Chapter 4

Monitoring the impact of agriculture on the natural asset base and environmental quality of life

Chapter 4 focuses on the group of indicators relating to the natural asset base and the environmental quality of life. It examines the role that availability and the quality of freshwater, biological diversity and ecosystems, and the productivity of land and soil resources play in the development of green growth in agriculture. Due to data and methodological issues, no indicator that captures the impact of the environment on people's quality of life is proposed.

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.

The group of indicators on ***the natural asset base*** aims to monitor whether the natural asset base is maintained – a condition for sustainable growth – because rising productivity may be associated with an increase in environmental pressures. Indicators in this group should be aligned with indicators of environmental and resource productivity, and focus on natural assets that matter the most to agricultural production. Consequently, indicators will vary across countries according to their natural asset base.

A major methodological question is the extent to which one type of asset can be substituted for another. Can, for example, an increase in land used for agricultural production offset the loss of a natural forest? As many natural assets are not (fully) priced, asset prices cannot adequately reflect society's preferences, which leads to under- or over-exploitation of these assets.

In principle, and for the purposes of indicator construction, social shadow prices (i.e. the social opportunity costs of the resources used) could be estimated, which could then be used to value the net investment of each natural asset. However, for natural assets, such as water and soil, the calculation of social shadow prices is not straightforward due to externalities and imperfect information about resource rents. In such cases, the physical evolution of natural assets could provide a starting point, although this alone would convey limited information about progress towards green growth. Indicators of stocks and flows of natural resources and environmental services need to be read along with information on resource management policies.

The main issues concerning green growth include the availability of freshwater and biological diversity and ecosystems, including species and habitat diversity, as well as the quality of land and soil resources. The following indicators are proposed.

Table 4.1. Indicators for monitoring the natural asset base

Theme	Indicators	Criteria			
		Capturing the nexus between the environment and the economy	Ease of communication for different users and audiences	Reflecting key global environmental issues	Measurable and comparable across countries
Renewable stocks	Freshwater resources				
	Share of agricultural freshwater withdrawal in total freshwater withdrawal	***	**	***	*
Biodiversity and ecosystem services	Land use resources				
	a) Land cover types, conversions and cover changes				
	Trends of arable land and cropland	***	***	***	***
	Trends of permanent pastures	***	***	***	***
	b) Soil resources				
	Share of agricultural land affected by water erosion classified as having moderate to severe water erosion risk	***	***	***	***
	Wildlife resources				
	Farm birds index	*	*	*	**

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The group of indicators on ***environmental quality of life*** attempts to capture the direct impact of the environment on people's lives, in terms of: 1) exposure to various pollutants and the associated health effects; and 2) access to environmental services (e.g. water, sanitation, green space, etc.). Indicators in this group should be selected to reflect the most pressing environmental health risks associated with agricultural production. This should be mirrored in the presentation of information on environmental services or amenities. The OECD's economy-wide green growth indicators work includes two indicators: percentage of population exposed to air pollution and percentage of population using improved sanitation and waste water treatment facilities (OECD, 2014).

There are nevertheless serious issues related to data availability and methodology in constructing rigorous indicators in this area. The most obvious proxy indicators for agriculture relate to: 1) health risks to people associated with exposure to pesticides (e.g. number and rate of acute work-related poisonings due to pesticide exposure);[1] and 2) health risks to people associated with water pollution from agriculture. In both cases, data are incomplete (OECD, 2013). It could be argued that in OECD countries, environmental quality of life issues related to agricultural production are critical only in certain regions of countries. For these reasons, no indicator is proposed under this heading.

Renewable stocks: Freshwater

Policy context

Agriculture is the world's largest water user. Challenges involve sustainable management of water resources in agriculture (and other uses) by avoiding over-exploitation and degradation. Using more efficient technologies and applying the user-pays-principle and adopting an integrated approach to the management of freshwater resources are essential elements (OECD, 2010).

Monitoring progress

The indicators presented here relate to the trends in agriculture freshwater withdrawals and their share in total freshwater withdrawals.

When interpreting this indicator, it should be kept in mind that it only gives insights into quantitative aspects of water resources. Moreover, it is at the national level and may conceal significant territorial differences and should be complemented with information at the sub-national level. Finally, this indicator should be read in connection with indicators on cost-recovery ratios, water productivity and water quality.

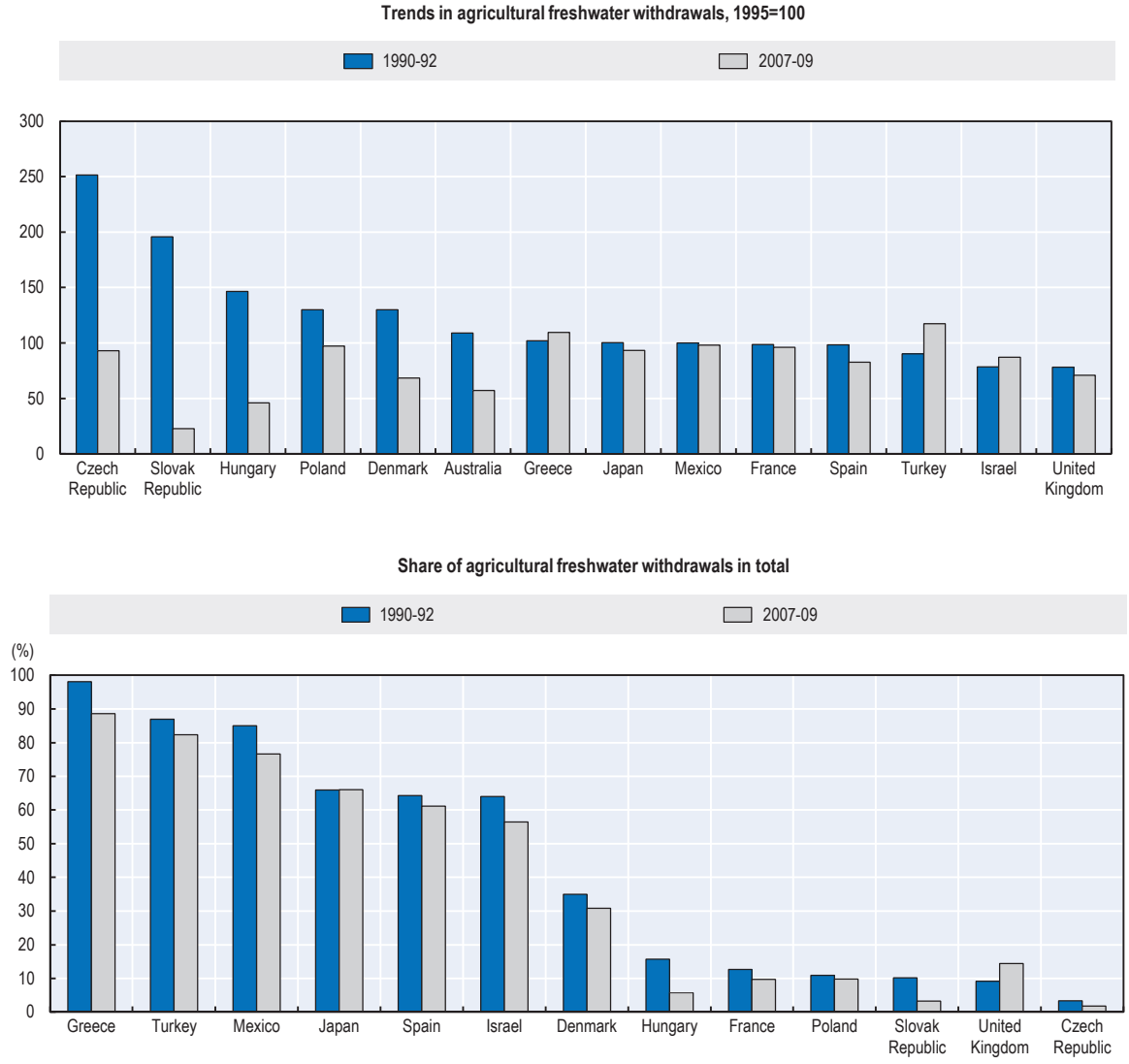
Measurability

Indicators for agriculture water resources are limited. Information on freshwater resources can be derived from water resource accounts. This is available for several OECD countries, although the definitions and estimation methods employed may vary considerably from country to country and over time. More work is needed to improve the completeness and historical consistency of data on water abstractions, and the methods for estimating renewable water resources.

Main trends

Overall, withdrawals of freshwater resources by agriculture have declined in most OECD countries for which data are available (**Figure 4.1**). Moreover, agriculture's withdrawal of freshwater, expressed as a share in total withdrawals, has decreased in recent years as compared with the early-1990s, although it remains a major water user, accounting for over 40% of total withdrawals in nearly half of the OECD member countries (OECD, 2013).

Figure 4.1. Agricultural water withdrawals in selected OECD countries



Note: 1994-95 for Belgium and Mexico.

Source: OECD (2013), "Agri-Environmental Indicators: Environmental Performance of Agriculture 2013", *OECD Agriculture Statistics* (database). doi: 10.1787/data-00660-en.

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The declining OECD trend in agricultural water withdrawals over the past decade was driven by a mix of factors, including: a near stable or reduction in the area irrigated (**Figure 3.12**); improvements in irrigation water management and technological efficiency; drought; release of water to meet environmental needs; and a slowdown in the growth of agricultural production (OECD, 2013).

Biodiversity and ecosystems

Policy context

Loss of biodiversity has been identified as one of the most pressing global environmental issues and its conservation is a key concern. Agriculture is crucial in biodiversity preservation as it is a major user of land and water resources that certain genetic resources and wild species depend on.

The way agricultural land is used and managed influences land cover and soil quality in terms of nutrient content and carbon storage. It affects water and air quality, determines erosion risks, plays a role in flood protection, and affects GHGs. The main challenge is to reconcile competing demands and conflicting interests sustainably and to preserve the land's essential ecosystem functions.

OECD countries employ a variety of policies and approaches designed to balance farm production and reduce harmful biodiversity impacts, especially those that affect wild species (e.g. birds) and ecosystems (e.g. wetlands). In addition, most OECD countries are signatories to international agreements of significance for agro-biodiversity conservation, such as the *Convention on Biological Diversity;* the *Convention on the Conservation of Migratory Species of Wild Animals*; and the *Ramsar Convention* for the protection of wetlands.

Monitoring progress

Development of a suitable indicator is beset with serious methodological and data difficulties. In the absence of such an indicator, the following proxy indicators – which relate to land use and cover, soil resources and wildlife resources – are proposed:

- *Land resources*: Changes in agricultural land use and land cover types – arable crops, permanent crops and pasture areas – are established environmental indicators. They represent a good proxy of the pressures on land-competing uses, as well as pressures on biodiversity. Although it does not directly measure biodiversity, it is considered as the best measure currently available to broadly monitor pressures on ecosystems and biodiversity.
- *Soil resources*: Agricultural land affected by water erosion classified as having moderate to severe water erosion risk.
- *Wildlife resources*: Farmland bird index.

Indicators on changes in agricultural land use and cover should be read in conjunction with changes on other types of land in the economy (e.g. forest, built-up areas, etc.), in order to obtain a more comprehensive picture of competing uses of land and potential pressures on ecosystems and biodiversity.

On wildlife resources, birds can act as "indicator species", providing a barometer of the health of the environment. Being close to (or at the top) of the food chain, they reflect changes in ecosystems rapidly compared to other species. The farmland bird index indicator measures populations of a selected group of breeding bird species that are dependent on agricultural land for nesting or breeding. In general, a decrease in the index means that the balance of bird species trend is negative, representing a biodiversity loss. Likewise, an increase in the index implies that the balance of bird species trend is positive, implying that biodiversity loss has halted. However, caution should be exercised in interpreting this indicator as an increasing farmland bird index may not always equate to an improving situation in the environment. In all cases, detailed analysis must be conducted to interpret accurately the indicator trends, while the composite index trend of farmland birds can hide important changes for individual species.

It should be noted that these indicators provide a partial picture only of the impact of agriculture on biodiversity. Furthermore, when making comparisons across countries, several factors should be taken into account including the level of economic development, the structure of agricultural production, countries' agricultural trade patterns, and geographical factors.

Measurability

Data on agricultural land use and cover exist for all OECD countries, although with varying degrees of quality. Internationally harmonised statistics on conversions from one type of land use to another are not yet available for non-agricultural land.

Data on threatened species are available for all OECD countries with varying degrees of completeness. The number of species known or assessed does not always accurately reflect the number of species in existence, and the definitions – which should follow International Union for Conservation of Nature (IUCN) standards – are applied with varying degrees of rigour in individual countries. Historical data are generally not comparable or are not available. Bird population indices are available for Europe and North America (Canada and the United States).

The indicator on agricultural land area classified as having moderate to severe water erosion, which is based on models, is subject to several limitations, making cross-country comparisons problematic. Moreover, comparable data are available for eight OECD countries only; in a number of countries where soil erosion or degradation is a widespread concern, there is little or no regular updating of national soil erosion monitoring (e.g. Australia, New Zealand, Portugal, Spain and Turkey) (OECD, 2013). For these reasons, results for this proposed indicator are not reported at this stage.

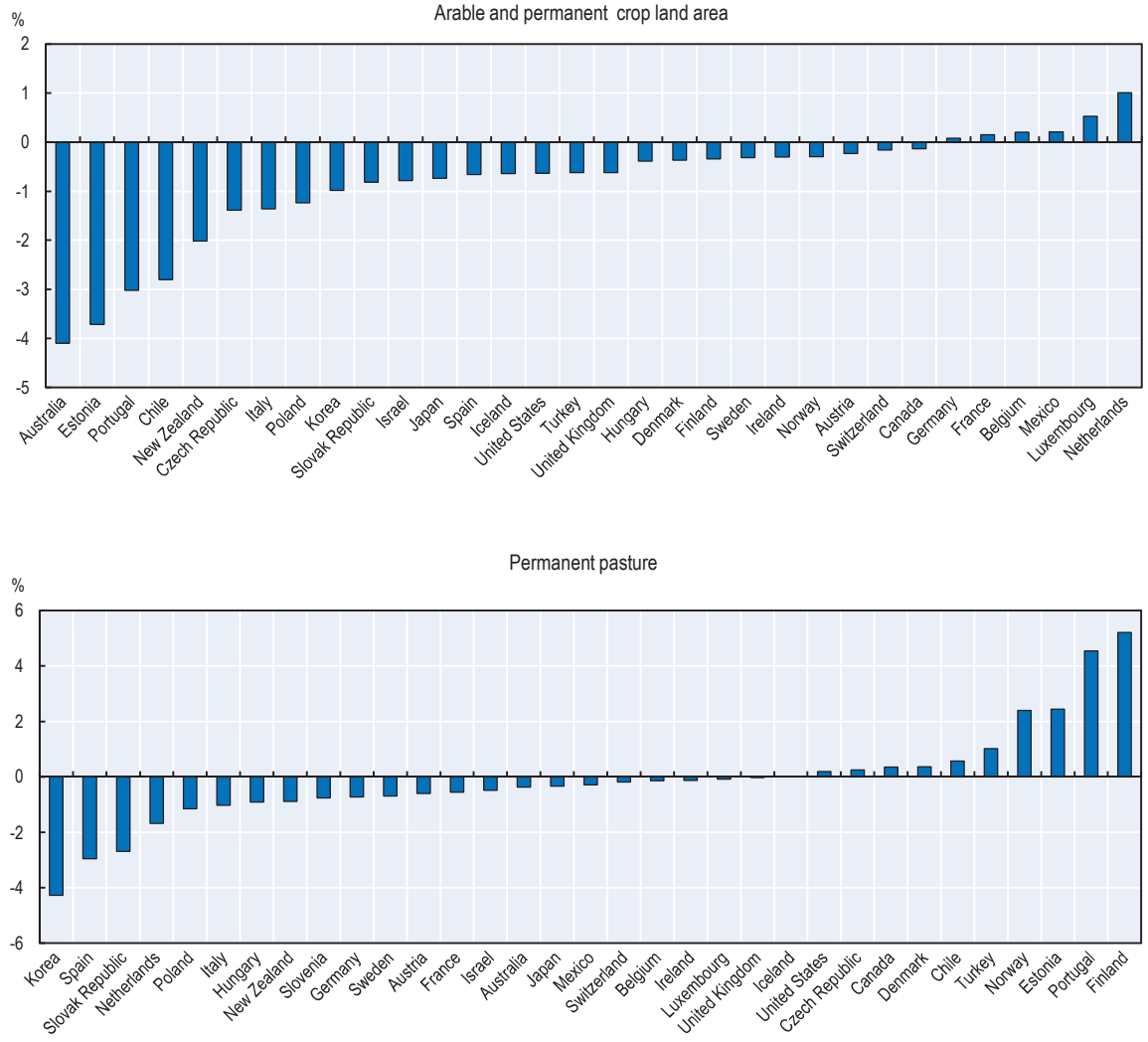
Main trends

In nearly all OECD countries the agricultural land area decreased over the 1990-2010 period in terms of both arable and crop land; permanent pasture area (which accounts for two-thirds of all OECD agricultural land) has declined in most countries (**Figure 4.2**). Agricultural land has mainly been converted to use for forestry and urban development (OECD, 2014; 2013). Despite this overall trend, agriculture remains the major land use for many countries, representing over 40% of the land area in two-thirds of OECD countries.

Permanent pasture, which represents a major share of agricultural semi-natural habitats, has declined most OECD countries. It has mainly been converted to forestry, although in some countries pasture has also been converted for cultivation of arable and permanent crops (e.g. Finland and the Netherlands).

The overall OECD trend masks some important differences between countries with a significant increase in permanent pasture area in countries which already had a high share of pasture in total agricultural land (e.g. Chile), and a sharp reduction in other countries where the permanent pasture share is also significant (e.g. Austria, the Netherlands and New Zealand).

Figure 4.2. Trends in agricultural land cover, change over the period 1990-2010 or most recent year



Note. Data for 2010 refer to the year 2009 for Austria, Canada and Israel; to the year 2008 for Chile and Italy.
Source: FAO, *FAOSTAT* (database), http://faostat.fao.org/.

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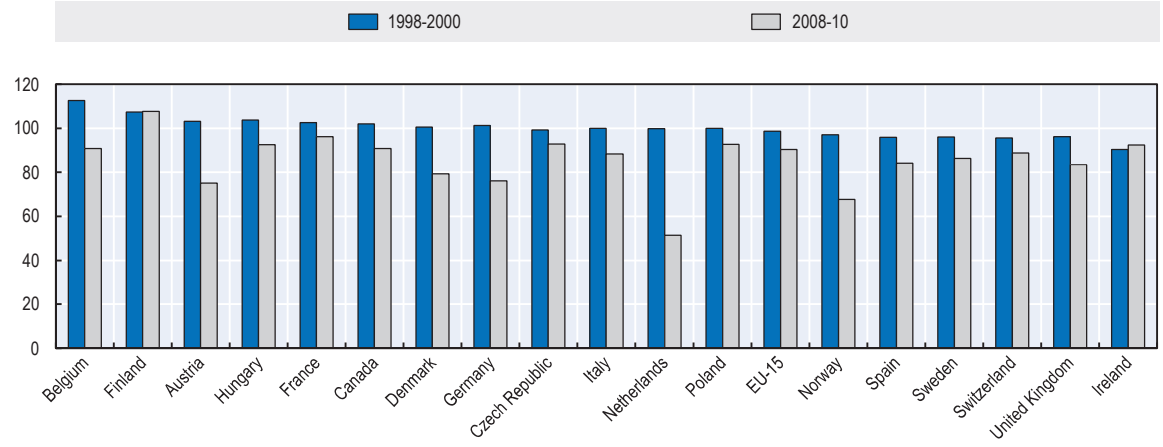
Trends in OECD farmland bird populations declined continuously from 1990 to 2010 for almost all countries (**Figure 4.3**). But interpreting the consequences of changes in permanent pasture land areas for farmland birds and other wildlife species is complex. Without knowledge of the quality of the land change and its subsequent management, it is difficult to assess these developments. Given the magnitude of the decline in permanent pasture across most OECD countries over this period, however, it is likely that this has been one of the factors influencing the overall decline in farmland bird populations.

Figure 4.3. Farmland bird index in selected countries

2000=100



Source: OECD (2013), "Agri-Environmental Indicators: Environmental Performance of Agriculture 2013", *OECD Agriculture Statistics* (database). doi: 10.1787/data-00660-en.

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The assessment of land use changes both between agriculture (e.g. pasture and arable crops) and other uses of land (e.g. forestry, urban use), and between pasture and arable crops is incomplete due to the paucity of datasets. A complete analysis of changes, including data on how different land types are managed and influence the wild flora and fauna that inhabit farmland, was not possible.

Note

1. See, for example, Minnesota Department of Health, *Acute Work-Related Pesticide Associated Illness and Injury Reported to Poison Control Centers,* www.health.state.mn.us/divs/hpcd/cdee/occhealth/indicators/pesticide.html.

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