Environmental Data

2024

LANDESAMT FÜR UMWELT,
LANDWIRTSCHAFT
UND GEOLOGIE

Freistaat
SACHSEN

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Foreword

The Environmental Data brochure has been published annually since 2010 and provides information on key environmental topics in Saxony, such as climate, nature conservation, soil, air, as well as surface and groundwater, along with their developments.

This year, as in previous editions, the impacts of climate change form a key focus of the brochure. The continuing rise in average temperatures, changes in precipitation and increasing extreme weather events are clear signs of climate change in the Free State of Saxony. The changes it brings have far-reaching consequences for the environment, society and the economy. For example, the earliest start of apple blossoming since records began was recorded at the Dresden-Pillnitz site in 2024.

A key factor linked to climate change, and particularly to climate protection, is the development of greenhouse gas emissions, especially CO_2. In Saxony, CO_2 emissions have stagnated at a constant level since 2002. This demonstrates the urgent need for substantial efforts, particularly in light of the ambitious climate protection goals. One important element will be the continued expansion of energy generation from renewable sources. Geothermal energy, with an annual growth rate of approximately 900 new installations in recent years, can serve as a meaningful contribution in this regard.

There have been positive developments in many of the areas of environmental protection highlighted in this brochure. However, there are also pressing, immediate challenges, such as adapting to climate change or preserving biodiversity, which are revealed by the environmental data.

The diagrams and their accompanying descriptions in this brochure provide information and make it clear that further efforts are necessary to meet the high demands of nature conservation, environmental protection, and climate protection.

Current and further information on the environment is available at: **www.umwelt.sachsen.de.**

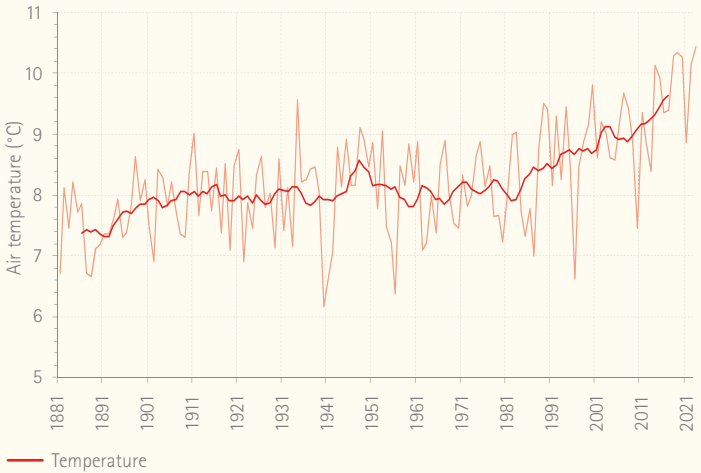
Heinz Bernd Bettig
President of the Saxon State Office for the Environment, Agriculture and Geology

Development of climate conditions in Saxony

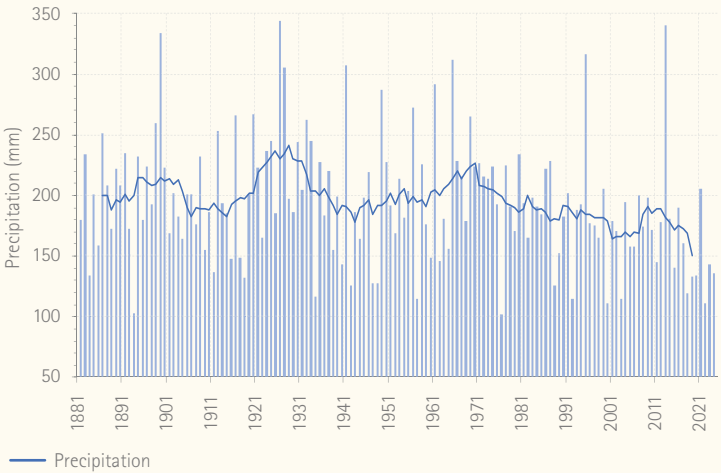
The charts show the annual mean air temperatures and total precipitation during growing season I (April–June) in the Free State of Saxony for the period from 1881 to 2023/2024. A clearer representation of long-term trends is achieved using an 11-year moving average, since this is less dependent on individual years. A suitable representation of climate change is made possible by the temporal development of air temperature. Higher temperatures lead, among other effects, to an extension of growing seasons and are accompanied by weather-related extremes (e.g., heat, drought) and the associated risks. Since 1971, each decade has been warmer than the previous one. Since the end of the 1980s / beginning of the 1990s, there has been a noticeable accumulation of the warmest years in Saxony. With an average of 10.4 degrees Celsius, 2023 was the warmest year since 1881. The nine warmest years on record have all occurred since the turn of the millennium.

Compared with temperature, precipitation is quite heterogeneous with respect to its spatio-temporal occurrence. A decrease in rainfall during growing season I has slowed the growth of the plants and increased the risk of crop failure. Especially in combination with rising temperatures, this is increasingly affecting agriculture, among other things. Since 1971, each decade has been drier than the previous one. However, Saxon farmers have been able to adapt to the changing conditions through improved water management. The measures range from the selection of certain crop varieties and types to adjusting soil cultivation and fertilisation methods, as well as irrigating certain crops and adjusting crop rotations.

Annual mean temperature in Saxony, 1881–2023
(11-year moving average)



Precipitation in growing season I (April to June) in Saxony, 1881–2024
(11-year moving average)



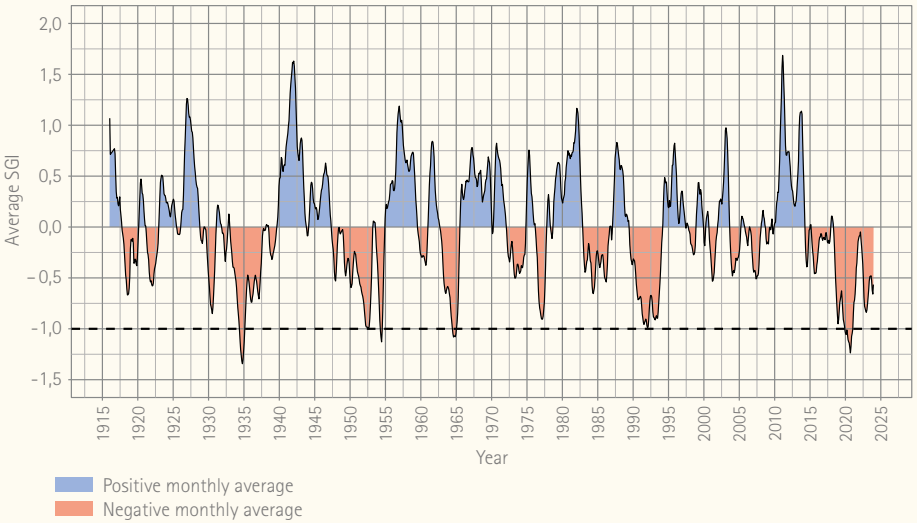
Source: Saxon State Office for the Environment, Agriculture and Geology, German Meteorological Service (DWD), 2024

Standardised Groundwater Index (SGI)

The SGI is a tool used to represent groundwater droughts as well as wet and dry years, analogous to other related indices. The diagram displays the 6-month moving average of the calculated SGI from Saxony's groundwater monitoring network from 1916 through to the end of the 2023 hydrological year. Only groundwater monitoring stations with a measurement series of at least 30 complete hydrological years were included.

The most recently observed groundwater drought is comparable to that from 1929 to 1938, during which a historical low of –1.48 was recorded in July 1934. In August 2020, similar values of up to –1.37 were reached. This is primarily due to the most recently observed groundwater drought, lasting from 2014 to 2023.

Standardised Groundwater Index (SGI) – 6-month moving average



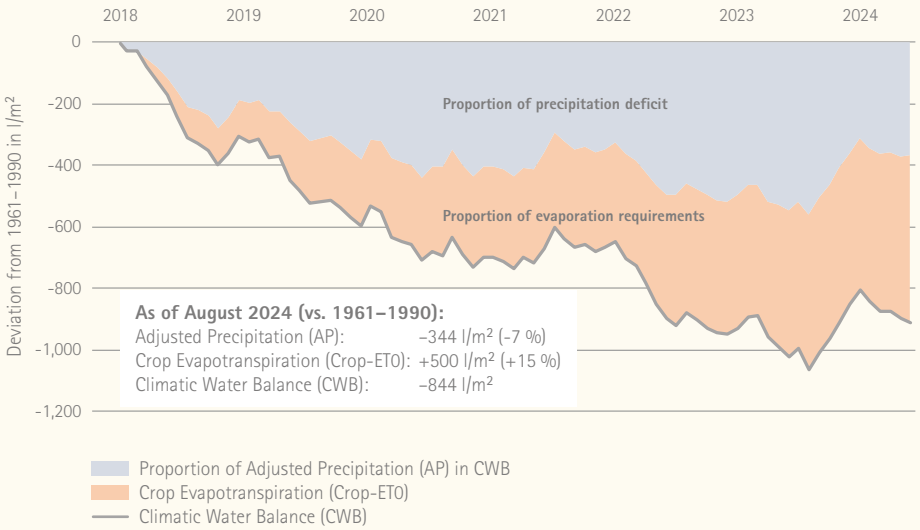
Source: Saxon State Office for the Environment, Agriculture and Geology

Development of the climatic water balance

The climatic water balance directly relates the precipitation that has fallen (gain) to the evaporation (loss) and is thus a measure of the susceptibility of various environmental systems to the development of drought conditions. Since November 2017, a cumulative deficit of the climatic water balance of about 844 l/m² has arisen in the Free State of Saxony over the five subsequent years.

The illustration highlights the cumulative water deficit, which is caused partly by below-average rainfall and partly by above-average evaporation due to higher temperatures. The direct consequences of this can be seen, for example, in the widespread below-average groundwater levels or the increasing forest damage.

Development of the climatic water balance in the Free State of Saxony

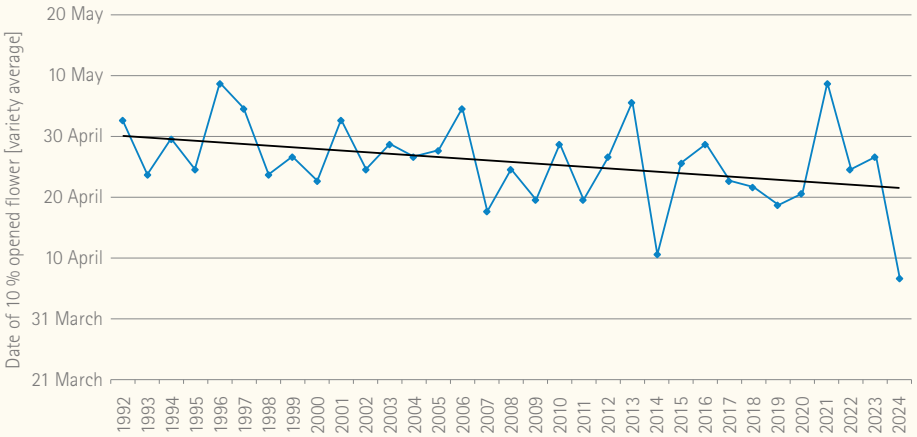


Source: Saxon State Office for the Environment, Agriculture and Geology

Beginning of the fruit tree flowering period

The day when about 10 % of the flowers are open marks the beginning of the fruit tree flowering period. For the representation used here, an average value across all observed varieties is calculated. The start of flowering also signals the beginning of fruit development and thus the growing season that is critical for fruit cultivation. The beginning of flowering serves as an indicator of climate change. The data of the Saxon State Office for Environment, Agriculture and Geology (LfULG) presented here show a slight trend towards a possible earlier beginning of flowering and thus an extension of the growing season. This improves overall cultivation opportunities for plants requiring a high degree of warmth while simultaneously increasing the risk of late frost damage. In 2024, the earliest recorded beginning of flowering since records began was documented at the Dresden-Pillnitz site.

Mean beginning of apple flowering in Dresden-Pillnitz 1992–2024

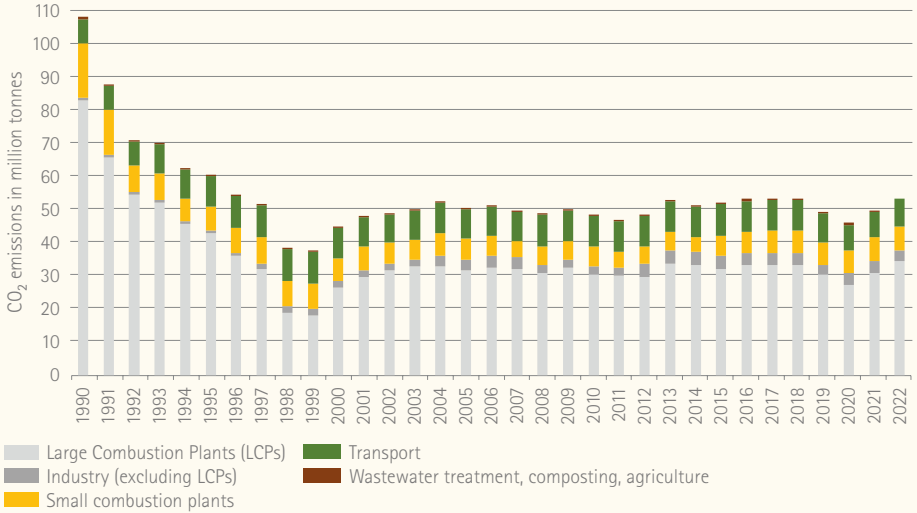


Source: Saxon State Office for the Environment, Agriculture and Geology, German Meteorological Service

Greenhouse gases

Carbon dioxide emissions (CO_2) account for over 90 % of total greenhouse gases, which, through their accumulation in the atmosphere, accelerate climate change. Large combustion plants (major industrial facilities for power and heat generation) remain the primary contributors. The decline in the 1990s was brought about by the closure of many plants. The increase at the beginning of the 2000s is due to new power plant units. Since 2002, carbon dioxide emissions have stabilised. The decrease in 2019 and 2020 was due not only to the impact of the coronavirus pandemic but also to decommissioning measures at the Lippendorf lignite power plant.

Development of CO_2 emissions in Saxony from 1990 to 2022

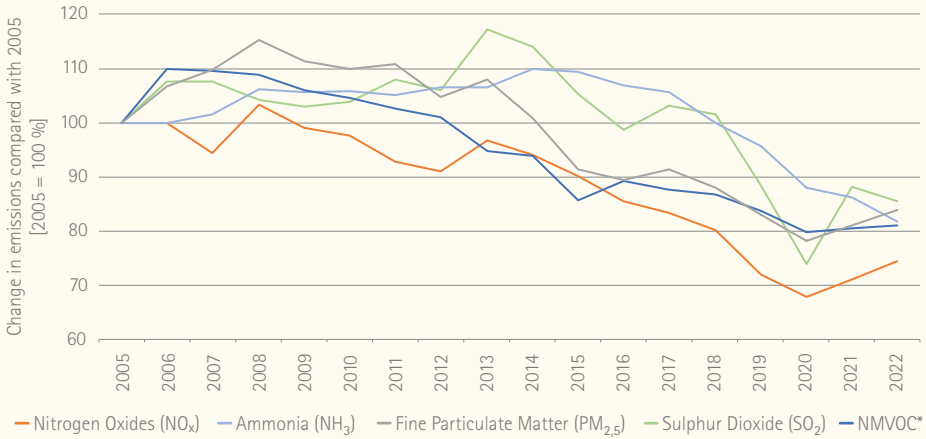


Source: Saxon State Office for the Environment, Agriculture and Geology, German Meteorological Service, as of 06/2024

Air pollutant emissions

Air pollutants can trigger a wide range of negative effects on both humans and the environment. From 1990 to 2000, emissions of air pollutants in the Free State of Saxony were significantly reduced (not shown). This was primarily due to the economic restructuring in eastern Germany during the 1990s. Since 2000 or 2005, the base year of the National Emission Reduction Commitments Regulation (43rd BImSchV), the reductions achieved have been smaller. By 2022, emissions had decreased by between 15 % for sulphur dioxide and 26 % for nitrogen oxides compared to 2005 levels. The reduction in sulphur dioxide emissions in 2020 can be attributed to the decommissioning measures at the Lippendorf lignite power plant.

Emissions of air pollutants in Saxony according to 43. BImSchV



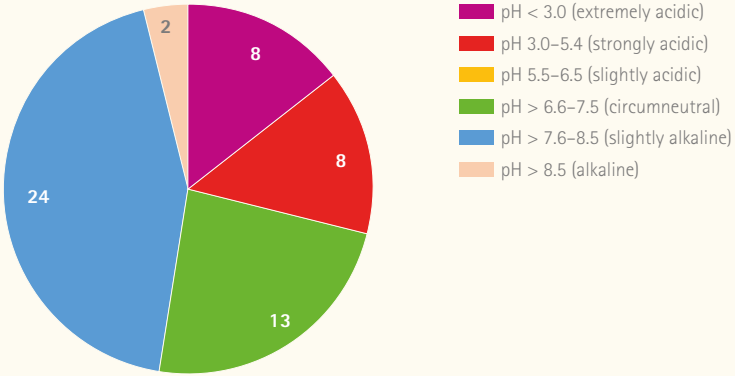
*NMVOC = Non-Methane Volatile Organic Compounds
NO_x and NMVOC emissions from agriculture are not considered according to the accounting framework of the 43rd BImSchV.

Source: Saxon State Office for the Environment, Agriculture and Geology, German Meteorological Service, as of 06/2024

Acidification levels of post-mining lakes

Lignite has been mined in Saxony for over 150 years. The reclamation of the areas affected by mining poses a significant challenge. The residual pits from open-cast mines are flooded, forming post-mining lakes. These lakes are often burdened with acidity, iron and/or sulphate due to previous pyrite weathering. Overall, however, there is a trend towards improving water quality in these lakes. Of the 55 post-mining lakes with a water surface area of more than 10 hectares, approximately three-quarters had neutral or slightly alkaline water, while about one-quarter remained slightly to extremely acidic by the end of 2023.

Saxony total

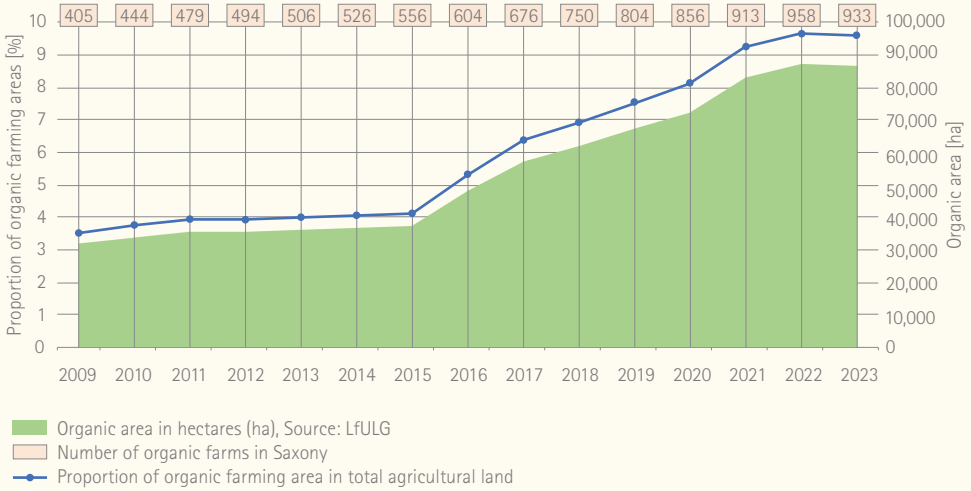


Source: Saxon State Office for the Environment, Agriculture and Geology, Lusatian and Mitteldeutsche Bergbau-Verwaltungsgesellschaft mbH

Organic farming

Before 1994, the proportion of land used for organic farming was one per cent. In the years that followed, and especially after 2015, there was a significant increase. This is likely due to the increase in organic farming subsidies from 2016 onwards. In addition, producer prices for non-organic products were volatile during this period. Sales of organic products increased due to the trend towards food that is largely free of undesirable residues and associated with greater animal welfare. Russia's invasion of Ukraine in 2022, which is ongoing, led to an energy crisis and price inflation, among other effects. Under these conditions, some farmers abandoned organic production. In 2023, the number of organic farmers and the area under organic cultivation stabilised.

Organic farming in Saxony

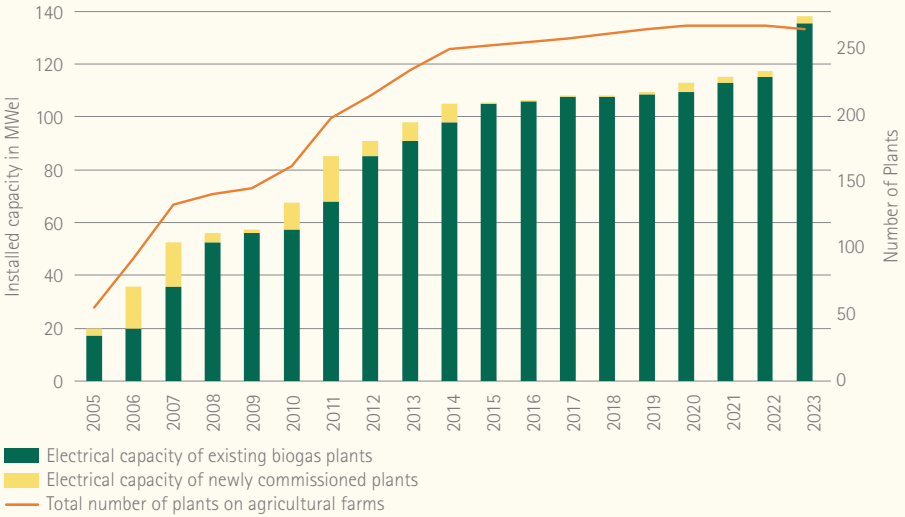


Source: Reports from private organic control bodies, Saxon State Office for the Environment, Agriculture and Geology

Biogas plants on agricultural farms

Biogas plants generate electricity, heat and renewable fuels from agricultural residues, waste materials and renewable raw materials. In Saxony, slurry is predominantly used as a feedstock (>70 %). The fermentation of slurry reduces greenhouse gas emissions compared to the storage of untreated slurry. The proportion of maize used as a substrate is below the national average. In addition to maize, other renewable raw materials such as grasses, silphium perfoliatum or whole cereal crops are also used for biogas production. Biogas plants can compensate for fluctuations in wind and solar energy because they provide controllable and storable energy. The installed capacity of the 266 agricultural biogas plants in Saxony currently amounts to 137 megawatts.

Biogas plants on agricultural farms

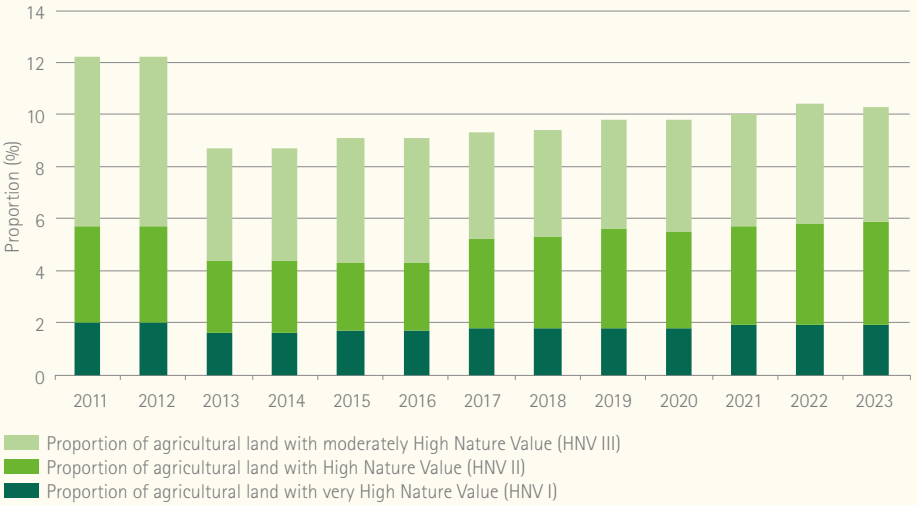


Source: Saxon State Office for the Environment, Agriculture and Geology (no guarantee of completeness, data as of 04/2024)

Agricultural land with High Nature Value

In agricultural landscapes, near-natural landscape elements and extensively used areas are of outstanding importance for biodiversity. This indicator measures the proportion of agricultural land with High Nature Value (HNV) relative to the total agricultural area. Long-term monitoring allows the effects of fundamental changes in land use and landscape structure (e.g., through intensification) on biodiversity to be assessed. In Saxony, the proportion of HNV farmland was already below the target value of 19 % set for Germany in 2015, standing at approximately 12 % in 2011. From 2012 to 2013, it dropped significantly by about 30 %, falling to below 9 %. Since 2013, there has been a slight upward trend from this low level. The current value for 2023 is 10.3 %.

Agricultural land with High Nature Value



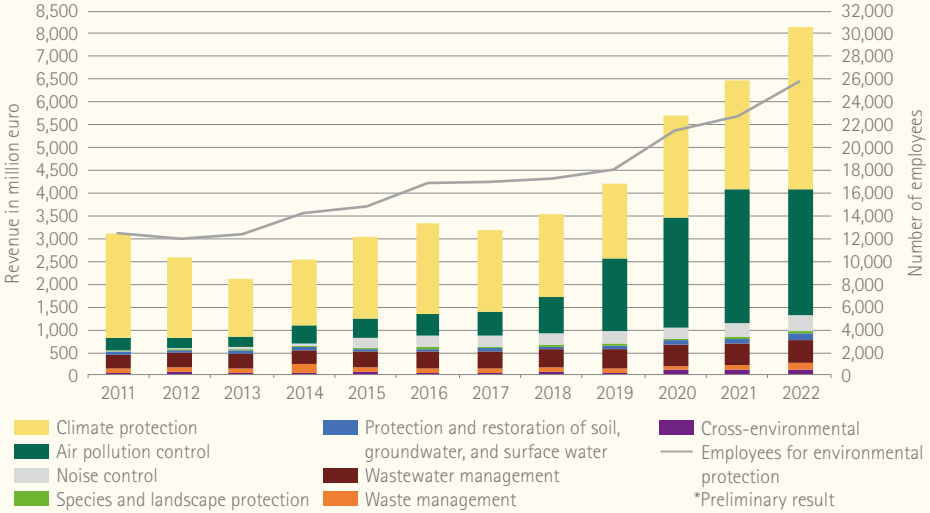
Source: Saxon State Office for the Environment, Agriculture and Geology

Environmental economy

The environmental economy has become an integral part of Saxony's overall economy in recent years. Nearly 23,000 people are now employed in this sector, and a significant increase in revenues for environmental protection has been observed. Most areas of the environmental economy show sustained positive trends in both revenue and employment. In recent years, revenues have risen particularly in the areas of climate protection and air quality improvement.

Since the 2019 reporting year, revenues from storage technologies for electromobility are no longer classified under climate protection but are instead attributed to air quality improvement. As a result, a considerable proportion of revenue has shifted between the environmental sectors compared with the previous year.

Revenue and employees for environmental protection in Saxony



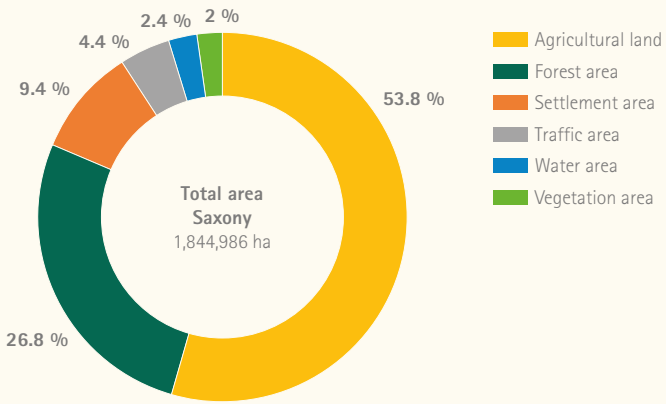
Source: Statistical Office of the Free State of Saxony

Land use in Saxony

The percentages for the main types of land use in 2023 are shown. Land use changes in the Free State of Saxony are dynamic. While agricultural land, at 53.8 %, is continuously shrinking, settlement and transport areas, at 13.8 %, are still increasing. Forest and vegetation areas account for 28.8 % of the state's total land area, and water bodies have grown to 2.4 %.

All types of land use are affected by new land consumption for construction activities. These changes impact all types of land use. However, the changes are rarely measurable because measures related to new land consumption or soil de-sealing often occur within the same land use type and are not reflected in land use statistics.

Land use in Saxony

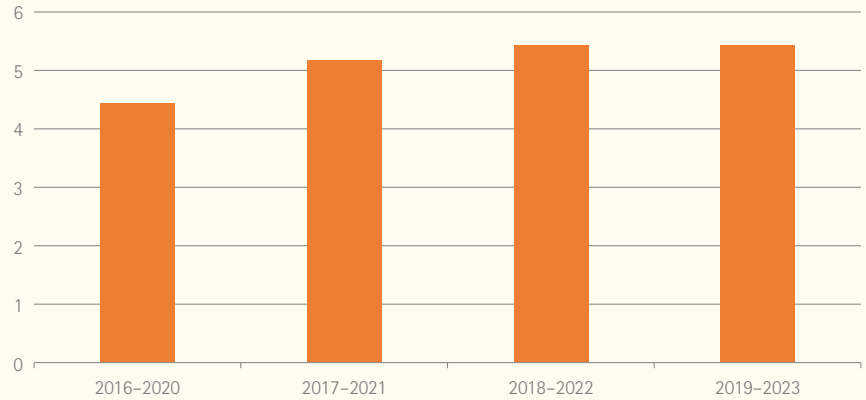


Source: Statistical Office of the Free State of Saxony

Sealing – development of settlement and transport areas

For years, the trend of consuming natural soils for settlement and transport areas in Saxony has continued unabated. Through land consumption, the natural functions of soils are degraded, compacted and sealed. Sealed soils can no longer absorb or temporarily store water. High levels of soil sealing cause water to run off and prevent evaporation from the ground. This leads to rising air temperatures and atmospheric heating, making conditions drier. Extensive soil sealing negatively impacts the local climate. The objective of the Free State of Saxony is to revitalise old settlement and transport areas to reduce new land consumption. Creating more green spaces within urban areas is part of Saxony's state development programme.

New land consumption for settlement and transport in hectares per day



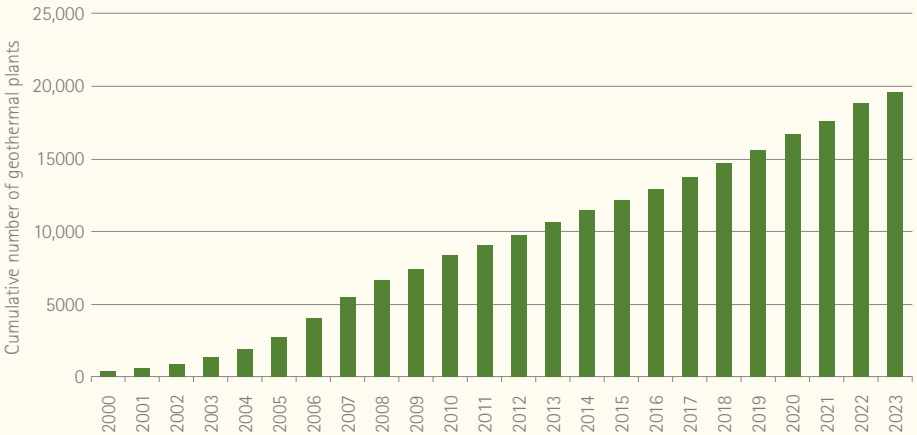
Source: Statistical Office of the Free State of Saxony

Geothermal energy

Geothermal energy is a renewable energy source that can significantly contribute to achieving climate protection goals, particularly in the context of the energy transition. In the Free State of Saxony, shallow geothermal energy is used for heating and cooling buildings, as well as to heat water in facilities such as single and multi-family homes, office buildings, schools and nurseries.

In 2023, Saxony had 19,637 geothermal systems in operation, with a total capacity of around 240 megawatts (thermal). In recent years, the growth rate has been approximately 900 new systems per year. The most common forms of use in Saxony are geothermal probes, accounting for about 90 %, followed by ground collector and well systems. The existing systems in Saxony currently prevent over 40,000 tonnes of CO_2 emissions annually.

Development of the total number of geothermal plants

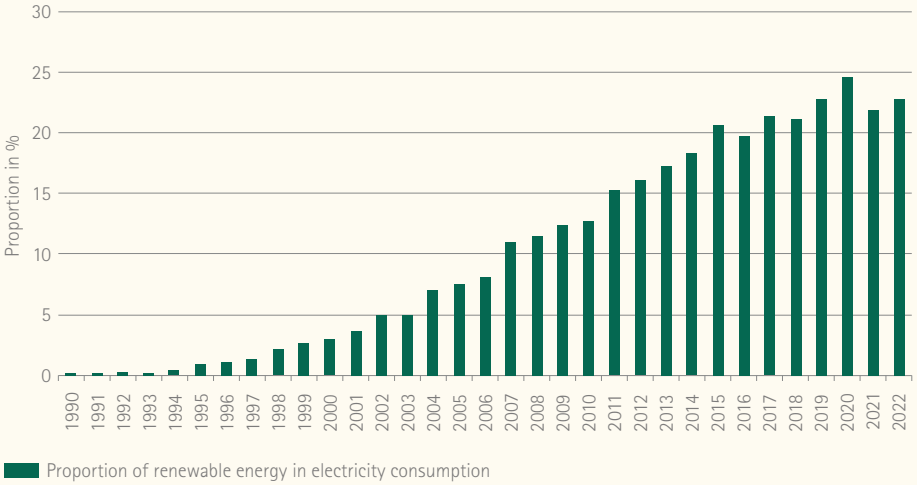


Source: Saxon State Office for the Environment, Agriculture and Geology, Department of Raw Material Geology

Proportion of renewable energy in electricity consumption

Saxony is increasingly confronted with the impacts of climate change and its accompanying effects such as droughts and severe weather. The Free State is focused on expanding renewable energy as well as improving energy efficiency and saving energy to shape its future energy supply. The Saxony Energy and Climate Programme (EKP) 2021 sets the framework for the capacity expansion of sustainably produced electricity over the coming years. The proportion of renewable energy in (gross) electricity consumption presented here is composed of net electricity generation, cross-border electricity exchanges, self-consumption by power plants and grid losses. Progress has been made since the mid-1990s.

Renewable energy

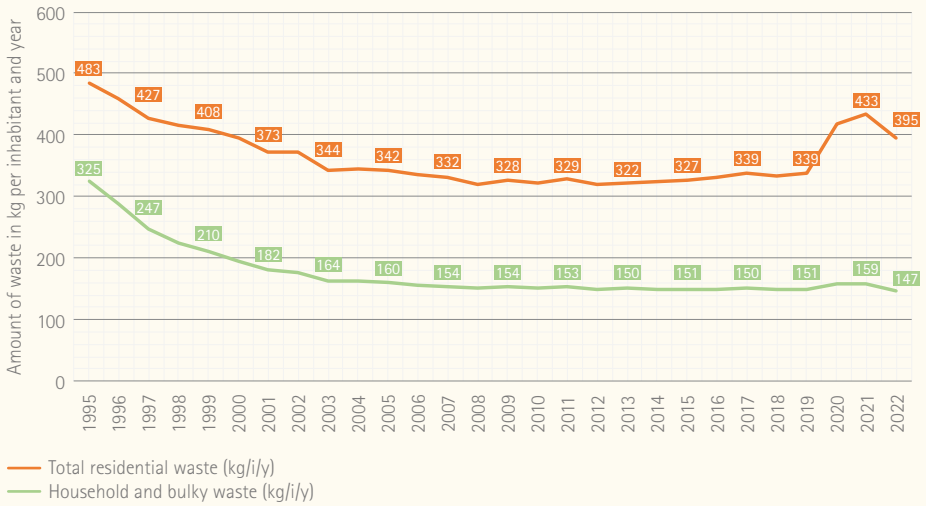


Source: Federal States Working Group (LAK) on Energy Balances

Residential waste

The volume of residential waste from households indirectly shows the development of the prevention of waste from households. Both the quantity of residential waste and the volume of household and bulky waste show a declining trend over the observation period, with both stabilising at a nearly constant level over the past ten years. This development is supported by low-waste consumption, the reuse of used goods and a user-pays system of waste collection and disposal fees. The year 2022 marks a reversal of the increase in household waste observed during the two years of the coronavirus pandemic.

Residential waste

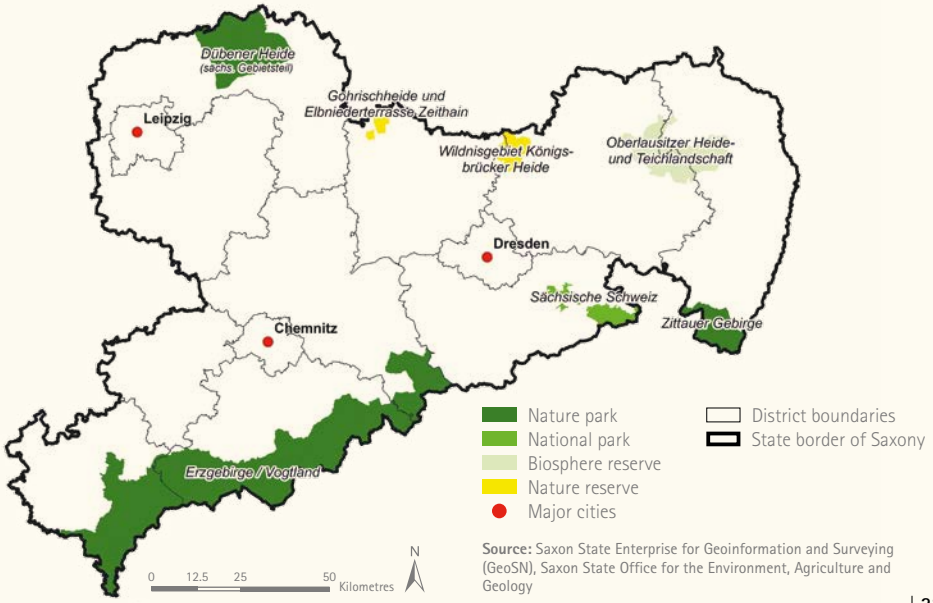


Quelle: Saxon State Office for the Environment, Agriculture and Geology, Department 41 Recycling Economy, Residentiall Waste Balance 2022

Location of large protected areas

The map shows Saxony's large protected areas (national park, nature park and biosphere reserve) as well as two large nature reserves with state-managed conservation authorities. These areas are characterised by their extensive nature or landscape conservation features. Depending on their category, differentiated levels of tourism or economic use are permitted. The purpose of these large protected areas is to safeguard and develop near-natural landscapes or diverse cultural landscapes. This is closely linked to the preservation of species and habitat diversity.

Location of large protected areas



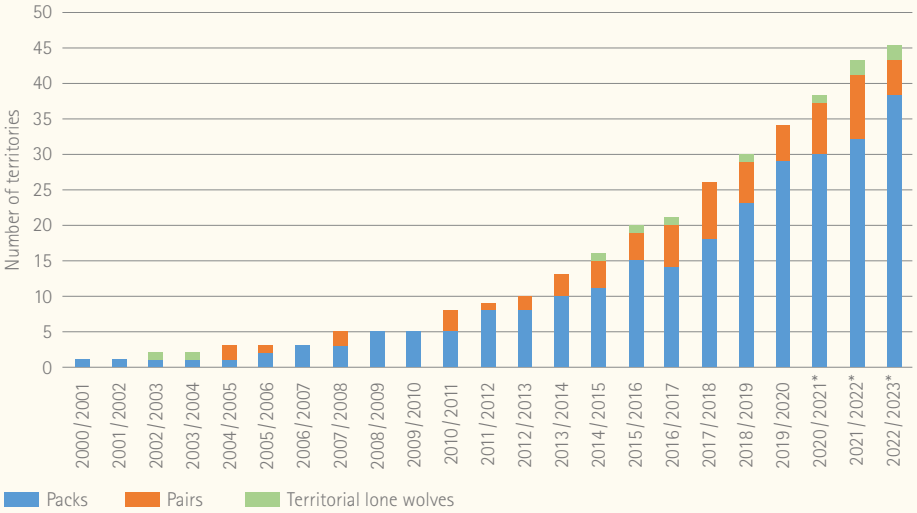
Source: Saxon State Enterprise for Geoinformation and Surveying (GeoSN), Saxon State Office for the Environment, Agriculture and Geology

Wolf populations in Saxony

With the detection of the first wolf pack on the Saxon military training area Oberlausitz in 2000, wild wolves were born and raised in Germany for the first time in 150 years. In the following years, wolves migrating from the east or born in Germany settled in new territories and formed additional packs. In the monitoring year 2022/2023, a total of 38 packs, five pairs and two territorial lone wolves were identified in the Free State.

In addition to wolf monitoring, the assessment of livestock damage, herd protection advice and environmental education on wolves are central tasks managed by the Wolf Unit at the LfULG. It serves as the main point of contact for citizens, livestock keepers and media representatives in Saxony.

Development of confirmed wolf territories in Saxony since 2000



Source: Wolf Unit, Saxon State Office for the Environment, Agriculture and Geology

* Due to new findings in wolf monitoring, data from previous monitoring years may be updated retroactively.
Updates on the confirmed wolf territories can be found on the website of the Federal Documentation and Advisory Centre on Wolves.

The topics of the brochure on the internet:

www.umwelt.sachsen.de

www.landwirtschaft.sachsen.de

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