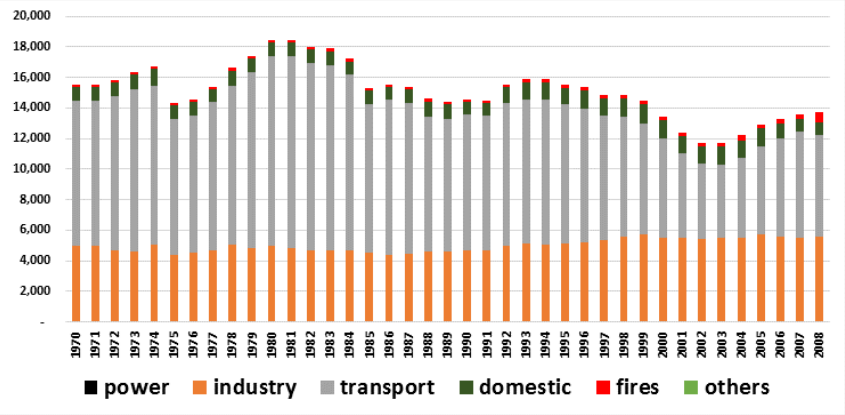


Rosario:



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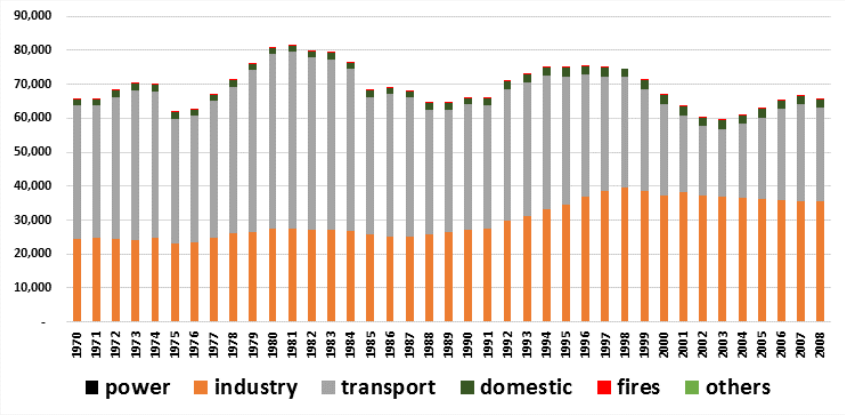

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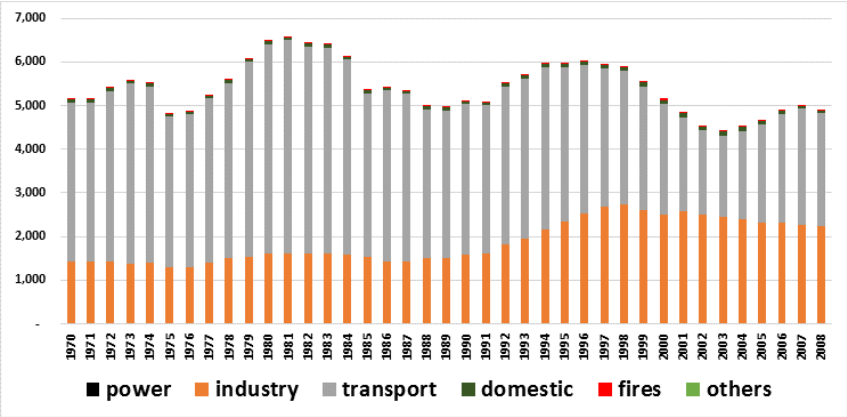
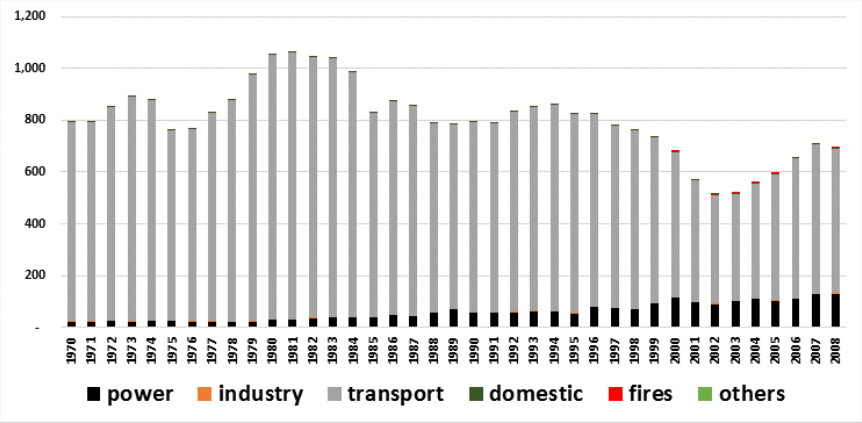


Neuquén-Plottier-Cipolletti:



San Salvador de Jujuy:

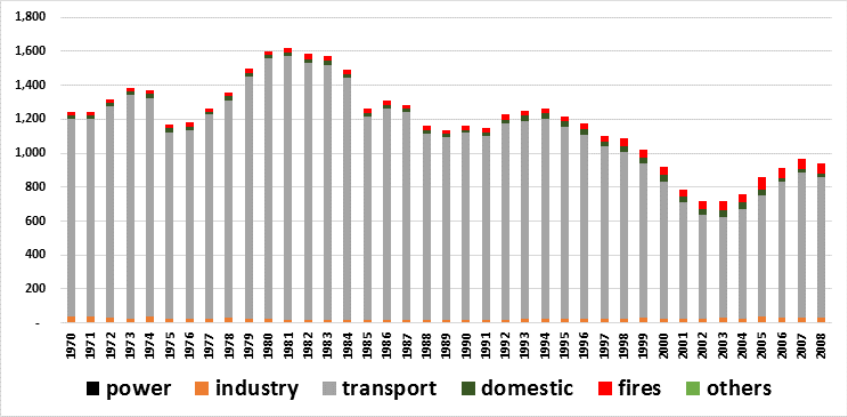
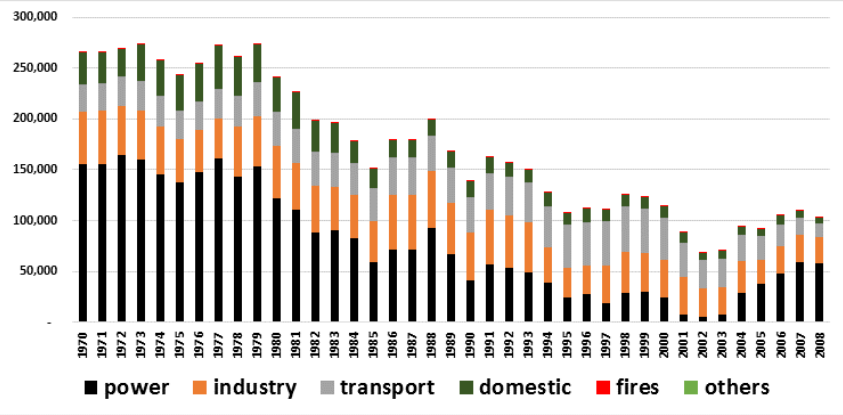
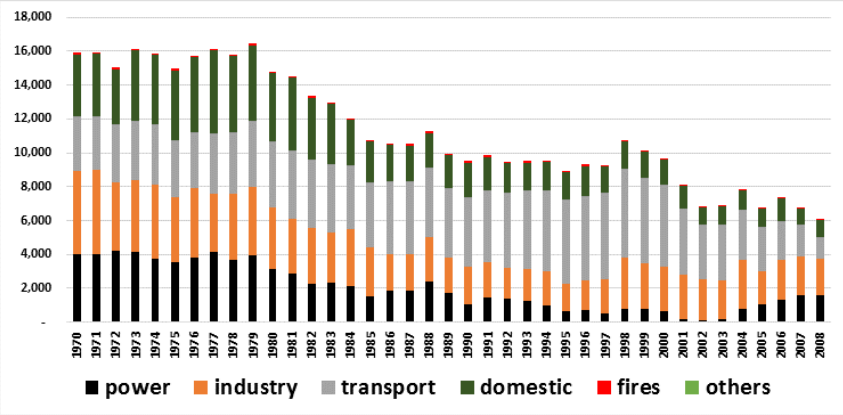


Figure 41: SO2 emissions (tons/year)

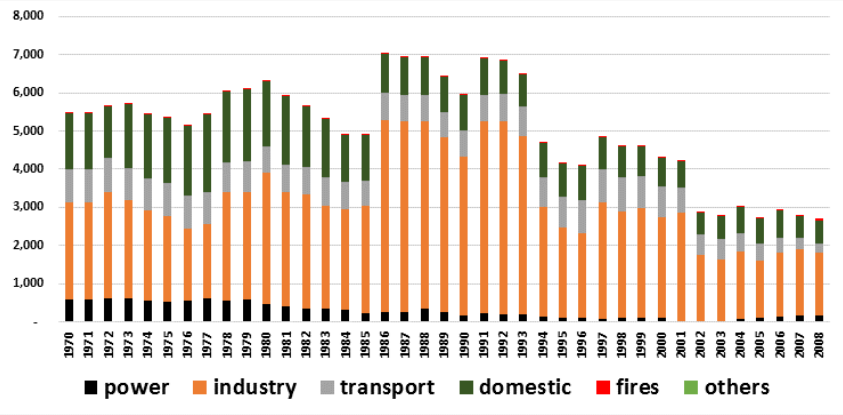
Buenos Aires:



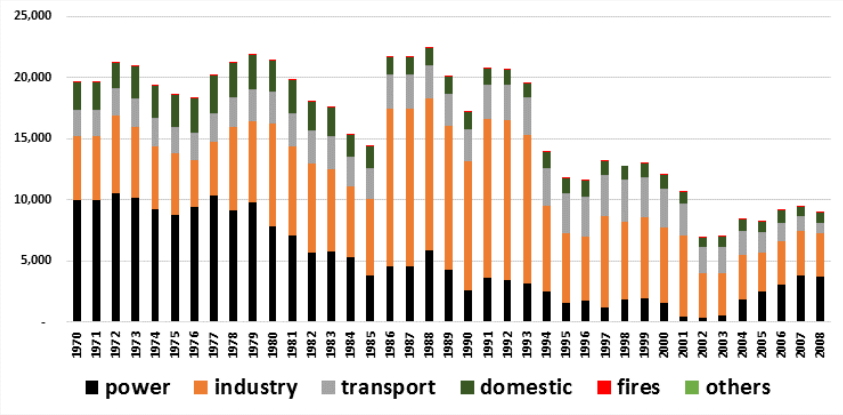
Córdoba*:*



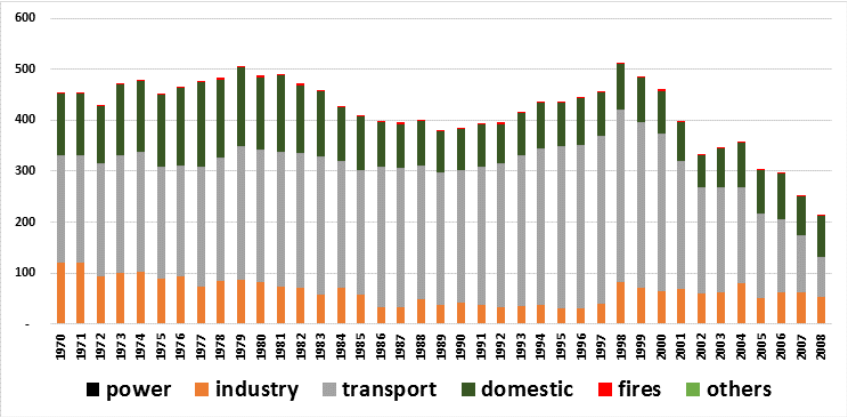
Rosario:



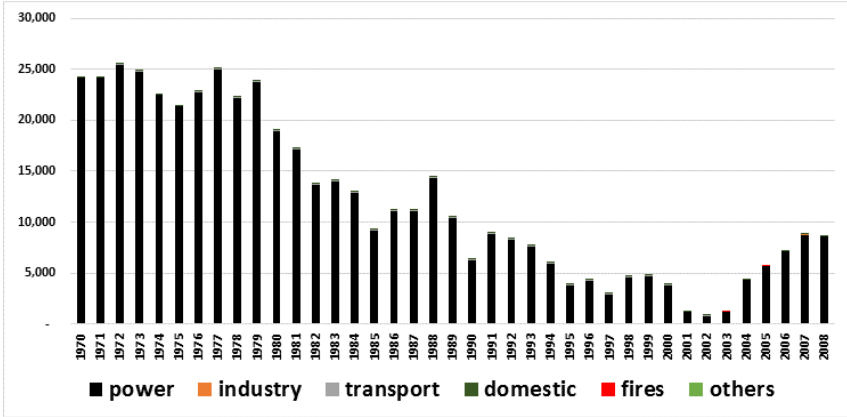
Mendoza:



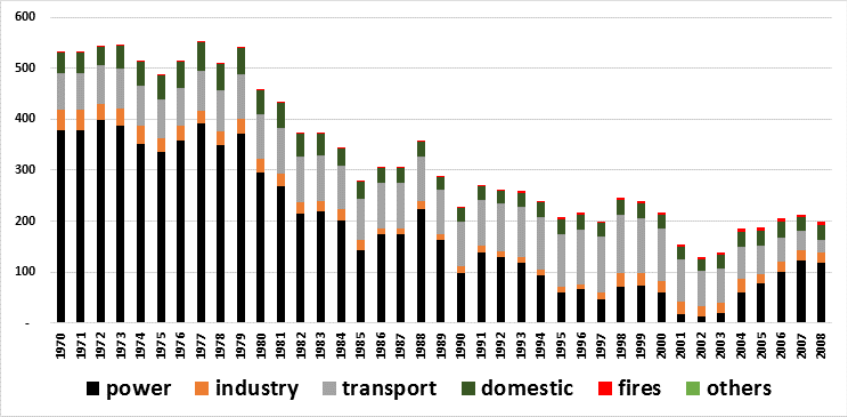
Salta:



Neuquén-Plottier-Cipolletti:



San Salvador de Jujuy:



References

AFAC (2014): Flota vehicular circulante en Argentina 2014, Asociación de Fábricas Argentinas de Componentes y Promotive S.A., Buenos Aires

AGN (2011): Subsecretaría de Pesca y Acuicultura. Situación de la merluza y el calamar, Documento de Difusión, Auditoría General de la Nación, Buenos Aires

AGN (2013) Informe Integral de las Actividades del Plan Integral de Saneamiento Ambiental (Pisa) Por el Ejercicio Cerrado al 31 de Diciembre de 2012

AGN (2014a) Informe Integral de las Actividades del Plan Integral de Saneamiento Ambiental (Pisa) Por el Ejercicio Cerrado al 31 de Diciembre de 2013

AGN (2014b): Baja aplicación de la Ley de Protección de Bosques Nativos". Auditoría General de la Nación.

AGN (2014c) Informe de Auditoría Independiente sobre los Estados Financieros del proyecto de Desarrollo Sustentable de la Cuenca Matanza-Riachuelo Convenio de Prestamo7706-AR BIRF.

AGN (2015): Informe de Auditoría, Auditoría de la Subsecretaría de Pesca y Acuicultura respecto de la explotación de especies costeras, Auditoría General de la Nación, Buenos Aires

Atlas ID (2016): Índice máximo de magnitud de inundaciones, Ministerio del Interior, Obras Públicas y Vivienda

Auditor General de la CABA (2014): Contaminación por plomo en niños de las villas de la Ciudad Autónoma de Buenos Aires, Informe del Auditor General de la CABA, Ing.F.del Gaiso, Buenos Aires, 5/6/2014

AYSA (2008): Resumen Ejecutivo. Estudio de Impacto Ambiental. Plan Director de Saneamiento - Obras básicas en la cuenca Matanza Riachuelo, AYSA, Buenos aires, 24/11/2008

Azqueta, D. (2007): Introducción a la Economía Ambiental, 2ª EDICION, Mc Graw Hill.

Banco Mundial (2002): World Development Report 2003: Sustainable Development in a Dynamic World, The World Bank, Washington DC

Banco Mundial (2003): World Development Report 2004: Making Services Work for Poor People, The World Bank, Washington DC

Banco Mundial (2006): Colombia - Mitigating environmental degradation to foster growth and reduce inequality, World Bank, Washington, DC.

Banco Mundial (2012): Inclusive Green Growth: The Pathway to Sustainable Development, The World Bank, Washington D.C.

Banco Mundial (2014a): Matanza-Riachuelo Basin (MRB) Sustainable Development Adaptable Lending Program (P105680). Implementation Status & Results Report, 16/06/2014

Banco Mundial (2014b): Matanza-Riachuelo Basin (MRB) Sustainable Development Adaptable Lending Program (P105680). Implementation Status & Results Report, 31/12/2014

Barros, V., J.Boninsegna, I.Camilloni, M.Chidiak, G.Magrin y M.Rusticucci (2015): "Climate change in Argentina: Trends, projections, impacts and adaptation", WIREs Climate Change,Wiley, vol.6 Issue 2

Cetrángolo, O.; M.Chidiak; J.Curcio y V. Gutman (2004): Política y Gestión Ambiental en Argentina: Gasto y Financiamiento. Comisión Económica para América Latina y el Caribe (CEPAL), Serie Medio Ambiente y Desarrollo no. 90, Santiago de Chile

CIAFA (2015): Consumo de Fertilizantes en el Agro – 2014, Cámara de la Industria Argentina de Fertilizantes y Agroquímicos

Chidiak, M. y V. Gutman (2011): Desafíos e implicancias fiscales de la inversión en infraestructura baja en carbono. CEPAL, Serie Macroeconomia del Desarrollo N° 115, Santiago de Chile

Defensor del Pueblo de la Nación (2014): Informe Especial del Cuerpo Colegiado, A seis años del fallo de la Corte Suprema de Justicia de la Nación por la Cuenca Matanza Riachuelo

Defensor del Pueblo de la Nación (2015): Información Pública, Informe especial del Cuerpo Colegiado presentado en el Exp. C.MA-R 201/05.

EDSA (2013) Encuesta del Barómetro de la Deuda Social Argentina de la Universidad Católica Argentina

EM-DAT (2015): The international disasters database, Centre for Research on the Epidemiology of Disasters

EPA (2003): Protecting Water from Urban Runoff, U.S. Environmental Protection Agency, Washington DC

EPH (2014) Encuesta Permanente de Hogares, National Institute of Statistics and Censuses Argentina

EU 2010: Being wise with waste: the EU's approach to waste management, European Commission, Luxembourg: Publications Office of the European Union

EVAL (2010): Evaluación Regional de Gestión de Residuos Sólidos Municipales en América-Latina y el Caribe, Inter-American Development Bank

FAOSTAT (2016): FAOSTAT database, Food and Agriculture Organization of the United Nations, available at http://faostat.fao.org/.

FAO (2015): Las Evaluaciones de recursos forestales mundiales - Informe Nacional Argentina, Food and Agriculture Organization of the United Nations, Rome

Forest Carbon Partnership (2015): REDD Readiness Progress Fact Sheet Argentina. Online verfügbar unter https://www.forestcarbonpartnership.org/argentina.

García Collazo, M. A.; Panizza, A. y J. M. Paruelo (2013): Ordenamiento Territorial de Bosques Nativos: Resultados de la Zonificación realizada por provincias del Norte argentino. Ecología Austral 23:97-107. Agosto 2013

Gasparri, I., et al. "Estimación de volumen, biomasa y contenido de carbono de las regiones forestales argentinas." Informe final, Unidad de Manejo del Sistema de Evaluación Forestal, Dirección de bosques,

Global Forest Watch (2016): Global Forest Watch Country Dataset, available at http://www.globalforestwatch.org/country/ARG

Gosling, Simon N., et al. "Climate: Observations, projections and impacts." Climate: Observations, projections and impacts (2011).

Grau, Ricardo; Gasparri, Ignacio; Aide, Mitchell (2005): Agriculture expansion and deforestation in seasonally dry forests of north-west Argentina. In: Envir. Conserv. 32 (02), S. 140

Grau, Ricardo; Gasparri, Ignacio; Aide, Mitchell (2008): Balancing food production and nature conservation in the Neotropical dry forests of northern Argentina. In: Global Change Biol 14 (5), S. 985–997. DOI: 10.1111/j.1365-2486.2008.01554.x.

Greenpeace (2013): Las Aguas Siguen Bajando Turbias. Análisis sobre la calidad ambiental de las aguas superficiales en la Cuenca Matanza Riachuelo. Campañas ACUMAR 2008-2012.

Greenpeace (2014): Desmontes S.A. Parte 2. La responsabilidad empresaria y gubernamental en la violación de la Ley de Bosques en Salta. Disponible en http://www.greenpeace.org/argentina/Global/argentina/report/2014/bosques/DesmontesSA2daparte.pdf

INDEC (2012a): Censo Nacional de Población, Hogares y Viviendas 2010. Censo del Bicentenario. Resultados definitivos, Serie B Nº 2. Tomo 1, Instituto Nacional de Estadísticas y Censos, Buenos Aires. Disponible en www.censo2010.indec.gov.ar

INDEC (2012b): Censo Nacional de Población, Hogares y Viviendas 2010. Censo del Bicentenario. Resultados definitivos, Serie B Nº 2. Tomo 2, Instituto Nacional de Estadísticas y Censos, Buenos Aires. Disponible en www.censo2010.indec.gov.ar

INTA

International Energy Agency: Total Carbon Dioxide Emissions from the Consumption of Energy (Million Metric Tons). Online verfügbar unter http://www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=90&pid=44&aid=8.

IPS 2013: Luxury Homes Block Up Delta near Buenos Aires, Inter Press Service News Agency, available at : http://www.ipsnews.net/2013/04/luxury-homes-block-up-delta-near-buenos-aires/

Kennedy, John (2011): Why is Argentina So Efficient? Corn+Soy Digest. Online verfügbar unter http://cornandsoybeandigest.com/tillage/why-argentina-so-efficient, zuletzt aktualisiert am 01.01.2011.

Kolstad, C. (2001): Economía Ambiental, Oxford UniversityPress, México.

Larsen, B, J. Skjelvik y E. Golub (2014): An Economic Assessment of Environmental Degradation in Argentina. Prepared for the World Bank. August 2014

Maggiora, C. D. and López-Silva, J. A. 2006: Vulnerability to Air Pollution in Latin America and the Caribbean Region, Latin America and Caribbean Region Sustainable Development Working Paper 28, The World Bank

Markandya, A.; K. Hamilton y E. Sanchez-Triana (2006): Getting the Most for the Money - How Public Environmental Expenditure Reviews Can Help. Environment Strategy Brief N° 16 September 2006

Mathews, J. A., & Goldsztein, H. (2009). Capturing latecomer advantages in the adoption of biofuels: the case of Argentina. Energy Policy, 37(1), 326-337

MECON (2013a): Ejecución Presupuestaria de la Administración Nacional Año 2012, Secretaria de Hacienda, Ministerio de Economía y Finanzas Públicas, Buenos Aires

MECON (2013b): Resumen del Presupuesto 2014, Oficina Nacional del Presupuesto, Secretaría de Hacienda, Ministerio de Economía y Finanzas Públicas, Buenos Aires. Disponible en http://www.mecon.gov.ar/onp/html/presupresumen/resum14.pdf

MECON (2014): Ejecución Presupuestaria de la Administración Nacional Año 2013, Secretaria de Hacienda, Ministerio de Economía y Finanzas Públicas, Buenos Aires

MinAgri (2014): “Suelos, producción agropecuaria y cambio climático. Avances en la Argentina”. Ministerio de Agricultura, Ganadería y Pesca de la Nación. Documento disponible en http://64.76.123.202/site/agricultura/_pdf/Suelos_Cambio_Climatico_Produccion_Agropecuaria.pdf

Navajas, F. (2015):" Subsidios a la energía, devaluación y precios", Documento de Trabajo No 122 , FIEL, Fundación de Investigaciones Económicas Latinoamericanas, Buenos Aires

OECD (2001): Environmentally Related Taxes in OECD Countries. Issues and Strategies. Organisation for Economic Co-operation and Development, Paris

OECD (2007), Pollution Abatement and Control Expenditure in OECD Countries, Organisation for Economic Co-operation and Development, Paris.

Pengue, Walter A. (2005): Transgenic crops in Argentina: the ecological and social debt. In: Bulletin of Science, Technology & Society 25 (4), S. 314–322.

Pereira, M.; De Miguel, C.; Taboulchanas, K. y M.P. Collinao (2014): “El gasto en protección ambiental en América Latina y el Caribe Bases conceptuales y experiencia regional”. Documento de Proyecto, Comisión Económica para América Latina y el Caribe (CEPAL), Santiago de Chile

Piquer-Rodríguez, María; Torella, Sebastián; Gavier-Pizarro, Gregorio; Volante, José; Somma, Daniel; Ginzburg, Rubén; Kuemmerle, Tobias (2015): Effects of past and future land conversions on forest connectivity in the Argentine Chaco. In: Landscape Ecol 30 (5), S. 817–833. DOI: 10.1007/s10980-014-0147-3.

PNUD (2011): Informe sobre el Desarrollo Humano 2011: Sostenibilidad e equidad – Un mejor futuro para todos, Programa de las Naciones Unidas para el Desarrollo, New York

PNUD/CNCPS (2012): Objetivos de Desarrollo del Milenio. Informe País Argentina 2012, Programa de Naciones Unidas para el Desarrollo y Consejo Nacional de Coordinación de Políticas Sociales/Presidencia de la Nación, Buenos Aires

PNUMA (2011): Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication, United Nations Environment Programme

Portier, Christopher J., et al. "Differences in the carcinogenic evaluation of glyphosate between the International Agency for Research on Cancer (IARC) and the European Food Safety Authority (EFSA)." Journal of epidemiology and community health (2016): jech-2015.

REDAF (2012): 3° Informe Conflictos sobre la Tenencia de la Tierra y Ambientales en la Región Chaqueña Argentina, redaf - La Red Agroforestal Chaco Argentina, *Informes Conflictos, Informes Observatorio*

SAyDS - MAGyP (2013): Cartilla para titulares de tierras con bosques nativos y para profesionales responsables - Enriquecimiento. Secretaría de Ambiente y Desarrollo Sustentable - Ministerio de Agricultura, Ganadería y Pesca - Documento disponible en http://obio.ambiente.gob.ar/multimedia/files/Cartilla%20para%20titulares%20de%20tierras%20con%20bosques%20nativos%20y%20para%20profesionales%20responsables%20de%20planes.pdf

SAyDS (2012): Informe sobre el Estado del Ambiente, Secretaría de Ambiente y Desarrollo Sustentable, Buenos Aires

SAyDS (2014): Monitoreo de la Superficie de Bosque Nativo de la República Argentina Período 2011 – 2013. Secretaría de Ambiente y Desarrollo Sustentable de la Nación. Documento disponible en

http://obio.ambiente.gob.ar/multimedia/files/Monitoreo%20de%20la%20Superficie%20de%20Bosque%20Nativo%202011-2013.pdf

SAyDS (2015a): Monitoreo de la Superficie de Bosque Nativo de Argentina Período 2013 – 2014. Secretaría de Ambiente y Desarrollo Sustentable de la Nación

SAyDS (2015b): Proyecto Tercera Comunicación Nacional Sobre Cambio Climático, Centro de Investigaciones del Mar y la Atmósfera, Cambio climático en Argentina; tendencias y proyecciones

SAyDS (2015c): Proyecto Tercera Comunicación Nacional Sobre Cambio Climático, Centro de Investigaciones del Mar y la Atmósfera, Agricultura y Ganadería: Impacto y vulnerabilidad al cambio climático

Scientific American 2013: Climate Change Combined with Poor Urban Planning Exacerbated Deadly Argentine Flooding, By Ines Perez, ClimateWire on April 19, 2013, available at http://www.scientificamerican.com/article/climate-change-combined-with-poor-urban-planning-exacerbated-deadly-argentine-flooding/

Secretaría de ambiente y desarrollo sustentable (2004).

SIB (2016): Listado de las Áreas protegidas nacionales, Sistema de Información sobre Biodiversidad

SIIA (2015): Sistema Integrado de Información Agropecuaria Database, Ministerio de la Agroindustria Argentina

Sistema de estadistica ambiental (2015): Database available at http://estadisticas.ambiente.gob.ar/ , Ministerio de Ambiente y Desarrollo Sustentable

UN WUP 2014: World Urbanization Prospects: The 2014 Revision, United Nations, Department of Economic and Social Affairs, Population Division. Highlights (ST/ESA/SER.A/352).

Third National Communication to UNFCCC (2016): Argentina's third National Communication (TNC) to the United Nations Framework Convention on Climate Change (UNFCCC), available at: http://www.ambiente.gov.ar/?idseccion=356

Trigo, Eduardo J.; Cap, E.; Malach, V.; Villarreal F (2009): The case of zero-tillage technology in Argentina. In: IFPRI Discussion Paper (915). Online verfügbar unter http://ebrary.ifpri.org/cdm/ref/collection/p15738coll2/id/29503.

WHO 2005: Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide - Global update 2005, World Health Organization

World Bank, 2014: Argentine Republic's Environmental and Social Regulatory Framework

World Bank 2015: Del problema a la oportunidad: Gestión Integrada del Riesgo de Inundaciones en Áreas Urbanas, Autor: María Catalina Ramírez Villegas

World Bank, 2016: Leveraging the Potential of Argentine Cities: A Framework for Policy Action.

Zak, Marcelo R.; Cabido, Marcelo; Cáceres, Daniel; Díaz, Sandra (2008): What drives accelerated land cover change in central Argentina? Synergistic consequences of climatic, socioeconomic, and technological factors. In: Environmental Management 42 (2), S. 181–189.