PART I

Chapter 1

Key environmental trends

This chapter provides a snapshot of key environmental trends in Brazil, highlighting some of the main achievements and remaining challenges on the path towards sustainable development and a greener economy. It reviews progress against national policy goals and international commitments, focusing on the period since 2000. Beginning with an overview of key socio-economic developments, the chapter presents Brazil's progress in moving towards i) an energy-efficient and low-carbon economy; ii) resource efficiency in material consumption, waste management and agro-chemical use; and iii) sustainable management of the natural asset base, including forests, biodiversity and water resources.

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

1. Introduction

Brazil's environmental performance must be seen in the context of its size, its vast natural wealth and its economic and social development since the early 2000s. The world's fifth largest country, by both land area and population, it possesses enormous biological diversity and is exceptionally rich in fertile soil, forests, water, minerals and fossil energy resources. Economic growth was strong throughout the decade to 2012 and Brazil achieved remarkable progress with respect to social development and inclusion. However, expanding economic activity, population growth and rising living standards are increasing the need for energy, food, minerals and other resources, amplifying environmental pressures in both rural and urban areas.

This chapter provides a snapshot of Brazil's main environmental achievements as well as remaining challenges on the path towards sustainable development and a greener economy. Based on indicators from national and international sources, the chapter reviews progress against national policy goals as well as international commitments and targets, focusing on the period since 2000. To the extent possible, it compares the state of the environment and key environmental trends with those of OECD member countries and the other emerging economies in the BRIICS group (Brazil, Russia, India, Indonesia, China and South Africa). The chapter provides a baseline for the rest of the report, which examines the effectiveness of Brazil's environmental policies in tackling key challenges and in using environmental objectives to generate economic and social opportunities.

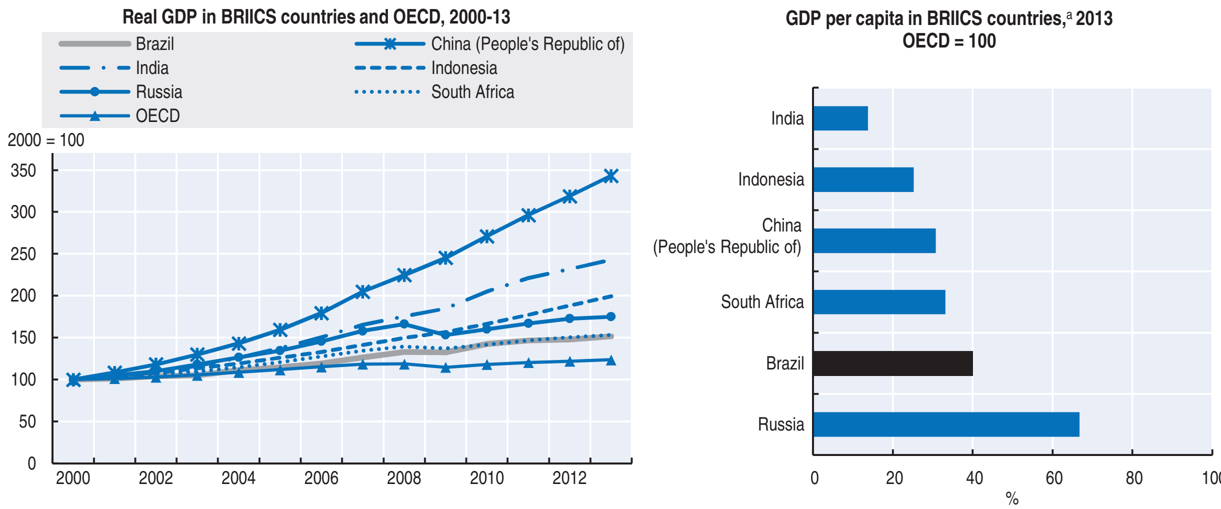
2. Key economic and social developments

2.1. Economic performance

Brazil is the world's seventh largest economy, and South America's largest. It enjoyed strong economic growth over most of the 2000s, with average annual GDP growth well above the OECD average, though below the economic performance of other BRIICS economies (Figure 1.1; also see Basic Statistics). Per capita income increased by around 30% between 2000 and 2013, allowing about 40 million Brazilians to enter the middle class. The share of the population living in poverty (on less than USD 2 per day) fell from 19% in 2002 to less than 7% in 2012. However, per capita income remained at about 40% of the average income in OECD countries in 2013 (Figure 1.1), and poverty in Brazil is higher than in some other Latin American countries. Strong economic growth has been largely driven by strong domestic demand, as well as a favourable external environment (OECD, 2013a; OECD, 2015a; World Bank, 2015).

While the economy weathered the 2009 global financial crisis well, growth began decelerating in 2012 and reached almost zero in 2014. Growth is expected to remain modest in coming years due to tightening monetary and fiscal policies, weaker external demand and such persistent barriers to growth as infrastructure bottlenecks, low investment, high tax and administrative burdens (known as the "Brazil cost"), trade protection and low domestic competition, as well as a tight labour market and skills shortages (OECD, 2013a;

Figure 1.1. **Brazil's per capita income reached higher levels than in most BRIICS countries**



a) GDP per capita at current purchasing power parities. Data include estimates.
Source: OECD (2015), "OECD Economic Outlook No. 96", *OECD Economic Outlook: Statistics and Projections* (database); OECD (2015), *OECD National Accounts* (database).

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OECD, 2015b; World Bank, 2011). The water crisis in south-eastern Brazil (Section 5.2) and the energy shortages resulting from it are further constraining the picking up of the economy.

Brazil undertook major economic reforms in the 1990s and has since enjoyed stable macroeconomic conditions. However, its well-earned reputation for solid macroeconomic and fiscal policies has weakened, as both the fiscal deficit and public debt showed significant increases in 2013 and 2014, while inflation remained elevated (OECD, 2015b; IMF, 2014). In 2013, tax revenue and government expenditure stood at levels slightly below the respective OECD averages (see Basic Statistics). Environmental taxes make up a minor share of total tax revenue, while fiscal revenue from hydrocarbons and mining was 2.4% of GDP in 2013 (OECD, 2015c) (Chapter 3).

Brazil's labour market performance has been strong. According to national statistics, the unemployment rate fell to a record low of 5.2% in 2013, down from 10.5% in 2004 (Figure 1.2). Labour market informality has receded considerably. At the same time, real wages increased by almost 60% between 2004 and 2013 (Figure 1.2). The growth in real wages accelerated after 2010, reflecting tight labour market conditions and skills shortages (OECD, 2013a). However, unemployment has been on the rise since early 2015 (OECD, 2015b).

2.2. Structure of the economy and trade

Brazil has a diversified economy and a broad industrial base, albeit one characterised by low productivity and competitiveness (OECD, 2015b). The economic structure has shifted towards stronger reliance on services in recent decades while the share of the primary sector and industry in value added has declined. Nevertheless, the primary sector accounts for a larger share of GDP than in OECD countries (see Basic Statistics) and remains a mainstay of the economy. Brazil ranks among the world's five largest agricultural producers and exporters (Section 4.3), is a major player in global mining production (including iron ore, copper, bauxite and gold manganese) and will be among the world's top

Figure 1.2. **Unemployment decreased while labour income increased**

Unemployment rates and average annual wages, 2004-13

Note: Data are based on national surveys which cover persons aged of 10 years and over.
Source: IBGE (2014), *Pesquisa Mensal de Emprego.*

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oil producers when large oil and gas reserves discovered in 2006 are developed over the next two decades (IBRAM, 2012; IEA, 2013). Agriculture and mining registered higher production, employment and export growth than knowledge-intensive sectors over the 2000s (IPEA, 2012).

Primary products dominate the export portfolio, accounting for roughly two-thirds of total exports in 2013 (WTO, 2014; also see Basic Statistics). While the trade volume almost quadrupled over the past decade, exports and imports together amount to only about 25% of GDP, significantly lower than in similar sized countries. Brazil is also less integrated into international value chains and has high tariff protection levels (WTO, 2014).

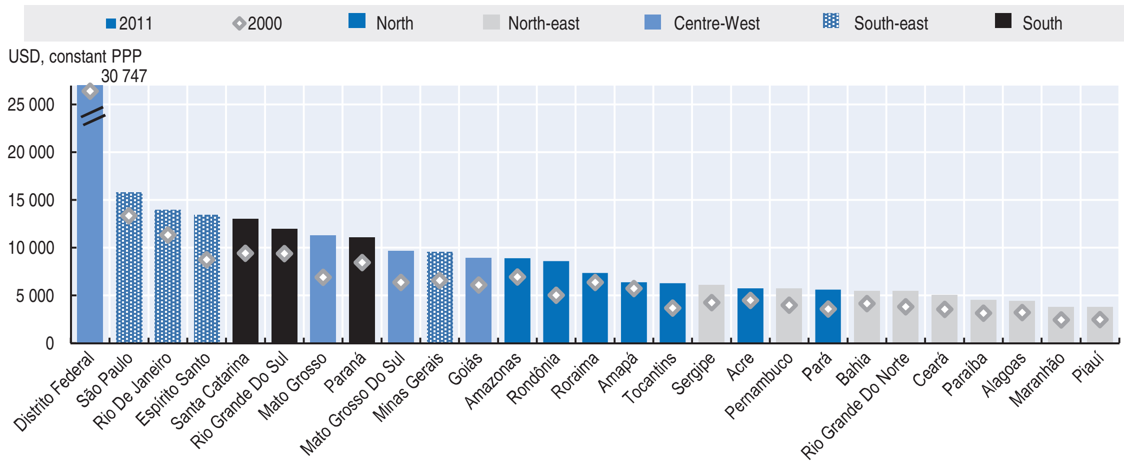
2.3. Regional disparities and inequality

Economic activity in Brazil is geographically highly concentrated. Most industry is located in the South-east region and, to a lesser extent, the South, while farming and other natural-resource-based activities prevail in the North, North-east and Centre-West regions.[1] The South and South-east enjoy significantly higher income (Figure 1.3) and perform better in key socio-economic indicators. Inequality among regions has been declining since 2000, mainly due to above-average growth rates in areas specialised in agriculture and mining; however, the position of the most lagging areas (most of which are located in the North-east) improved only marginally (OECD, 2013b).

Brazil is the only BRIICS economy to have experienced a decline in income inequality. As measured by the Gini coefficient, inequality fell from 58.6 to 52.7 over 2002-12, although it remains one of the highest levels in the world (World Bank, 2015; also see Basic Statistics). The fall in poverty and inequality is attributed to changes in labour income as well as direct income redistribution, including a large-scale conditional cash transfer programme, Bolsa Família (Box 3.1) (OECD, 2013a; World Bank, 2011).

Figure 1.3. **Per capita income varies widely across Brazilian states**

GDP per capita by state and region, 2000 and 2011



Source: OECD (2015), "Large regions, TL2: Regional accounts", *OECD Regional Statistics* (database).

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2.4. Population, urbanisation and quality of life

The population is growing rapidly (see Basic Statistics), and it is projected to peak at about 230 million inhabitants by 2040 (IBGE, 2014). The country's size results in relatively low average population density, but the population is highly concentrated along the coast. Still, the proportion of the population living in predominantly rural areas is relatively high by OECD standards (see Basic Statistics). Almost 5 million Brazilians live in traditional or indigenous communities that practice extractive activities of non-timber forest products, small-scale agriculture, hunting or fishing (Fundaj, 2014).

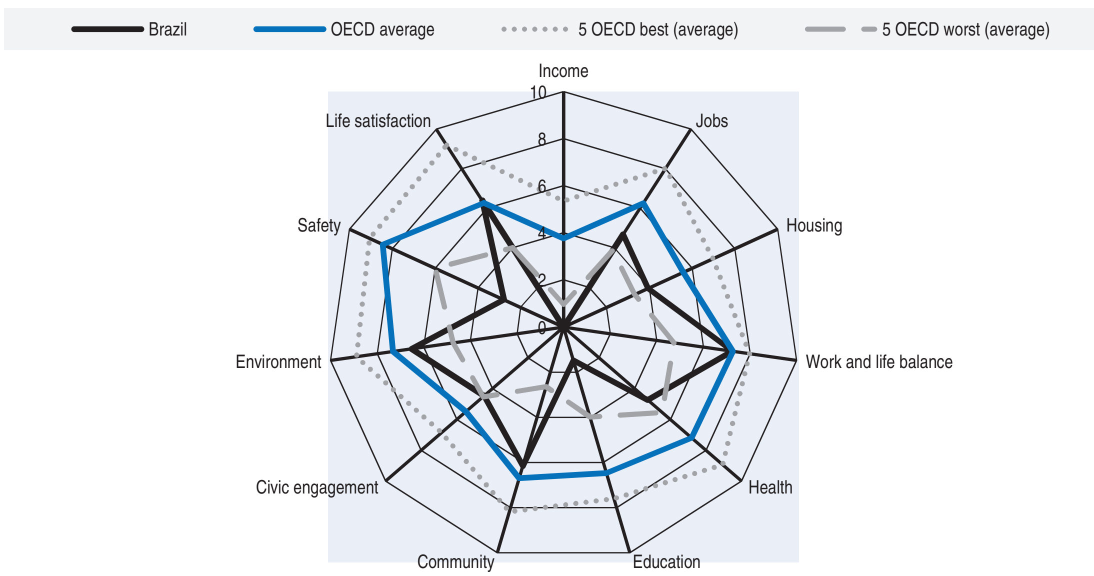
Even though the process of urbanisation has been slower than in OECD or other BRIICS economies, most cities are experiencing increasing environmental pressures. These include traffic congestion, air pollution, waste volumes that exceed the capacity for adequate treatment and disposal, and polluted water sources due to insufficient sanitation and wastewater treatment infrastructure. Housing remains a major challenge: some 11 million Brazilians live in *favelas* (IBGE, 2011), informal urban settlements characterised by low public service delivery and high crime. Public safety remains a problem despite improvement such as progress in reducing armed violence.[2]

Access to and quality of key public services such as education and health have improved. Access to primary education is almost universal and enrolment rates for secondary and tertiary education have been increasing. Educational outcome indicators (as measured by the Programme for International Student Assessment, PISA) have also improved, especially among the young and people from low-income backgrounds (OECD, 2013a; OECD, 2013c). However, in 2012, only 13% of the working population had competed tertiary education; human capital still significantly lags behind OECD standards, which constrains growth prospects. Health services have become more accessible to poor households and improved in quality, as reflected in rising life expectancy, which remains nonetheless below the OECD average (see Basic Statistics). Regional disparities with respect to education and health services remain large.

Overall, Brazil is making progress in improving quality of life. Brazilians seem to be slightly more satisfied with their quality of life than the average person in the OECD, according to the OECD Better Life Index[3] (OECD, 2013c). In addition to a relatively low level of disposable income, education, safety and housing present the greatest constraints to life quality for much of the population (Figure 1.4). Brazilians are proud of their country's natural wealth, and awareness and concern about environmental pressures are increasing (MMA, 2012a). Deforestation, water and air pollution and waste generation and treatment are considered the most pressing environmental problems (Figure 2.3).

Figure 1.4. **Life satisfaction in Brazil is high, but some constraints remain**

OECD Better Life Index, 2013



Note: Each well-being dimension is measured by one to three indicators from the OECD Better Life Index data set. Indicators are averaged with equal weights and then normalised to express all values in a range from 0 (worst) to 10 (best).
Source: OECD (2013), "Better Life Index: Better Life Index 2013", *OECD Social and Welfare Statistics* (database).

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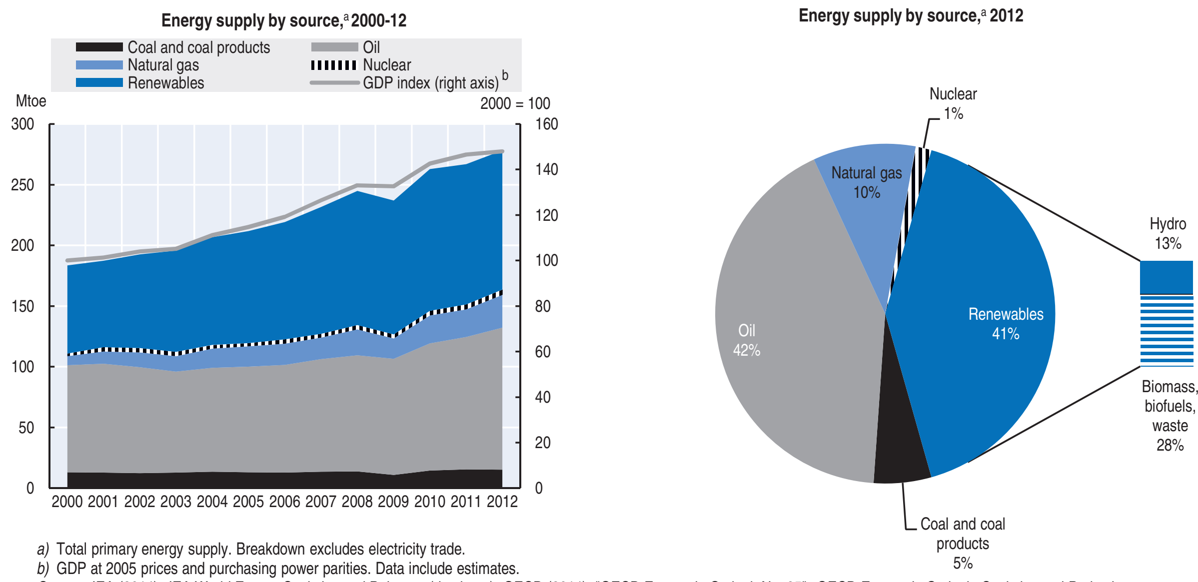
3. Transition to an energy-efficient and low-carbon economy

3.1. Energy use in Brazil

Energy mix

Brazil has a low-carbon energy mix. The use of renewable energy sources has increased steadily to reach 41% of total primary energy supply (TPES) in 2012 (Figure 1.5). This is one of the world's highest shares, more than four times the OECD average (see Annex 1.A and Basic Statistics). Renewables account for 83% of electricity generation, far above the OECD average of 21% (IEA, 2014a). Iceland and Norway are the only OECD countries that source more power from renewables (Annex 1.A). Hydropower for electricity generation and biofuels for industrial and transport uses are the main renewable sources. Brazil has encouraged the development of large-scale sugar cane ethanol production and the use of ethanol to power road vehicles since the 1970s (Chapter 3). As a result, biofuels accounted for 17% of fuels used in road transport in 2012, by far the highest share in the world and well above the OECD average of 4% (IEA, 2014a; also see Annex 1.A). Other renewables play a minor but growing role. Power generation from wind turbines increased

Figure 1.5. **Renewables make up an increasingly large share of the energy supply**



a) Total primary energy supply. Breakdown excludes electricity trade.
b) GDP at 2005 prices and purchasing power parities. Data include estimates.
Source: IEA (2014), *IEA World Energy Statistics and Balances* (database); OECD (2014), "OECD Economic Outlook No. 95", *OECD Economic Outlook: Statistics and Projections* (database).

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by more than 400% over 2009-12; solar installations are also widespread, mainly in decentralised applications (IEA, 2013).

The use of petroleum products, mainly in road transport, has increased to reach more than 40% of TPES in 2012. Brazil imports a significant share of its petroleum supply, but exploitation of pre-salt reserves discovered in 2006 could triple oil production (IEA, 2013).[4] Other fossil fuels and nuclear energy play minor roles (Figure 1.5).

Energy consumption and intensity

Strong economic growth and the rise of a middle class led to a rapid increase in energy use: both total final consumption and TPES increased by about 50% between 2000 and 2012 (IEA, 2014a). More than half of the demand increase occurred in industry and transport, the sectors that are the biggest energy consumers in absolute terms (Figure 1.6). The rise in transport energy demand came almost exclusively from road transport, reflecting a rapid increase in the vehicle fleet (ANFEVA, 2015).

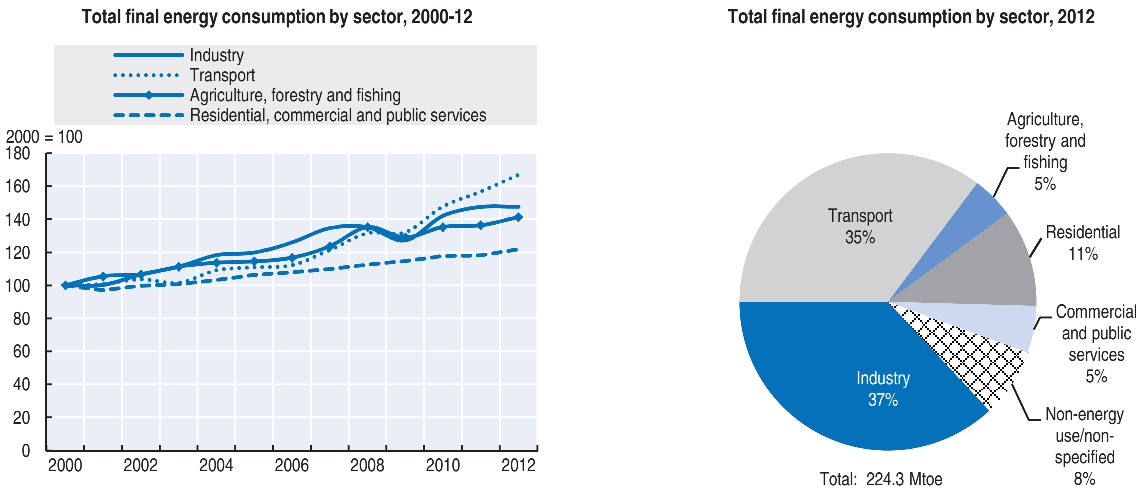
As the increase in energy use occurred at the same pace as GDP growth, the energy intensity of the economy (TPES per unit of GDP) remained fairly stable. Brazil's energy intensity is lower than the OECD average and significantly below that of the other BRIICS, mainly because of the relatively small amount of energy used for heating and cooling and the large share of hydropower in the energy supply.[5] Per capita energy demand increased by about 31% over 2000-12 but is still about one third of the OECD average, due in part to the remaining income gap (see Annex 1.A and Basic Statistics).

3.2. Greenhouse gas (GHG) emissions

GHG emission profile

In 2010, Brazil was the world's sixth-largest emitter of greenhouse gases (behind China, the United States, India, Russia and Indonesia), contributing 3.2% of global GHG

Figure 1.6. **Energy consumption in transport and industry has been rising rapidly**



Source: IEA (2014), *IEA World Energy Statistics and Balances* (database).

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emissions (IEA, 2014b). Two features distinguish its emission profile from those of most OECD or BRIICS economies. First, the large share of renewables results in relatively low emissions in the energy sector, which accounts for the bulk of GHG emissions in most OECD countries. Second, land use, land-use change and forestry (LULUCF),[6] mainly deforestation, has been a key driver of GHG emissions in Brazil. According to national estimates, 60% of net emissions stemmed from LULUCF in the first half of the 2000s (MCTI, 2014a). The IEA estimated that, in 2010, LULUCF (excluding removals) still accounted for about 35%, a share second only to that of Indonesia (IEA, 2014b; Figure 1.7).[7]

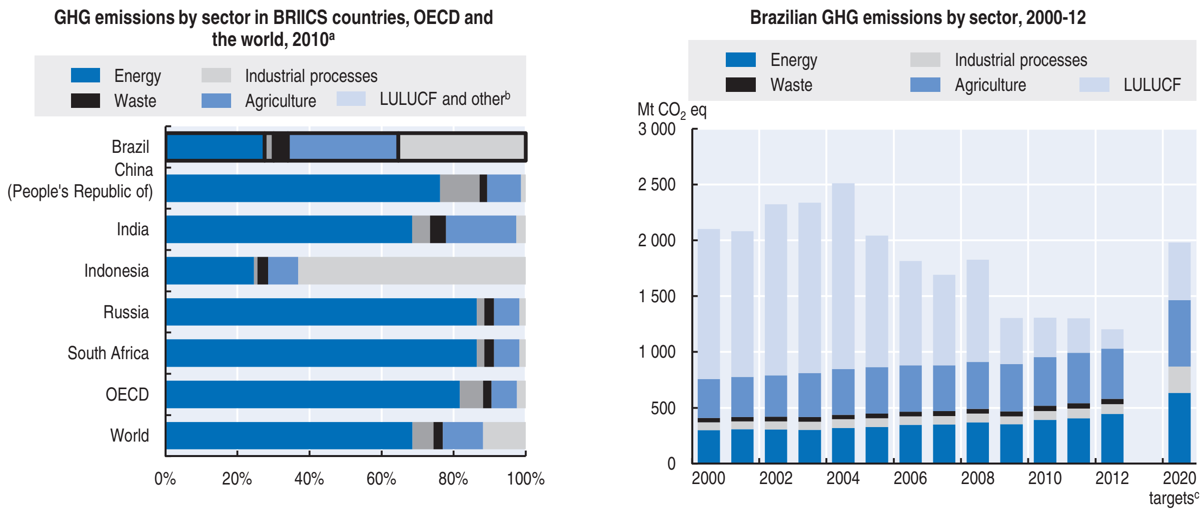
Brazil's total GHG emissions declined by 43% between 2000 and 2012, thanks to a steady decline in deforestation and associated emissions since the mid-2000s (Figure 1.7; Section 5.1). However, emissions are projected to increase. GHG emissions from sectors other than LULUCF rose steadily, by about 35% overall, between 2000 and 2012. The trend was particularly pronounced in energy-related emissions (+49%), mainly as a result of fossil fuel combustion in industry and road transport. Agricultural emissions also grew substantially (+28%). By 2012, energy and agriculture had replaced land use as the primary source of emissions, accounting for 37% of total emissions each, followed by LULUCF (15%), industrial processes (7%) and waste management (4%) (MCTI, 2014a).

In 2010, Brazil committed itself to limit emissions by between 36.1% and 38.9% compared to a business-as-usual (BAU) scenario by 2020.[8] This sets a ceiling of roughly 2 billion tonnes of CO_2 equivalents (tCO_2eq), up from about 1.2 billion tCO_2eq in 2012 (Figure 1.7). As almost half of future emissions were projected to stem from LULUCF, success in reducing deforestation puts Brazil in a good position to meet the target. However, the latest estimates suggest that both LULUCF and total emissions grew by about 8% from 2012 to 2013 (SEEG, 2014),[9] which may make reaching the target more challenging than expected.

Emission intensities

Despite a decline since the mid-2000s, Brazil's GHG emission intensity (GHG emissions, excluding LULUCF, per unit of GDP) remained in line with the OECD average in 2012 (see

Figure 1.7. **GHG emissions from deforestation declined, but emissions are rising in other sectors**



a) IEA estimates.

b) Excludes removals from LULUCF and includes emissions from: forest, peat and other vegetation fires; decay of drained peat soils and of aboveground biomass that remains after logging and deforestation (IPCC cat. 5); solvent use (IPCC cat. 3); application of agricultural lime (IPCC cat. 4); fossil fuel fires (IPCC cat. 7); some industrial processes such as methanol production (IPCC cat. 2); N_2O usage, human sewage discharge and waste incineration (non-energy), and indirect N_2O from atmospheric deposition of NO_x and NH_3 from non-agricultural sources (IPCC cat. 3, 6 and 7).

c) According to Decree n. 7.390/2010, which defines the expected GHG emissions under business-as-usual (BAU) scenario and sectoral emission reduction targets varying from 36.1% to 38.9% of the BAU. The category "industrial processes" includes emissions from waste management.

Source: IEA (2014), "Emissions of CO_2, CH_4, N_2O, HFCs, PFCs and SF_6", *IEA CO_2 Emissions from Fuel Combustion Statistics* (database); MCTI (2014; 2013), *Estimativas anuais de emissões de gases de efeito estufa no Brasil*; MCTI (2010), *Second National Communication of Brazil to the UNFCCC*.

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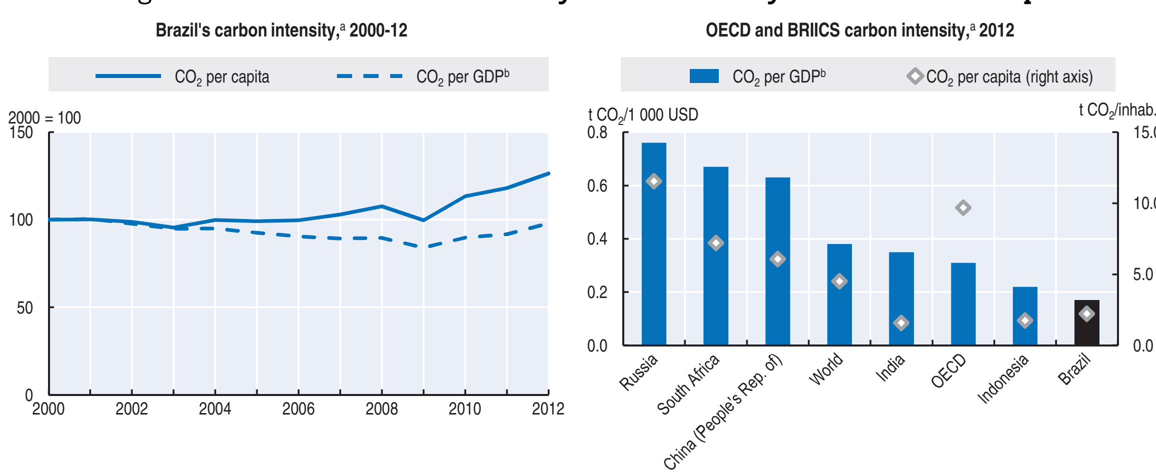
Basic Statistics). Brazil's carbon intensity (CO_2 emissions from fuel combustion per unit of GDP) is low by international comparison in both per capita terms and per unit of GDP, partly due to the low-carbon energy mix and the fact that per capita energy use is still significantly below OECD levels (Figure 1.8 and Annex 1.B). CO_2 emissions from fossil fuel combustion increased at a slower pace than GDP, resulting in a relative decoupling from

Figure 1.8. **Brazil's carbon intensity remains low by international comparison**



a) CO_2 emissions from energy use only; sectoral approach; excludes international marine and aviation bunkers.

b) GDP at 2005 prices and purchasing power parities. Data include estimates.

Source: IEA (2014), *IEA CO_2 Emissions from Fuel Combustion Statistics* (database); OECD (2014), "OECD Economic Outlook No. 95", *OECD Economic Outlook: Statistics and Projections* (database); OECD (2014), "Population projections", *OECD Historical population data and projections statistics* (database).

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economic growth and a decline of the carbon intensity of the economy (by 2%) over 2000-12. However, energy-related CO_2 emissions per capita grew by 26% over the period (Figure 1.8), in line with the increase in per capita energy consumption.

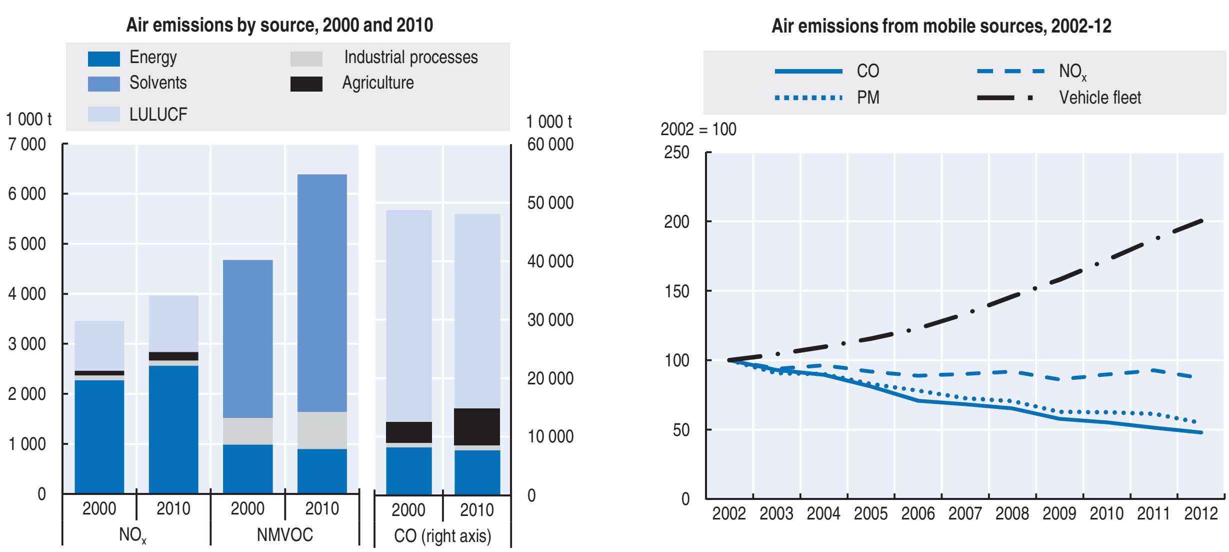
3.3. Other air emissions and air quality

Air emissions

Data on air emissions are limited; the Ministry of the Environment has published two inventories of atmospheric emissions in transport (2011 and 2013), but air emissions from point sources are not systematically captured or aggregated at national level. As in many countries, the main sources of air pollution are transport, industry and energy generation.

Available data suggest that total carbon monoxide (CO) emissions were fairly stable between 2000 and 2010, decreasing in the energy and LULUCF sectors yet rising in agriculture (+77%). Total nitrogen oxide (NO_x) emissions increased by 15% over 2000-10, primarily due to energy-related fossil fuel combustion but also rising emissions from LULUCF (MCTI, 2014b). Emissions of volatile organic compounds (VOCs) increased by 37% over 2000-10, mainly from solvent production and use and industrial processes (Figure 1.9). There are no national, cross-sector emission inventories of other air pollutants, including sulphur oxides (SO_x) and ammonia (NH_3).

Figure 1.9. **Transport-related air emissions are decreasing, but overall emissions are rising**



Source: ANFAVEA (2014), *Anuário da Indústria Automobilística Brasileira*; MMA (2014), *Inventário Nacional de Emissões Atmosféricas por Veículos Automotores Rodoviários, 2013*; UNFCCC (2014), *First Biennial Update Report of Brazil.*

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The number of vehicles in use more than doubled between 2000 and 2014. It reached 35 vehicles per 100 inhabitants, which remains well below the OECD average and the vehicle ownership rate of most OECD countries (see Annex 1.A and Basic Statistics). Nonetheless, emissions of CO, NO_x and particulate matter (PM) from mobile sources decreased significantly, thanks to stricter vehicle emission standards, improvement in road vehicle technology and widespread use of ethanol in cars (Figure 1.9; also see Chapter 3). Transport-related PM and NO_x emissions largely stem from buses and heavy-duty diesel vehicles. Over 2002-12, PM emissions from mobile sources declined by about 45%. Transport-related NO_x emissions decreased by 13% thanks to better performance of the passenger car fleet (Figure 1.9), yet NO_x emissions from heavy trucks increased by roughly 25% (MMA, 2014a).

Air quality

Air pollution in urban areas is considered a serious environmental challenge (IBGE, 2012a), but quantitative data are scarce as Brazil lacks an effective air quality monitoring system. The law obliges the states to monitor air quality and produce annual air quality reports, but only 12 of the 27 states (including the Federal District) had some type of monitoring system installed by 2012, and few of them provide consistent, accessible data (IEMA, 2012). Less than 2% of municipalities monitor air quality (ISS, 2014).

PM_{10} emitted by industry and transport is the most serious air quality issue. At a national level, average exposure to air pollution from $PM_{2.5}$ is relatively low in Brazil compared to most OECD countries (Annex 1.B), but this average hides wide differences across urban and rural areas. PM_{10}, $PM_{2.5}$ and ozone (O_3) are the pollutants that most frequently exceed national and/or international standards, while CO, SO_2 and NO_2 seem to be somewhat better controlled. This difference may partly be linked to the distinct smog composition in Brazilian urban areas, which is related to the reliance on ethanol in road transport[10] (IEMA, 2014; MCTI, 2010); however, it may also be explained by the fact that fewer data points are available for CO, SO_2 and NO_2.

PM_{10} concentration levels have been reduced in most cities of more than 100 000 inhabitants in the past two decades, thanks largely to stronger vehicle emission control and advancements in engine technology and fuel quality (World Bank, 2015; IBGE, 2012a; also see Chapter 2). This reduction resulted in a decrease in the average annual exposure level of urban residents to outdoor PM from 46 to 36 µg/m^3 over 2000-11 (World Bank, 2015).[11] Annual average concentrations remain above this level in several metropolitan areas, however, and peak concentrations still regularly exceed national air quality standards in many cities. Rio de Janeiro, among the cities with the greatest traffic congestion problems, registered the highest levels of PM_{10} exposure in 2010: both the highest annual mean concentration (67 µg/m^3) and highest peak concentration (574 µg/m^3) among monitored cities. In São Paulo, PM_{10} concentrations decreased over the 2000s, but the city faces high O_3: concentration levels exceeded the national eight-hour average quality standard 257 times in 2010, or more than 70% of the year (IBGE, 2013).

Poor air quality poses severe health risks to Brazil's population, even in areas where pollution levels remain below national emission standards (Olmo et al., 2011). Estimates suggest that in the states of São Paulo and Rio de Janeiro alone, 135 000 people died from diseases caused by air pollution over 2006-11 (ISS, 2014).

Ozone-depleting substances

Brazil has reduced the use of ozone-depleting substances by more than 80% over the past two decades, surpassing the goals established in the Montreal Protocol (IBGE, 2013). Chlorofluorocarbons (CFCs), the main cause of stratospheric ozone depletion, and methyl bromide had been phased out by 2010, as required by the Montreal Protocol. The use of hydrochlorofluorocarbons, a common replacement for CFCs, with lower ozone-depleting potential but a high global warming potential, grew over the 2000s.

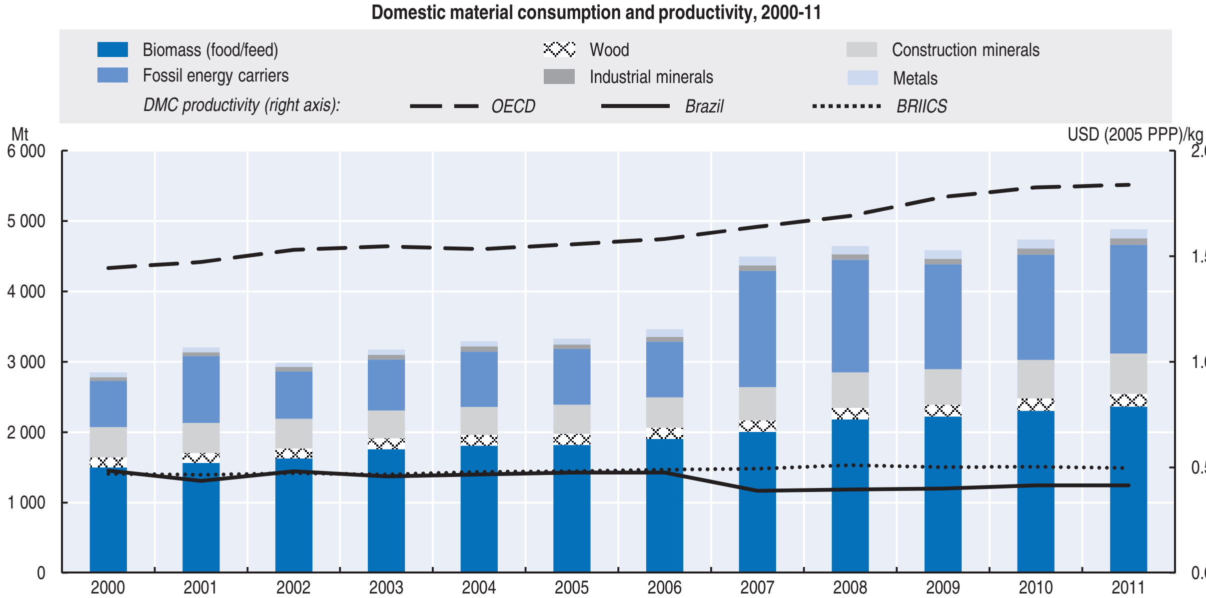
4. Transition to a resource-efficient economy

4.1. Material consumption

Domestic material consumption (DMC)[12] grew by more than 70% over 2000-11, faster than in any OECD country or other BRIICS country except China. As DMC grew even faster than GDP, material productivity (GDP per DMC) deteriorated by 14%, while in most OECD countries and all other BRIICS countries, it improved (Figure 1.10; Annex 1.C). In 2011, Brazil's material productivity was about one-quarter of the OECD average and below the BRIICS average. Material consumption per capita has also been growing and is high: in 2010, per capita DMC was 50% above the OECD average and well above DMC in other BRIICS countries.

Figure 1.10. **Domestic material consumption increased faster than GDP**

Domestic material consumption and productivity, 2000-11



Note: Domestic material consumption (DMC) designates the sum of domestic raw material extraction used by an economy and its physical trade balance. Material productivity refers to the amount of GDP generated per unit of materials used and corresponds to the ratio of GDP to DMC. A rise in material productivity is equivalent to a decline in material intensity (i.e. DMC/GDP).
Source: OECD (2015), "Material resources", *OECD Environment Statistics* (database).

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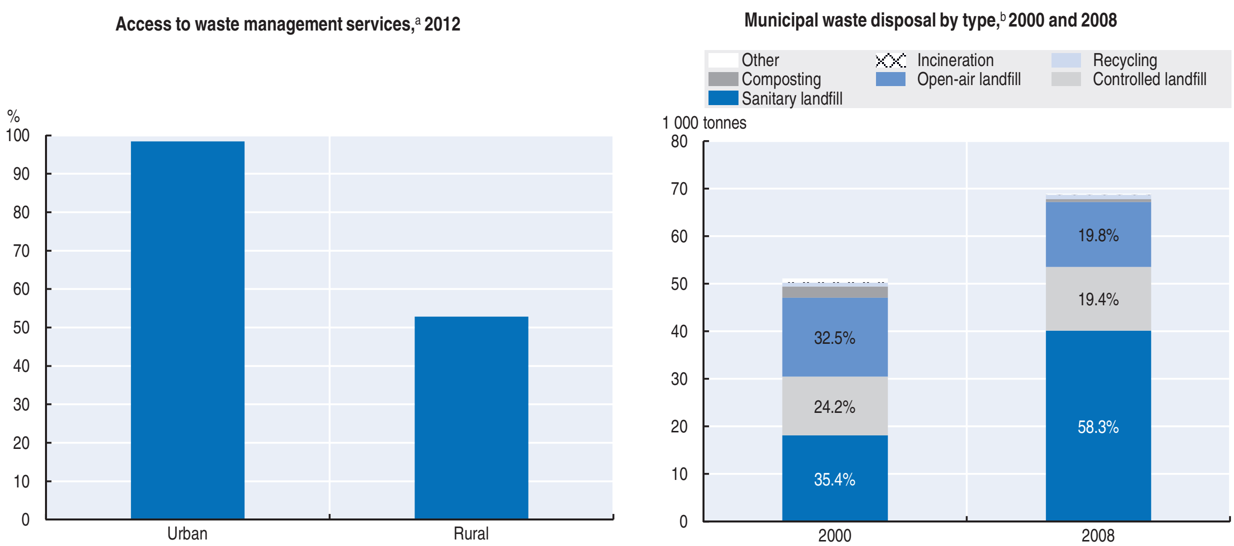
Due to Brazil's large agricultural and forestry sectors, biomass and wood extraction accounts for over half of total DMC, which is more than in any OECD country (Annex 1.C). Biomass DMC increased by 58% over 2000-11, a period in which sugar cultivation, largely for ethanol production, expanded considerably. DMC of fossil fuels and metals grew even faster due to a jump in domestic oil extraction in 2006/07 and increased metal exports (Figure 1.10). Brazil exports more materials than it imports and its trade surplus is rising, reflecting the increasing role of commodities (notably minerals and biomass) in its export portfolio (see Basic Statistics).

4.2. Waste management

Data on the generation, collection, treatment and disposal of solid waste are limited and hence need to be interpreted with caution.[13] According to the Brazilian Association of Public Cleaning and Special Waste Disposal Companies (Abrelpe), the amount of municipal solid waste (MSW) generated per year grew by about 10% over 2009–12, reflecting rising living standards and consumption levels. MSW has grown more rapidly than population in recent years, though slower than private consumption (Abrelpe, 2012; World Bank, 2015). Per capita waste generation remains significantly below OECD levels (see Annex 1.C and Basic Statistics).

Brazil has made noticeable progress in expanding household access to waste collection services, though with wide geographical disparity. In urban areas, access increased from 96% in 2004 to over 98% in 2012, while in rural areas it increased from 20% to 53%, although data are not fully comparable over time (Figure 1.11). Service coverage tends to be lower in small municipalities, as well as in the North and North-east regions, where only 85% and 88%, respectively, of the population had access to waste collection services. It is estimated that more than 6 million tonnes of MSW per year (almost 10% of the total) is burned, buried or dumped (Abrelpe, 2012).

Figure 1.11. **Waste management has improved, but remains challenging in rural areas**



a) Estimates based on sample surveys covering about 50% of municipalities.
b) Includes waste originating from households, offices, institutions, commerce and selected municipal services (i.e. street cleaning). Controlled landfill: site operating in compliance with technical control procedures, but not requiring environmental mitigation measures. Sanitary landfill: site operating in compliance with technical control procedures and measures to reduce environmental impacts (i.e. groundwater contamination).
Source: MMA (2012), *National Plan for Solid Waste*; UNSD (n.d.), UNSD Environmental Indicators.

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Appropriate MSW treatment and disposal remain a significant challenge. As in many developing or emerging economies, the main type of disposal is landfilling, which in Brazil accounted for almost 98% of treatment in 2008. Waste disposal in non-sanitary landfills (i.e. sites without measures to minimise environmental damage such as groundwater contamination) decreased over 2000-08, particularly disposal in uncontrolled, open-air dumps (Figure 1.11). Despite this improving trend, however, Brazil fell short of its national target to eliminate uncontrolled landfills by August 2014. Small municipalities, and those with large rural zones, have particular trouble complying with national legislation, usually because of limited institutional capacity and lack of economies of scale (Chapters 2 and 3). In addition, Brazil performs poorly in organic waste management, despite the very high share of such waste in total MSW (51%). In 2008, less than 2% of organic waste collected was disposed of at composting facilities, which are almost non-existent (MMA, 2012b).

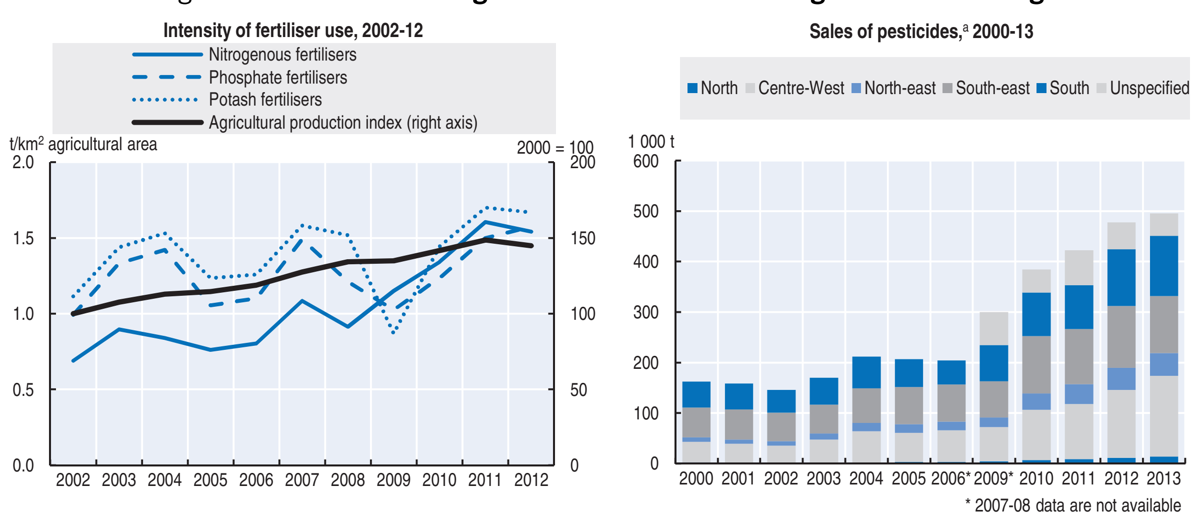
Recycling is very limited. It is estimated that only 27% of recyclable collected waste is effectively recovered. As in many developing or emerging countries, recovery is dominated by waste pickers (*catadores*), who earn their living by collecting recyclables and selling them to private recycling companies (Chapter 3). Waste pickers are responsible for almost 20% of the waste separated for recycling, and for the high recycling rates of aluminium cans (98%) and PET (57%). Only about 15% of municipalities, most of which are located in the South-east and South regions, offer selective waste collection services (Cempre, 2013).

4.3. *Agriculture and nutrient inputs*

Brazil is the world's fourth-largest agricultural producer, generating 6% of global output, after China (23%), the United States (10%) and India (10%). Agriculture accounts for 15% of employment; 75% of the rural workforce (about 12 million Brazilians) is employed in small-scale, relatively unproductive family farming (IBGE, 2009). Agricultural production increased by 70% between 2000 and 2012 (MMA, 2015a), due to both enhanced productivity and, especially in the early 2000s, an expansion of land area devoted to crops and livestock. The density of livestock has increased along with livestock inventories; it was about twice the OECD average in 2013, but remains below many regions with more intensive livestock production (e.g. Korea and a number of European countries; see Annex 1.C).

Fertiliser and pesticide use in Brazil has intensified. National statistics reveal a strong increase in fertiliser consumption over 2000-10, both in absolute terms (+137%) (IBAMA, 2013) and per unit of agricultural area (Figure 1.12). Brazil is one of the world's largest consumers of fertilisers (after China, India and United States) (FAO, 2014). Fertiliser use is particularly high for certain crops, such as soya (Accioli and Monteiro, 2011). It is also higher in the South and South-east regions, where large-scale farming prevails, and has been associated with increasing pressures on water and soil quality.

Figure 1.12. **The use of agricultural chemicals is high and increasing**



a) Pesticides and similar products according to the Decree n. 4.074 of 4 January 2002.
Source: FAO (2014), *FAOSTAT* (database); IBAMA (2013), *Agrotóxicos e Afins -Histórico das Vendas - 2000 a 2012.*

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Pesticide consumption has increased even more strongly, by almost 200%, since 2000 (Figure 1.12). In 2010, pesticide sales amounted to USD 7.2 billion, 10% more than in the US market (Pelaez et al., 2013). Almost a third of pesticides consumed are considered dangerous or highly dangerous for the environment and several widely used substances have been identified as detrimental to pollinators, notably bees (IBAMA, 2013; MMA, 2015a). The widespread use of pesticides is associated with the practice of minimum-tillage and no-tillage farming. Alternative pest control practices, such as crop rotation and biological control, are rare, perhaps in part because a relatively large share of farmers (78%) have only finished elementary school (IBGE, 2012a). Low education may also explain why 20% of pesticide consumers do not use protective equipment when applying them.

The high use of agricultural chemicals, and notably the use of unauthorised pesticides, has become a public health problem. Such chemicals are second only to medical drugs as a cause of poisoning (MMA, 2010). A study revealed that 36% of food samples in 2011 and 29% in 2012 contained unauthorised pesticides and/or exceeded allowable amounts of pesticides (ANVISA, 2013).

Organic farming accounts for a very small share of agricultural output. The latest national agricultural census showed less than 2% of farms producing organically in 2006, 82% of which were family farms that might have used chemicals if they had had access to them (IBGE, 2012b). In 2014, about 7 200 registered establishments produced certified organic products (MMA, 2015a), or about 0.1% of total farms and less than 1% of agricultural land area (Figure 4.11).

5. Managing the natural asset base

5.1. Biodiversity

Brazil is the world's most biodiverse country, hosting about 10% to 12% of known species and more endemic species than any other country (CDB, n.d.). The world's fifth-largest country, it covers 47% of the South American continent's surface and extends about 7 500 km along the Atlantic coast. Owing to its size, its physical characteristics vary enormously, as do climate, vegetation and land-use patterns. Accordingly, it is typically divided into six large terrestrial ecosystems, or biomes:[14] Amazon, Cerrado, Caatinga, Atlantic Forest, Pantanal and Pampa (Box 4.1). The Atlantic Forest and Cerrado biomes are two of the world's 35 biodiversity hotspots (Chapter 4). Brazil also has vast coastal and marine areas: it hosts rich coral reef ecosystems and has the world's largest contiguous area of mangroves.

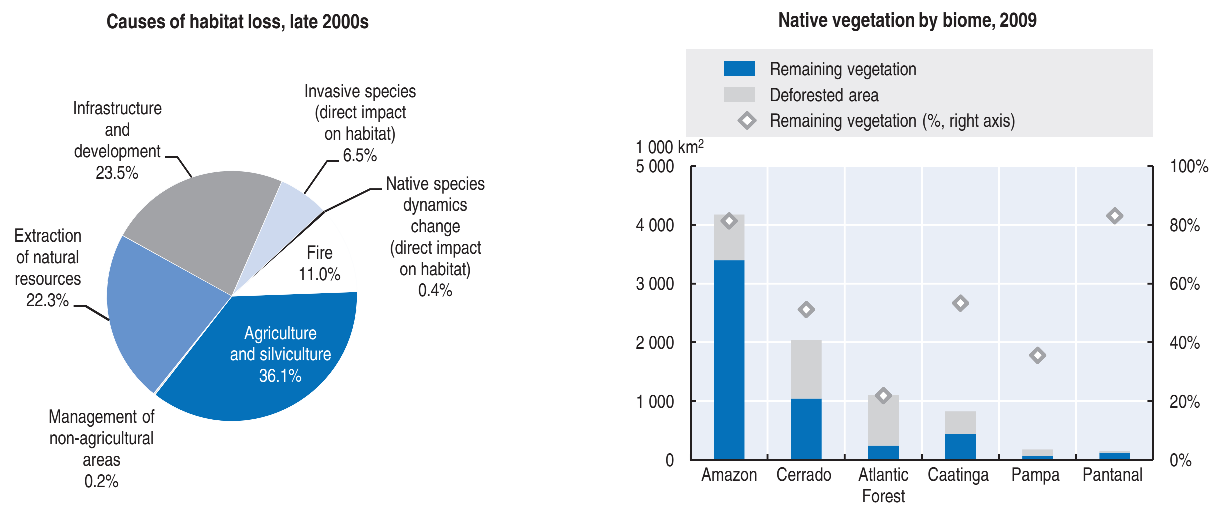
Despite past and current efforts to protect Brazil's natural wealth (Chapter 4), threats to biodiversity persist. Extension of agriculture and cattle farming, natural resource extraction, and infrastructure and development are the most significant causes of habitat loss (Figure 1.13). Unclear land tenure has historically exacerbated deforestation pressures, but the new Forest Code and its implementation mechanisms (notably the Rural Environmental Cadastre; see Chapter 4) promise to reduce illegal logging for land-titling purposes. Other threats to biodiversity include alien species and exotic diseases, overexploitation, pollution, fire and climate change (MMA, 2015a).

Forests and deforestation

Brazil's immense forest resources, 98.5% of which are native, include the world's largest rain forest (SFB, 2015). In 2012, 62% of the territory was covered with forests, double the OECD average (see Basic Statistics). Less than 1% of total forest area is used for timber production (SFB, 2013).[15] Brazil is a large producer and consumer of tropical timber: in 2007, the forestry sector accounted for 3.5% of GDP and 7.3% of exports, and employed about 7 million people (SFB, 2015).

About 70% of the total territory retains its original vegetation, in various degrees of conservation (MMA, 2010). The share varies widely across biomes, with the Amazon and Pantanal having more than 80% of their original vegetation and the Atlantic Forest biome, where nearly three-quarters of Brazilians live, about 20% (Figure 1.13).

Figure 1.13. **Vegetation cover has declined in some Brazilian biomes**



Source: Martinelli G. and M.A. Moraes (2013), *Livro vermelho da flora do Brasil*; MMA (2015), *Fifth National Report to the Convention on Biological Diversity*.

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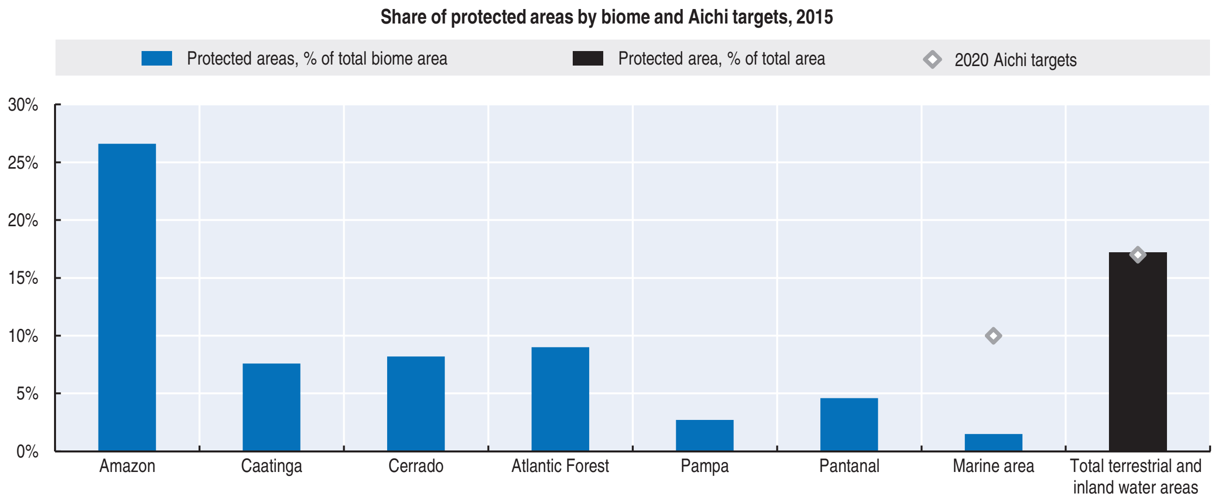
The area designated Amazônia Legal[16] was a deforestation hotspot in the 1990s and early 2000s, with deforestation peaks in 1994 and 2004, but is now recognised for successful large-scale deforestation control. A significant share of deforestation was due to illegal logging, with cleared land subsequently used for pasture (MMA, 2015a). In 2006, the government pledged to reduce deforestation in Amazônia Legal by 80% by 2020 (compared with the average of the previous ten years)[17] and has since considerably scaled up efforts to fight deforestation (e.g. creation of protected areas, land tenure regularisation, and enhanced monitoring, control and enforcement; see Chapters 4 and 5). This helped deforestation drop from 28 000 km^2 per year in 2004 to about 4 800 km^2 per year in 2014, by which time the deforestation rate was down by 75% (Figure 4.3) (INPE, 2015). Deforestation rates have also declined in other biomes in recent years. Pressures remain high in the Cerrado, however: it lost 0.4% of its total forest area in 2008-09 (IBAMA, 2015). Overall, total forest area has declined by about 5% since 2000.

Protected areas

One driver of the drop in deforestation was the rapid expansion of protected areas (Chapter 5). The number of official terrestrial protected areas (*unidades de conservação*) increased from 919 in 2000 to 1 940 in early 2015, or from 9% to 17.2% of the territory (MMA, 2015b).[18] Brazil achieved the Aichi target – protecting at least 17% of terrestrial and inland water areas by 2020, under the UN Convention on Biological Diversity – in 2010, well ahead of time. The coverage of protected areas varies across biomes, ranging from nearly 27% in the Amazon to 2.7% in the Pampa biome, and only 1.5% of marine areas are protected (Figure 1.14). In 2013, Brazil set a national target to protect 30% of the Amazon, 17% of other terrestrial biomes and 10% of coastal and marine areas by 2020.[19]

Figure 1.14. **A large share of Brazil's territory is under environmental protection**



Note: Officialy protected areas according to the National System of Protected Areas (SNUC).
Source: MMA (2015), *Cadastro Nacional de Unidades de Conservação.*

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In addition to the official protected areas, 13% of Brazil's territory (about 1.1 million km^2) is protected in about 600 indigenous lands, mostly located in the Amazon. Private landowners are required by law to set aside Permanent Preservation Areas (APPs) and Legal Reserves (RLs), in which original vegetation cover is maintained (Chapter 4). APPs cover 12% and RLs 30% of the territory, more than twice the area covered by official protected areas. While they have often not been respected in the past (Sparovek et al., 2010), the new Forest Code and its implementation mechanisms (Chapter 4) promise to increase effective conservation within these areas.

Terrestrial and marine species

The official list of threatened species, updated in 2014, counts more than 1 000 threatened fauna species and more than 2 000 threatened plant species (Chapter 4). The Atlantic Forest is the biome with the most threatened species, followed by the Cerrado and the Amazon. These are also the biomes with the most known species (IBGE, 2013). More than 400 marine and freshwater fish species are included in the 2014 official list of threatened species. Fishing and fish farming are the major pressure, followed by pollution from industrial, urban, agricultural and household waste, due in part to the high concentration of population and, in some areas, industry along the coastline (MMA, 2015a). Action on protection of threatened fauna species has increased: in 2012, about 50% of all threatened species were protected under a national action plan, compared with 4% in 2008 (MMA, 2014b).

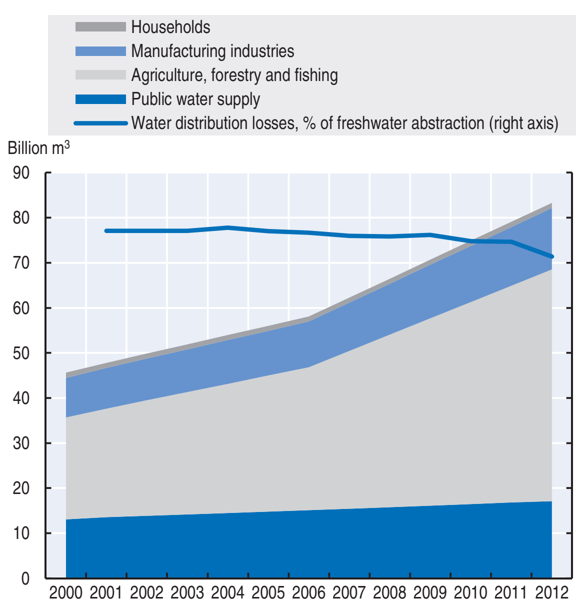
Catches of marine and freshwater fish grew by nearly 15% in 2000-13 (Annex 1.D). Fish catches increased by nearly 20% in inland waters and by about 13% in marine areas. Several coastal and inland fish stocks are fully exploited, or overexploited, as a result of overfishing, generally by industrial fisheries (FAO, 2013). In many cases, declining fish stocks are associated with resource conflicts between artisanal and industrial fishing and among fishing communities (MMA, 2015a).

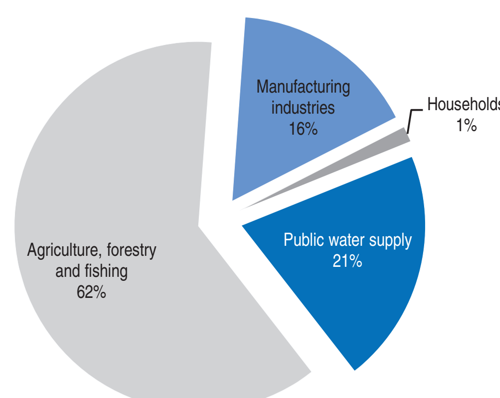
5.2. Water resources

Brazil is endowed with 12% of the world's freshwater resources and some of its largest water basins, including the Amazon, Paraná and São Francisco (ANA, 2013). Freshwater distribution is uneven, with the Amazon holding about 70% of freshwater resources. Annual per capita water availability varies from 1 460 m^3 in the semi-arid North-east region to 634 887 m^3 in the Amazon (GWP, 2013).

The size of Brazil's freshwater resources meant abstraction amounted to less than 1% of available freshwater in 2010, well below most OECD countries (ANA, 2013; also see Annex 1.D). However, water abstraction rose by more than 80% over 2000-12, reflecting population and economic growth. Agriculture is by far the largest user, accounting for more than 60% of abstraction in 2012 and more than 70% of the increase over 2000-12. Human and industrial water use, by contrast, increased only moderately (Figure 1.15). Losses in water distribution relative to total abstraction have decreased slightly since 2000 but still amounted to more than one-third of abstracted freshwater in 2012, and more than 50% in several northern and north-eastern states, primarily because of obsolete water supply and sanitation infrastructure. Per capita water consumption averaged 167 litres per day in 2013: it ranges from 126 litres in the North-east region to 193 litres in the South-east, reflecting differences in climatic conditions and consumption patterns (MCid, 2014). Overall, Brazil's yearly freshwater abstraction per capita is below the OECD average (see Annex 1.D and Basic Statistics), although with large regional variations.

Figure 1.15. **Water use, especially by agriculture, has increased considerably**





Source: OECD (2015), "Freshwater abstractions", *OECD Environment Statistics* (database).

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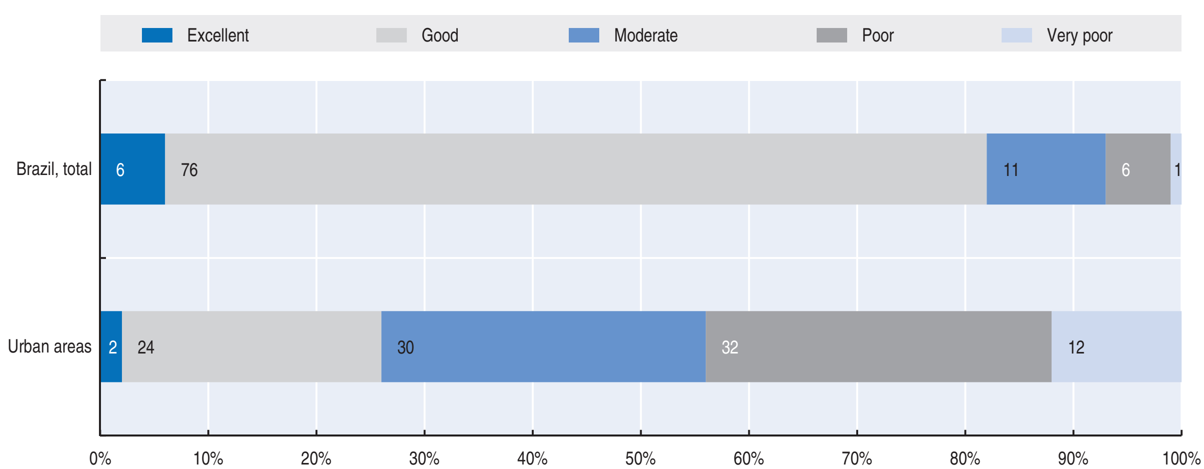
The balance between water supply and consumption is stable in most basins, but considered worrying, critical or very critical for almost 25% of freshwater resources due to scarcity (e.g. in the North-east) and extensive use (e.g. in the densely populated South-east) (ANA, 2013). In 2013 and 2014, high temperatures, low rainfall and years of inefficient water use caused severe water shortages in the South-east, notably in São Paulo state, with a severe impact on water supply and energy generation. About 4 million people, as well as industry and agriculture, were affected by water rationing and power cuts (The Guardian, 2015).

Water quality is good or very good in about 80% of water bodies but critical in many densely populated urban areas. The national water quality index showed 44% of urban monitoring sites recording poor or very poor quality in 2011 (Figure 1.16). This means water quality after conventional treatment is insufficient for public supply, requiring advanced treatment. The main problem affecting surface water quality is wastewater discharge, both treated effluent and domestic wastewater. The deterioration of water quality is usually related to increasing wastewater volumes, reflecting population growth and urbanisation, which were not matched by investment in wastewater collection and treatment systems (ANA, 2013; MMA, 2015a; also see Chapter 3). In 2012, only 39% of wastewater was treated (MCid, 2014) and only a fraction of that received treatment to remove phosphorus, hormones and antibiotics, which affect both ecosystems and human health. Other major pressures on water quality include mining, industrial effluent, diffuse flows from urban and agricultural soil drainage, and solid waste discharge.

Figure 1.16. **Water quality is critical in many urban areas**

Water quality index, 2011



Notes: Water quality index (IQA) calculated as weighted average of nine parameters. The index varies from 0 to 100. Water classes: "excellent" (≤79); "good" (51-79); "moderate" (36-51); "poor"(19-36); "very poor" (≤19). The last two categories (index values ≤ 36) refer to unsafe drinking water.
Source: ANA (2013), *Conjuntura dos Recursos Hídricos no Brasil.*

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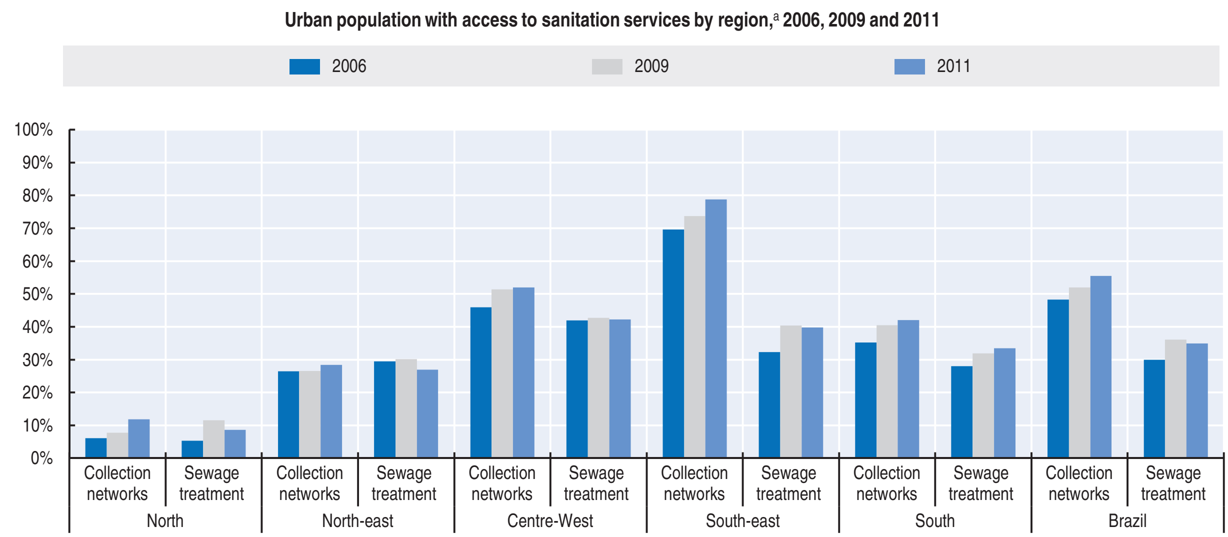
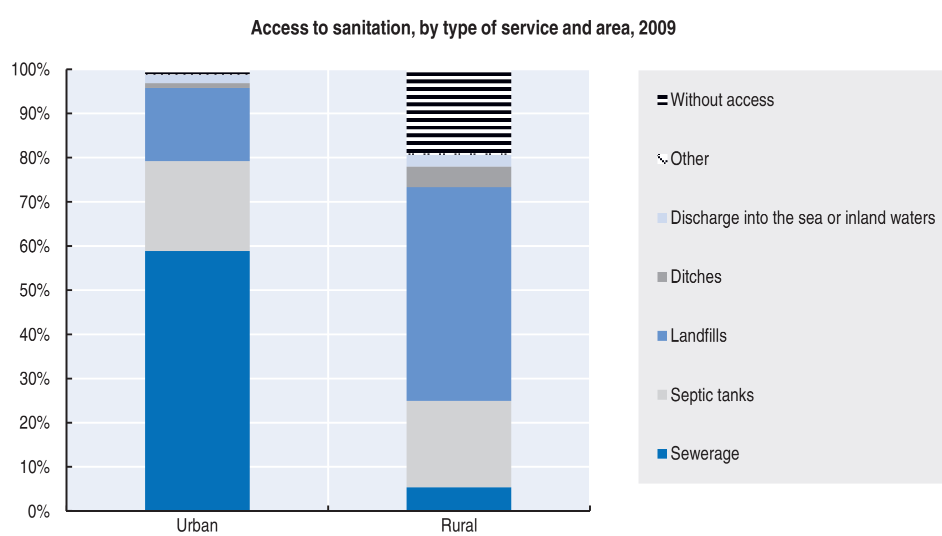
Access to clean water supply and sanitation

Brazil has made considerable progress in providing its citizens with water supply services. The share of the population with access to improved water sources increased from 88% in 1990 to almost 98% in 2012. Water supply in urban areas is almost universal, though 15% of the rural population still lacks access to an improved water source (Annex 3.A). The share of households connected to water pipe networks reached 94% in urban areas in 2013. Regional disparity is wide, however, with most of the urban dwellers still not connected to a water network found in the North-east region and, particularly, the North, where less than 60% are connected (MCid, 2014). Countrywide, only 24% of urban water supply networks are considered satisfactory; 33% need upgrading to meet quantity and/or quality standards and 43% need expansion to adequately meet projected demand increases (ANA, 2011).

Progress on sanitation has been somewhat slower. National estimates suggest that the share of urban population with access to a sewage collection network increased from 48% to 56% over 2006-11. Coverage rates are highest in the South-east region (79% of the urban population) and lagging in the North (12%) and North-east (28%) (MCid, 2014). The countrywide share of urban population with sewage treatment (through a network or local treatment) is even lower: 35% in 2011, up from 30% in 2006 (Figure 1.17). There is a wide disparity between urban and rural areas. Only 5% of households living in rural areas had

Figure 1.17. **Access to sewage collection networks and sewage treatment needs to be expanded**





a) Data refer to the share of urban population living in municipalities served by water supply services (93% of Brazil's total urban population in 2011, according to the SNIS).
Source: MMA (2014), *PNIA 2012: Painel Nacional de Indicadores Ambientais;* IBGE (2009), *Pesquisa Nacional por Amostra de Domicílios 2009.*

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access to sewage collection networks in 2009, compared to about 60% in urban areas; nearly 20% had no access to any form of sewage collection system (Figure 1.17).

Diseases related to inadequate sanitation decreased by more than 50% over 1993-2010 to 325 incidences per 100 000 inhabitants (IBGE, 2013), reflecting progress in expanding sanitation services. Not surprisingly, regional disparity is large, with 691 incidences in the North and 121 in the South-east, reflecting the overall sanitation service situation in the regions.

Recommendations on climate change policy and air, water and waste management

Climate change policy

- Rapidly implement the sectoral programmes to mitigate GHG emissions and speed up the development of the SMMARE system to monitor results; ensure that effective measures are replicated and scaled up.
- Further advance the development and implementation of the climate change adaptation plan with the involvement of all sectors, levels of government and stakeholders; ensure that the strategy adequately reflects economic, social and environmental impacts, including on biodiversity and water availability and quality.

Air pollution, water and waste management

- Develop an effective nationwide air quality monitoring system, with consistent methodologies and data collection across states.
- Establish consistent and compatible criteria for water allocation and ensure that wastewater discharge limits are set in accordance with use-based water quality standards.
- Strengthen solid waste management by:
  - better enforcing hazardous waste management regulations to eliminate the disposal of hazardous waste in municipal landfills without prior treatment;
  - establishing the National Solid Waste Management Information System, as required by law, and using it to facilitate implementation of “reverse logistics” programmes for key product waste streams.

Notes

1. Brazil is divided into five geographical regions: South-east, South, Centre-West, North and North-east. These regions enjoy no administrative or budgetary powers.
2. The homicide rate is one of the world’s highest: 21 murders per 100 000 inhabitants per year, compared to the OECD average of 2.2 (OECD, 2013c).
3. The Better Life Index is an interactive web-based tool created to engage people in the debate on well-being and, through this process, learn what matters most to them. The tool makes it possible to compare well-being across countries according to the importance that each participant attaches to a number of topics (community, education, environment, civic engagement, health, housing, income, jobs, life satisfaction, safety and work-life balance). The Better Life Index is part of the OECD Better Life Initiative, which aims to develop statistics that better capture aspects of life quality. See *www.oecdbetterlifeindex.org*.
4. In 2012, proven oil reserves stood at about 15.3 billion barrels and natural gas reserves at 450 billion m^3, with roughly 90% of both resources located offshore (ANP, 2013).
5. Conversion losses in hydropower are minimal, which makes it a much more efficient form of energy generation than fossil fuel combustion.

6. Land use, land-use change and forestry, as defined by the United Nations Framework Convention on Climate Change (UNFCCC), covers emissions and removals of GHGs resulting from direct human-induced LULUCF activities. LULUCF emissions as reported under the UNFCCC are net emissions, i.e. the sum of positive emissions to the atmosphere minus removals from the atmosphere through carbon sinks. Emissions to the atmosphere can occur through forest fires, conversion of forest to cropland and decomposition of aboveground biomass that remains after logging and deforestation. Removals from the atmosphere occur, for instance, through the extension of forest cover through afforestation and reforestation.
7. National data on GHG emissions, provided by the Ministry of Science, Technology and Innovation (MCTI), are not directly comparable to data provided by the International Energy Agency (IEA), owing to different accounting and estimation methods: IEA data include positive emissions from LULUCF but exclude carbon sequestration. MCTI data presents net LULUCF emissions (see note 6). In Brazil, GHG emissions from LULUCF are higher than removals, resulting in positive net GHG emissions in the LULUCF sector.
8. Brazil's commitment to reduce GHG emissions was set in Law 12.187/2009, which establishes the National Climate Change Policy. Projected BAU emissions and respective emission targets per sector are defined in Decree 7.390/2010.
9. Official GHG emission data are available until 2012. The Greenhouse Gas Emission System, a coalition of Brazilian think tanks and NGOs, provides unofficial annual data until 2013 (*www.seeg.eco.br*). Its estimates suggest that total Brazilian GHG emissions reached 1.57 tCO_2eq in 2013 – the highest emission levels since 2008. Emissions increased in all sectors, but most strongly from LULUCF and fossil fuel combustion.
10. Ethanol in fuel combustion produces less CO than gasoline and leads to lower NO_X and possibly PM_{10} concentrations, but results in greater emission of aldehydes and higher ground-level ozone.
11. PM concentrations refer to fine suspended particulates less than 10 microns in diameter (PM_{10}), which can penetrate deep into the respiratory tract, causing significant health damage. The state of a country's technology and pollution controls is an important determinant of PM concentrations. The estimates cited are urban population weighted PM_{10} levels in residential areas of cities with more than 100 000 residents. The estimates represent the average annual exposure level of the average urban resident to outdoor particulate matter.
12. DMC is the sum of domestic raw material extraction used by an economy and its physical trade balance (imports minus exports of raw materials and manufactured products).
13. There are significant data gaps for MSW management in Brazil. Various data sources are available for urban MSW, but methodologies and samples vary enormously, resulting in different and sometimes contradictory estimates. The two most important official data sources are the 2000 and 2008 National Surveys of Basic Sanitation, conducted by the Brazilian Institute of Geography and Statistics, and the annually updated National Sanitation Information System (SNIS), managed by the Ministry of Cities. Available data are hardly comparable, however, due to methodological difference and poor statistical bases (e.g. the SNIS relies on self-reported data from municipalities, but the number of municipalities participating is low and some of the data fed into the systems are inconsistent).
14. A biome is a large naturally occurring community of flora and fauna occupying a geographic region.
15. Includes national forests, states forests and forest plantations.
16. The Amazônia Legal super-region corresponds to an area larger than the Amazon biome, encompassing both the Amazonian forest (about 4.1 million km^2) and transitional vegetation (1 million km^2); the Amazon biome covers only the forest area. The Amazônia Legal takes in nearly nine states: Amazonas, Pará, Acre, Roraima, Rondônia, Amapá, Tocantins, and part of Mato Grosso and Maranhão.
17. The commitment to reduce deforestation was later incorporated into the National Climate Change Policy.
18. These numbers refer to protected areas officially designated under the National System of Protected Areas (SNUC). They do not include indigenous lands, protected area on private land (i.e. as requested under the Forest Code) and other areas that would qualify as protected area under international conventions.
19. The 2013 target expands the definition of protected areas to also include indigenous lands and areas under the Forest Code, including APPs and RLs.

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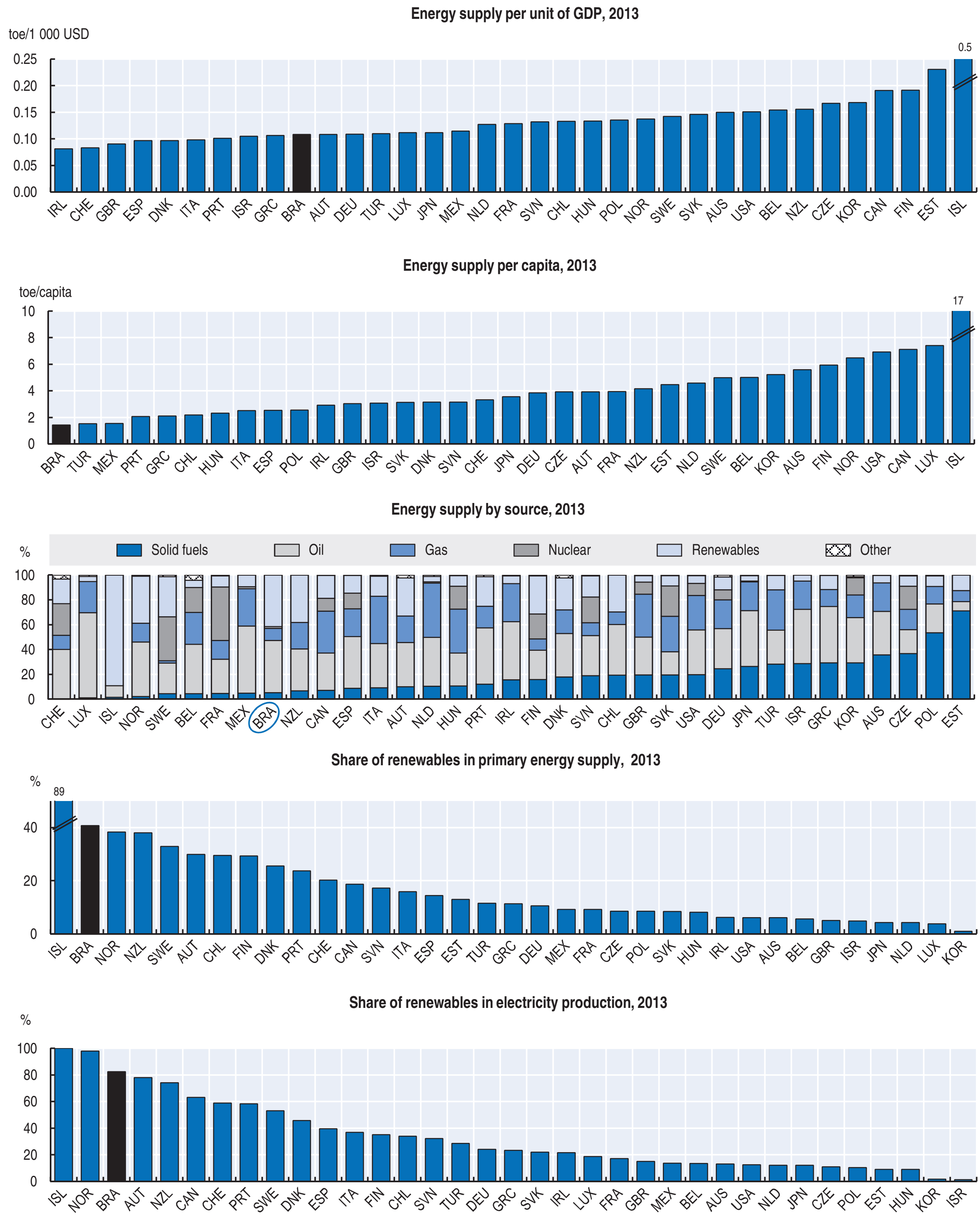
ANNEX 1.A

Energy and transport data

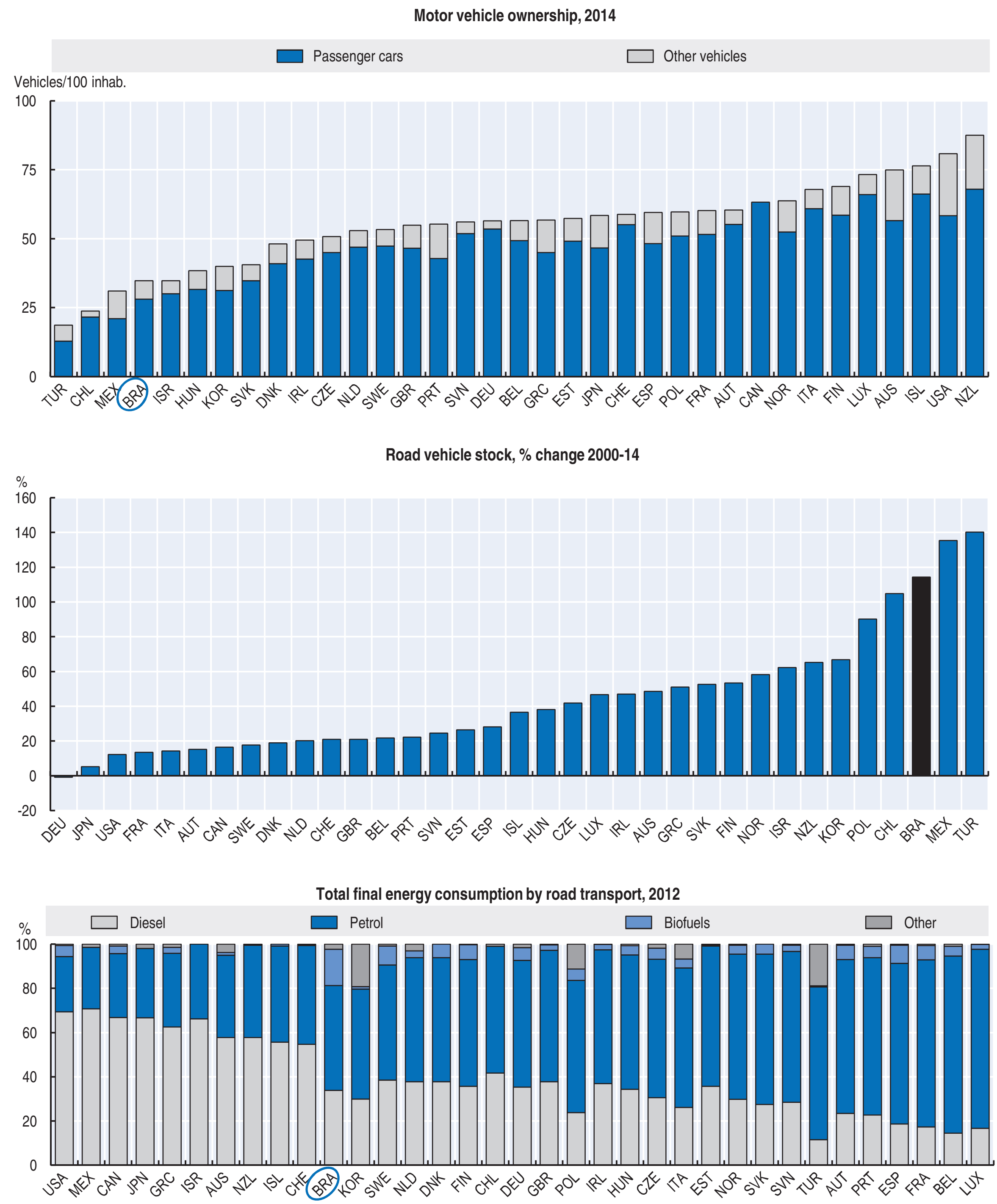
Figure 1.A1. **Energy structure and intensity**



Notes: Data for Brazil refer to 2012. Data may include provisional figures and estimates.
Total primary energy supply; the breakdown excludes electricity trade. GDP at 2005 prices and purchasing power parities.
Source: IEA (2014), *IEA World Energy Statistics and Balances* (database); OECD (2014), "OECD Economic Outlook No. 95", *OECD Economic Outlook: Statistics and Projections* (database).

StatLink http://dx.doi.org/10.1787/888933279845

Figure 1.A2. **Road transport**



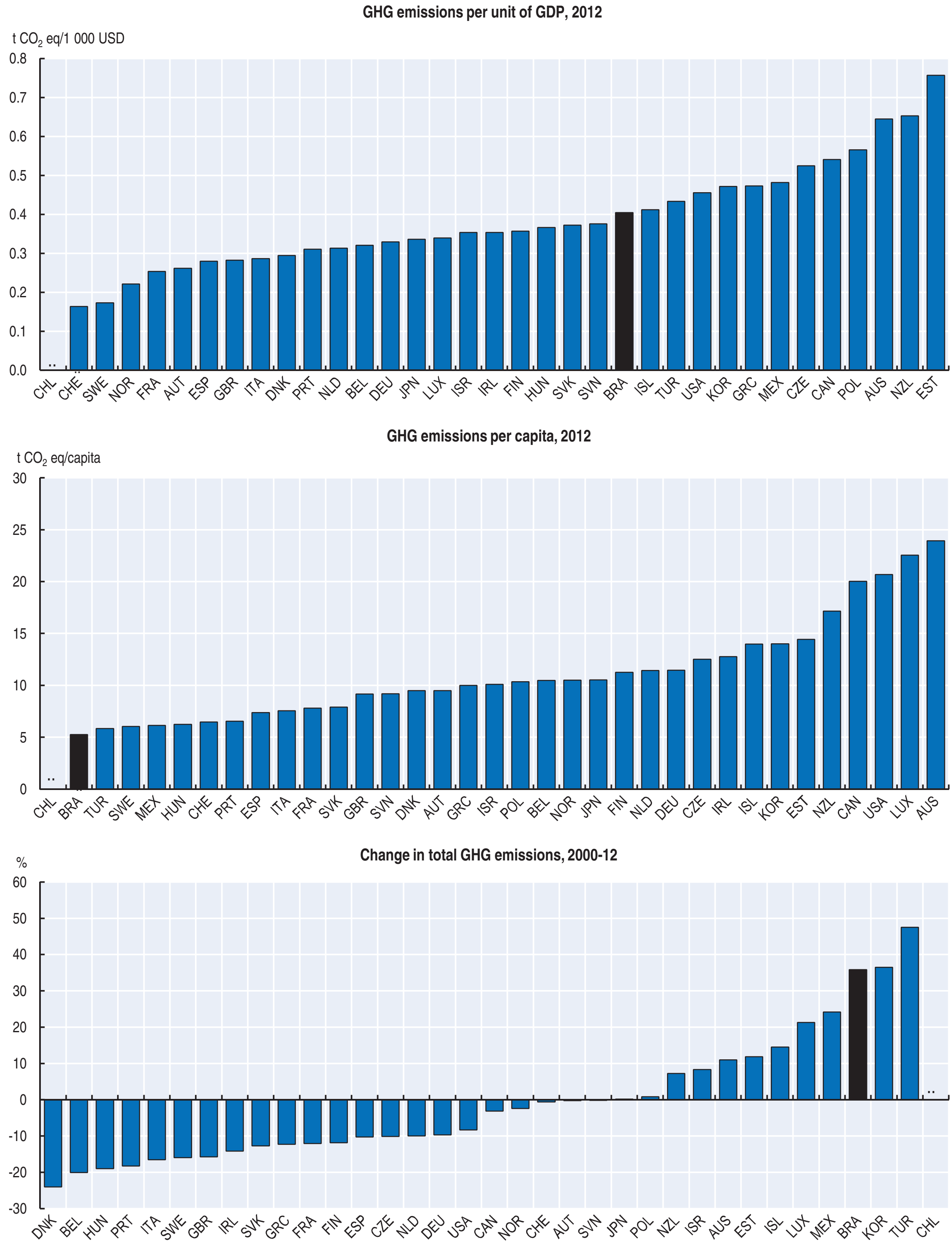
Notes: Data refer to the indicated year or to the latest available year. They may include provisional figures and estimates.
Vehicles: Motor vehicles with four or more wheels; Canada: data refer to total vehicles.
Source: IEA (2014), *IEA World Energy Statistics and Balances* (database); OECD (2015), *OECD Environment Statistics* (database).

StatLink http://dx.doi.org/10.1787/888933279855

ANNEX 1.B

Climate change and air pollution data

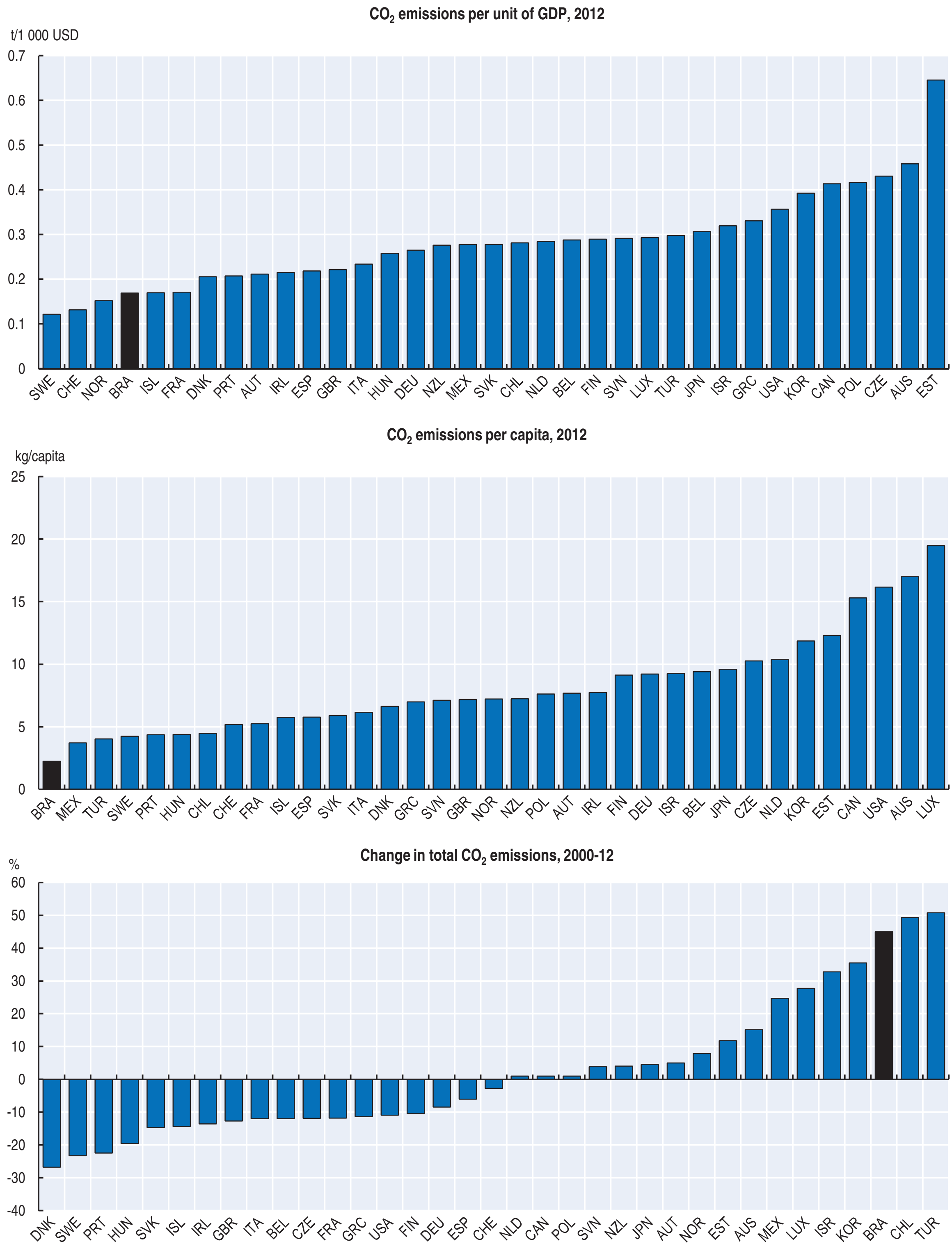
Figure 1.B1. **GHG emissions and intensity**



Notes: Data refer to the indicated year or to the latest available year. They may include provisional figures and estimates.
GHG emissions excluding emissions/removals from land use, land-use change and forestry. Israel: 2000 data exclude F-gases.
GDP at 2005 prices and purchasing power parities.
Source: OECD (2015), "Greenhouse gas emissions by source", *OECD Environment Statistics* (database); OECD (2014), "OECD Economic Outlook No. 95", *OECD Economic Outlook: Statistics and Projections* (database).

StatLink http://dx.doi.org/10.1787/888933279869

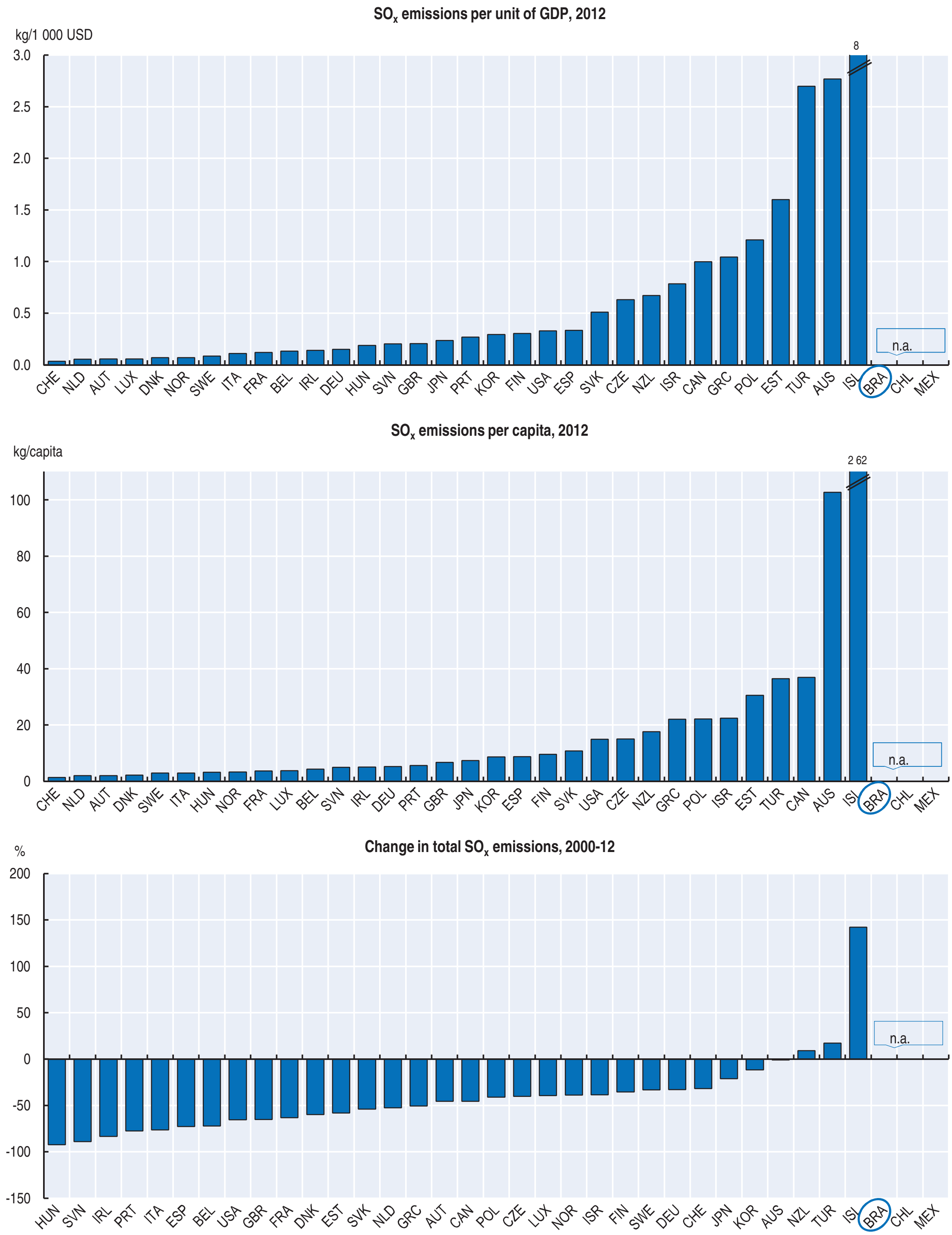
Figure 1.B2. **CO_2 emissions and intensity**



Notes: Data refer to the indicated year or to the latest available year. They may include provisional figures and estimates.
CO_2 emissions from energy use only; excluding international marine and aviation bunkers; sectoral approach. GDP at 2005 prices and purchasing power parities.
Source: IEA (2014), *IEA CO_2 Emissions from Fuel Combustion Statistics* (database); OECD (2014), "OECD Economic Outlook No. 95", *OECD Economic Outlook: Statistics and Projections* (database).

StatLink http://dx.doi.org/10.1787/888933279870

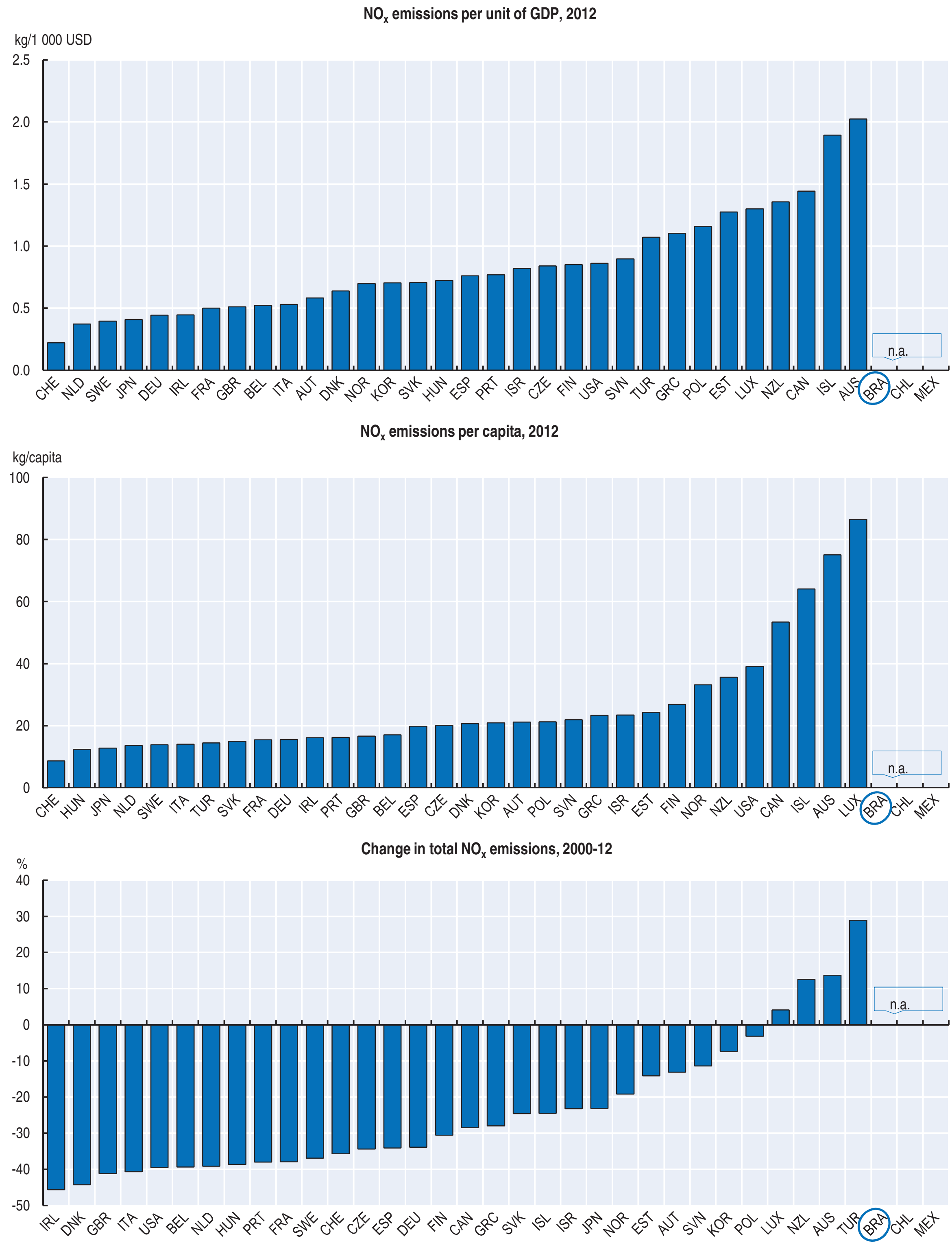
Figure 1.B3. SO_x emissions and intensity



Notes: Data refer to the indicated year or to the latest available year. They may include provisional figures and estimates.
GDP at 2005 prices and purchasing power parities.
Source: OECD (2015), "Air emissions by source", *OECD Environment Statistics* (database); OECD (2014), "OECD Economic Outlook No. 95", *OECD Economic Outlook: Statistics and Projections* (database).

StatLink http://dx.doi.org/10.1787/888933279885

Figure 1.B4. **NO_x emissions and intensity**



Notes: Data refer to the indicated year or to the latest available year. They may include provisional figures and estimates. GDP at 2005 prices and purchasing power parities.
Source: OECD (2015), "Air emissions by source", *OECD Environment Statistics* (database*);* OECD (2014), "OECD Economic Outlook No. 95", *OECD Economic Outlook: Statistics and Projections* (database).

StatLink http://dx.doi.org/10.1787/888933279896

Figure 1.B5. **$PM_{2.5}$ emissions and pollution**

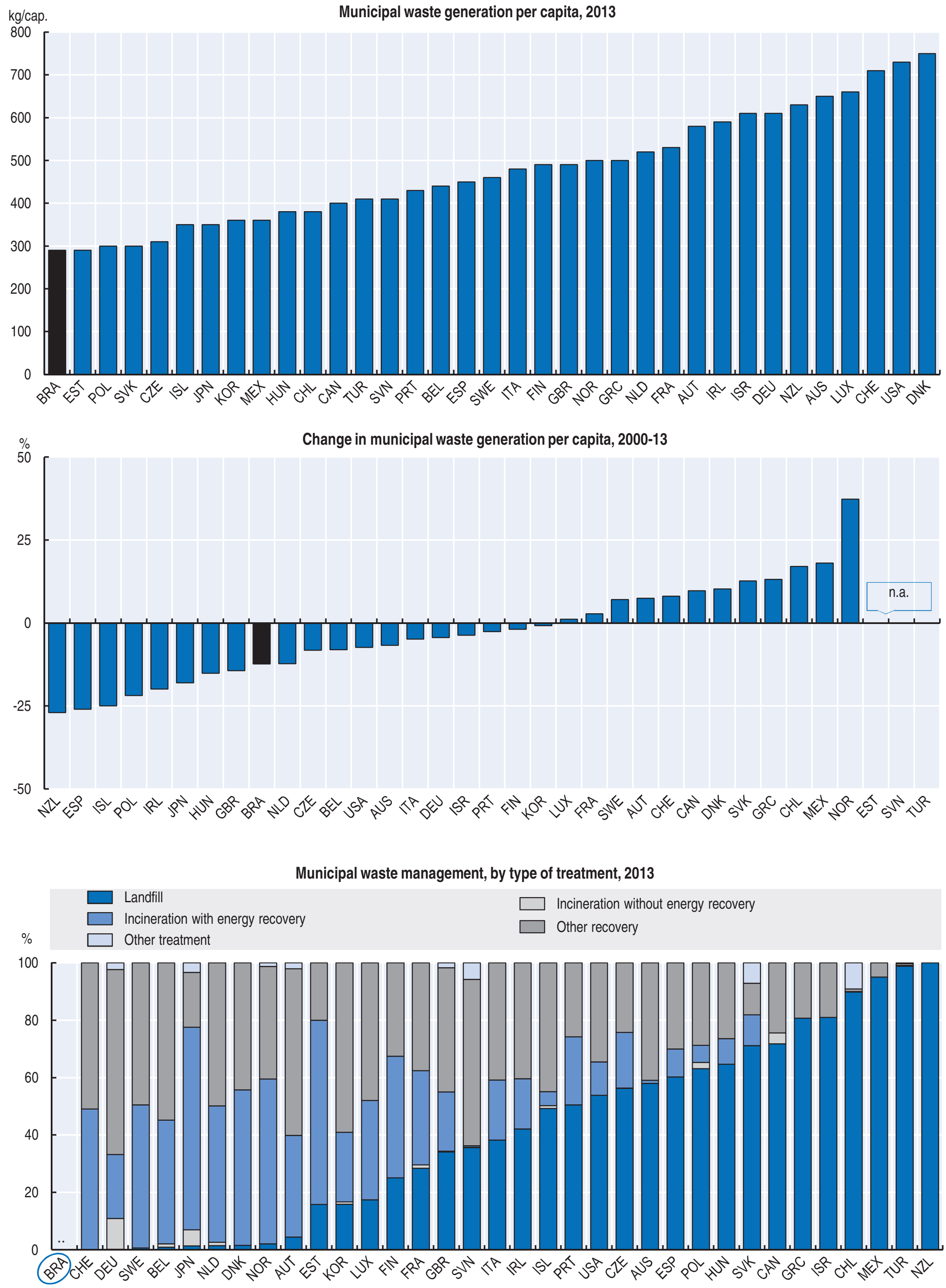
Notes: Data refer to the indicated year or to the latest available year. They may include provisional figures and estimates.
Population exposure to air pollution: estimated average exposure based on satellite imagery data; three-year average data.
Source: OECD (2015), "Air emissions by source", *OECD Environment Statistics* (database); OECD (2015), *OECD Regional Statistics* (database).

StatLink http://dx.doi.org/10.1787/888933279904

ANNEX 1.C

Waste and resource management data

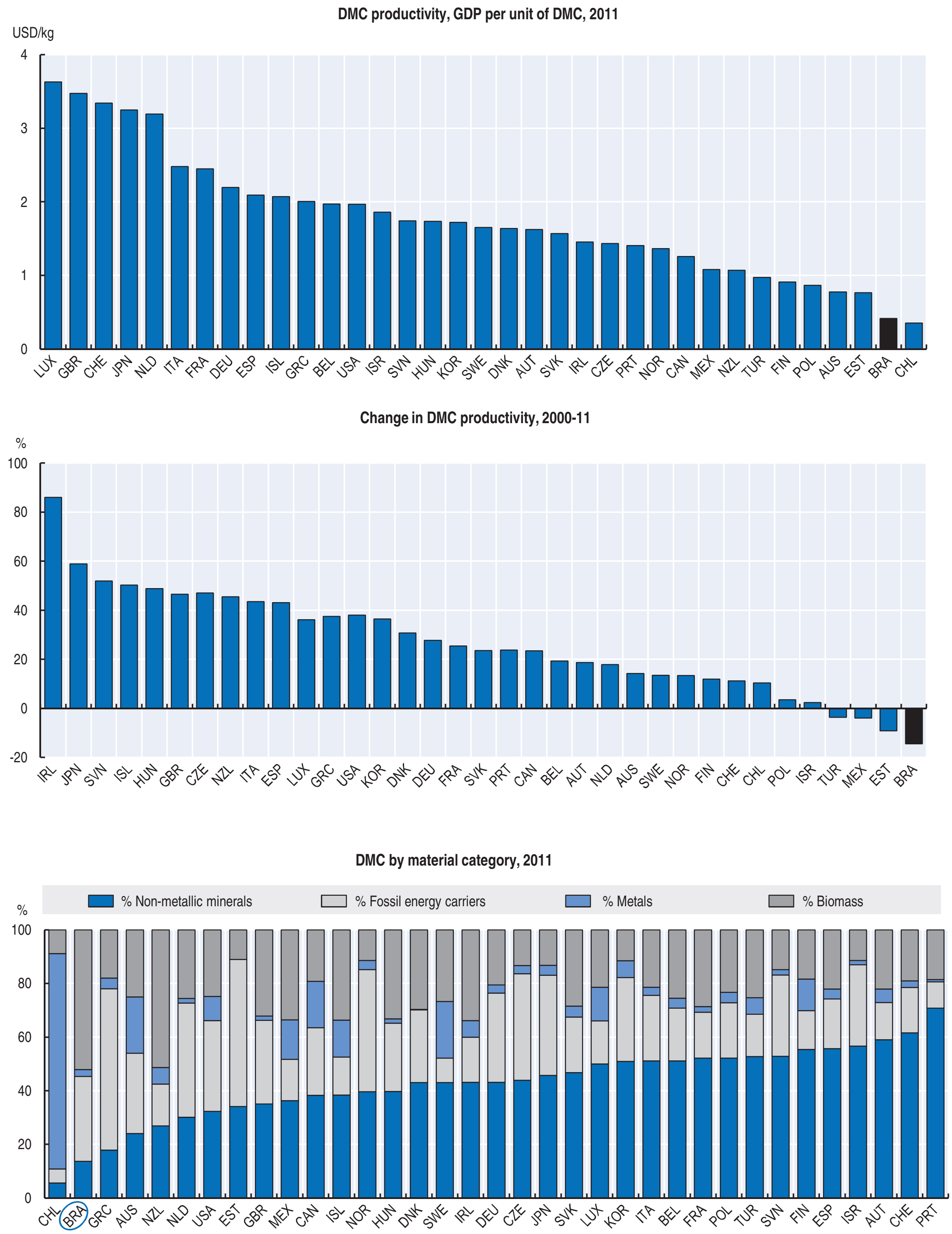
Figure 1.C1. **Waste generation and management**



Notes: Data refer to the indicated year or to the latest available year. They may include provisional figures and estimates. Amounts per capita are rounded.
Waste collected by or for municipalities. It includes household, bulky and commercial waste, and similar waste handled at the same facilities. It does not include municipal construction waste, nor waste sludges from municipal sewage treatment facilities.
Canada: household waste only and total incineration; New Zealand: landfilled waste only.
Source: OECD (2015), "Municipal waste", *OECD Environment Statistics* (database).

StatLink http://dx.doi.org/10.1787/888933279915

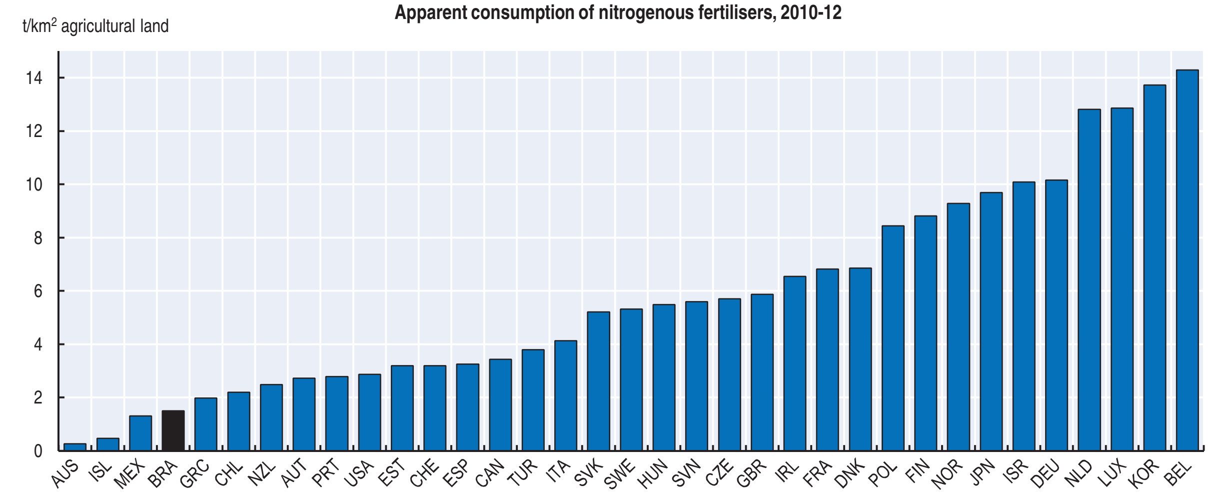
Figure 1.C2. **Material consumption and productivity**

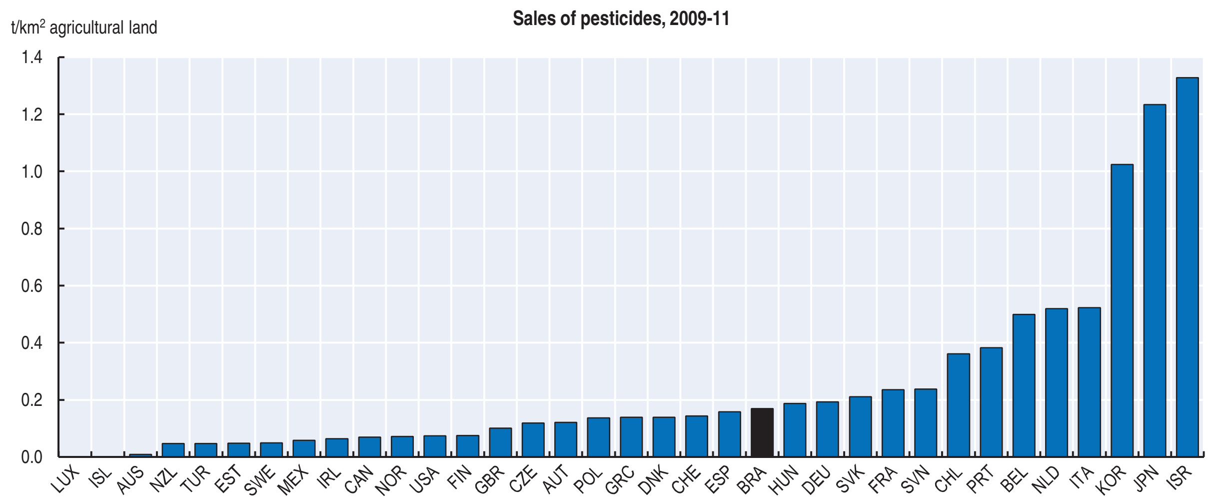


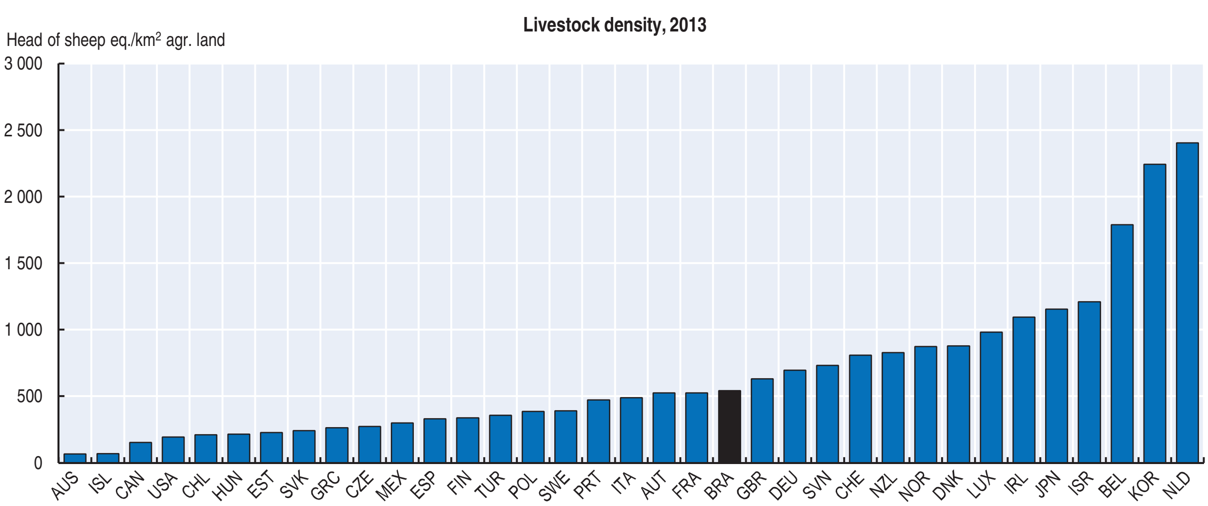
Notes: Data refer to the indicated year or to the latest available year. They may include provisional figures and estimates.
Domestic material consumption (DMC) equals the sum of domestic extraction of raw materials used by an economy and their physical trade balance (imports minus exports of raw materials and manufactured products). DMC productivity designates the amount of GDP generated per unit of materials used and is calculated as the ratio of GDP to domestic material consumption (DMC). GDP at 2005 prices and purchasing power parities.
Materials category: Non-metallic minerals: domestic extraction and trade of minerals used in industry and construction, plus trade of derived processed products; fossil energy carriers: coal, crude oil, natural gas, peat and traded-derived products; metals: domestic extraction of metal ores, plus trade of metal ores, metal concentrates, refined metals, products mainly made of metals, and scrap; biomass: domestic production from agriculture, forestry and fisheries, plus trade of raw and processed products from these sectors.
Source: OECD (2015), "Material resources", *OECD Environment Statistics* (database); OECD (2014), "OECD Economic Outlook No. 95", *OECD Economic Outlook: Statistics and Projections* (database).

StatLink http://dx.doi.org/10.1787/888933279927

Figure 1.C3. **Agricultural inputs and livestock density**







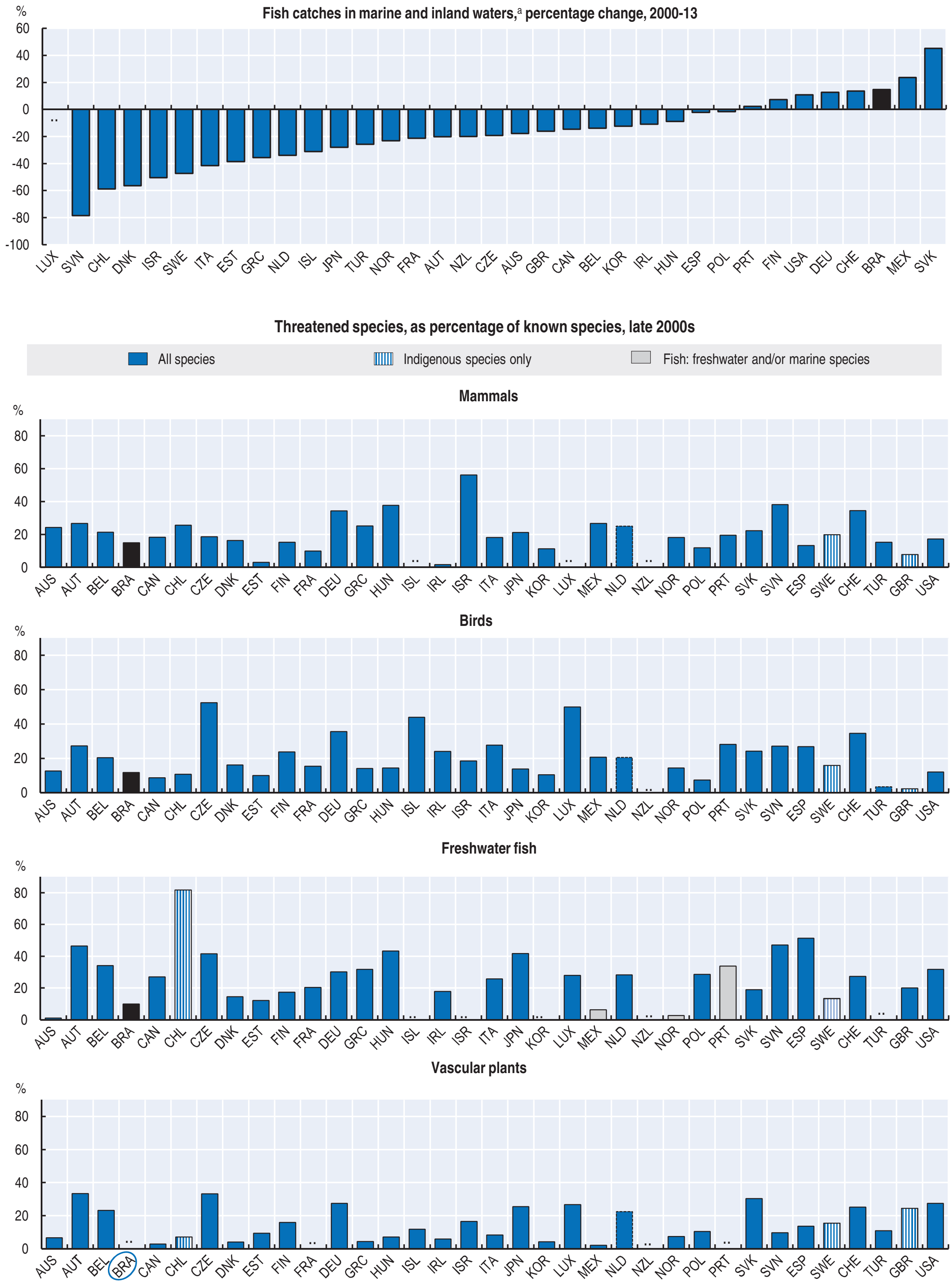
Notes: Data refer to the indicated year or to the latest available year. They may include provisional figures and estimates.
Source: FAO (2015), *FAOSTAT* (database); OECD (2015), *OECD Environment Statistics* (database).

StatLink http://dx.doi.org/10.1787/888933279935

ANNEX 1.D

Biodiversity and water data

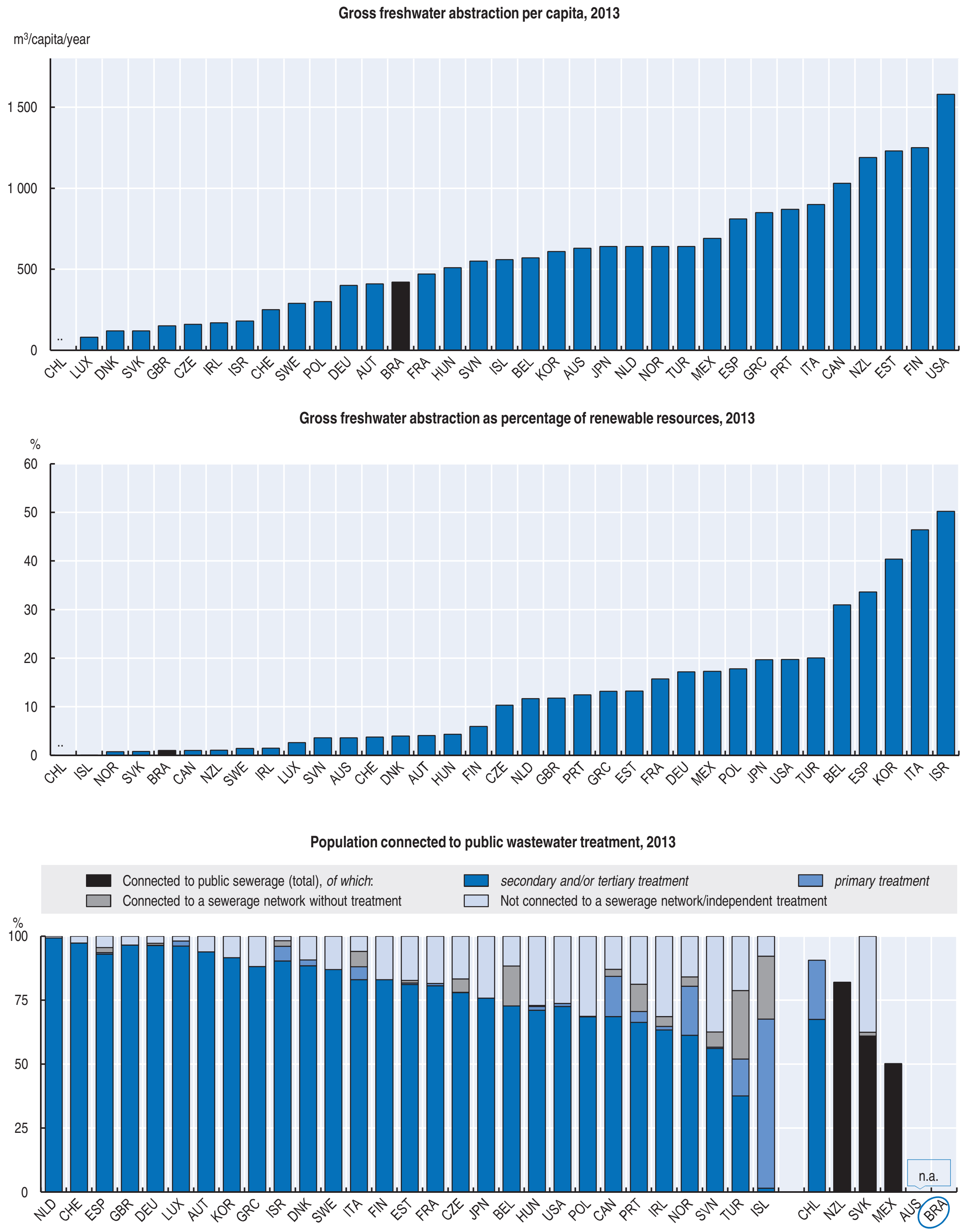
Figure 1.D1. **Fish catches and threatened species**



Notes: Data refer to the indicated year or to the latest available year. They may include provisional figures and estimates.
a) Includes fish, crustaceans, molluscs and other aquatic animals. Excludes marine mammals, crocodiles and alligators, and miscellaneous aquatic products.
Source: Chico Mendes Institute for Biodiversity Conservation (ICMBio) (2015), "Espécies Ameaçadas – Lista 2014" [Endangered species list 2014]; FAO (2015), *Global Capture Production* (database); MMA (2015), *Fifth National Report to the Convention on Biological Diversity*; OECD (2015), "Threatened species", *OECD Environment Statistics* (database).

StatLink http://dx.doi.org/10.1787/888933279943

Figure 1.D2. **Water abstraction and wastewater treatment**



Notes: Data refer to the indicated year or to the latest available year. They may include provisional figures and estimates. United Kingdom: England and Wales only.
Freshwater abstraction: for some countries, data refer to water permits and not to actual abstractions. Amounts per capita are rounded.
Source: OECD (2015), "Water: Freshwater Abstractions", "Wastewater Treatment (% Population Connected)", *OECD Environment Statistics* (database).

StatLink http://dx.doi.org/10.1787/888933279958

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