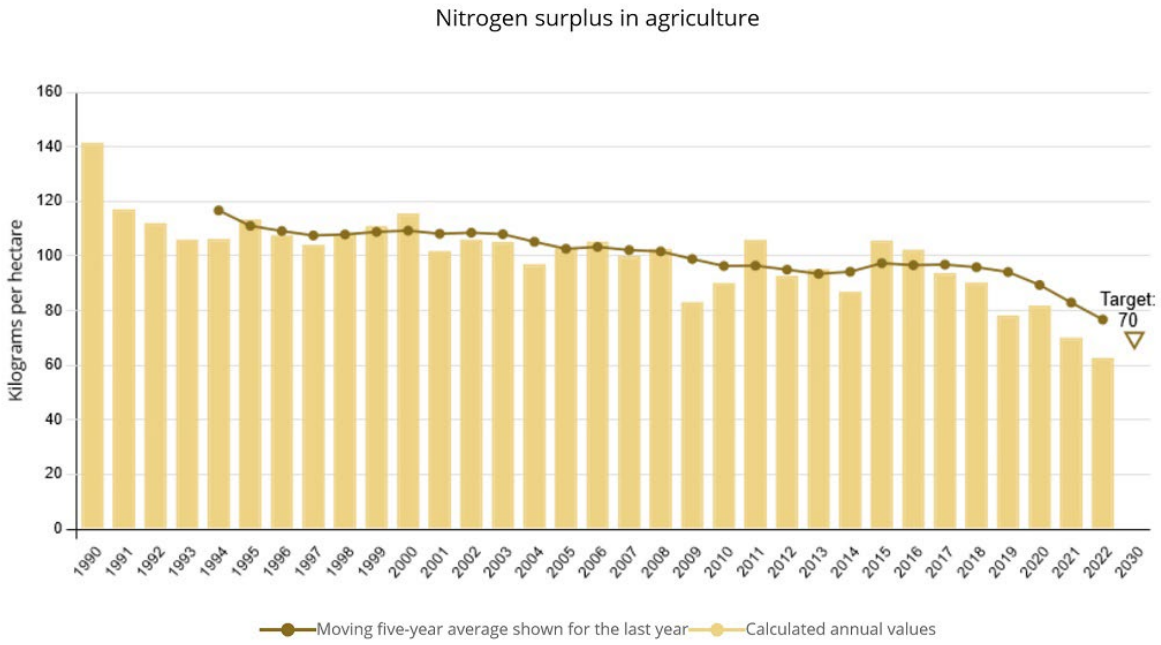
Farming – *Environmentally sound production in our cultivated landscapes*

2.1.a Nitrogen surplus in agriculture



Note(s):
1990 partly uncertain data basis. – 2015 to 2021 revised data. – 2022 provisional data.

Data source(s):
Julius Kühn Institute – Federal Research Centre for Cultivated Plants, Institute of Landscape Ecology and Resources Management University of Giessen, Federal Ministry of Agriculture, Food and Regional Identity

Definition
The indicator represents the annual nitrogen surplus in agriculture per utilised agricultural area (in kilograms per hectare) and year. The nitrogen surplus is calculated from the difference between nitrogen input and nitrogen output from the entire agricultural sector.

Intention
Excess nitrogen released into the environment leads to pollution of ground and surface water, oversupply of inland waters, oceans and terrestrial ecosystems with nutrients (eutrophication), the production of greenhouse gases and acidifying air pollutants with negative consequences for the climate, biodiversity and landscape quality.

Target
Reduction of the nitrogen surpluses of the overall balance for Germany to 70 kilograms per hectare of utilised agricultural area on an annual average between 2026 and 2030

Content and progress
In calculating this indicator, nitrogen inputs from fertilisers, biological nitrogen fixation, atmospheric deposition, seed and planting material, as well as animal feed are taken into account. Nitrogen outputs occur via crop and livestock market products. Excess nitrogen

can volatilise into the atmosphere, accumulate in the soil, or leach into groundwater. This can subsequently lead to nitrogen discharge into rivers and other ecosystems.

Thus, agricultural nitrogen surpluses directly impact the development of indicators 6.1.b Nitrate in Groundwater, 14.1.a Nitrogen Inputs via River Discharges into the North and Baltic Seas, and 15.2 Eutrophication of Ecosystems. In addition, nitrogen emissions from agriculture into the atmosphere also influence the time series for nitrogen dioxide and ammonia under indicator 3.2.a Emissions of Air Pollutants. The indicator is calculated by the Institute for Crop and Soil Science at the Julius Kühn Institute and the Institute for Landscape Ecology and Resource Management at the University of Giessen.

In 2022, mineral fertilisers represented the most significant source of nitrogen input, accounting for 46.2% (70 kilograms of nitrogen per hectare). Feedstuffs contributed 38.4% (58 kilograms per hectare), biological nitrogen fixation 9.6% (15 kilograms per hectare), and non-agricultural emissions 3.3% (5 kilograms per hectare).

The indicator is based on a moving five-year average, which is calculated from the mean of five consecutive reporting years. This average is attributed to the final year of the five-year period. This method smooths out annual fluctuations caused by weather and market conditions that are beyond the control of agricultural operations. The indicator does not provide information on the regional distribution of nitrogen surpluses.

Between 1994 and 2022, the moving five-year average of the nitrogen balance decreased by 34.3% – from 116.7 to 76.7 kilograms of nitrogen per hectare per year. A marked decline in nitrogen surplus was particularly evident in the early years of the time series, up to 2013. The primary drivers were reduced fertiliser application and declining livestock populations in the new Länder.

Up to 2018, annual values for nitrogen surpluses stagnated. During this period, there was a slight decline in the use of mineral fertilisers and an increase in crop yields – due to technological progress in plant production and breeding (such as more efficient nitrogen fertilisation and a broader range of crop varieties). At the same time, high-yield crops such as maize and wheat were cultivated more extensively, and feed utilisation efficiency in livestock farming improved.

Since 2018, the annual nitrogen surplus has declined more significantly, dropping by 10.7% in 2022 compared to 2021. It remains unclear to what extent this positive trend can be attributed to the amended Fertiliser Ordinance (Düngeverordnung) of 2017, in addition to the extreme agri-climatic conditions (drought years from 2018 to 2020). However, if the trend of recent years continues, the politically defined target of reducing the agricultural nitrogen surplus in the five-year average to a maximum of 70 kilograms per hectare by 2030 could be achieved.

Type of target
Target with specific target value

Assessment
The nitrogen surplus should be reduced to a maximum of 70 kilograms per hectare of utilised agricultural area on average between 2026 and 2030.

According to the target formulation, if the trend of the past six years continues, the politically defined target would already be significantly undercut as early as 2024. Indicator 2.1.a is therefore assessed as sun for 2022.

Note:
The indicator is presented as a five-year moving average. This means that the value relevant for the target year 2030 is calculated from the individual values for the years 2026 to 2030.