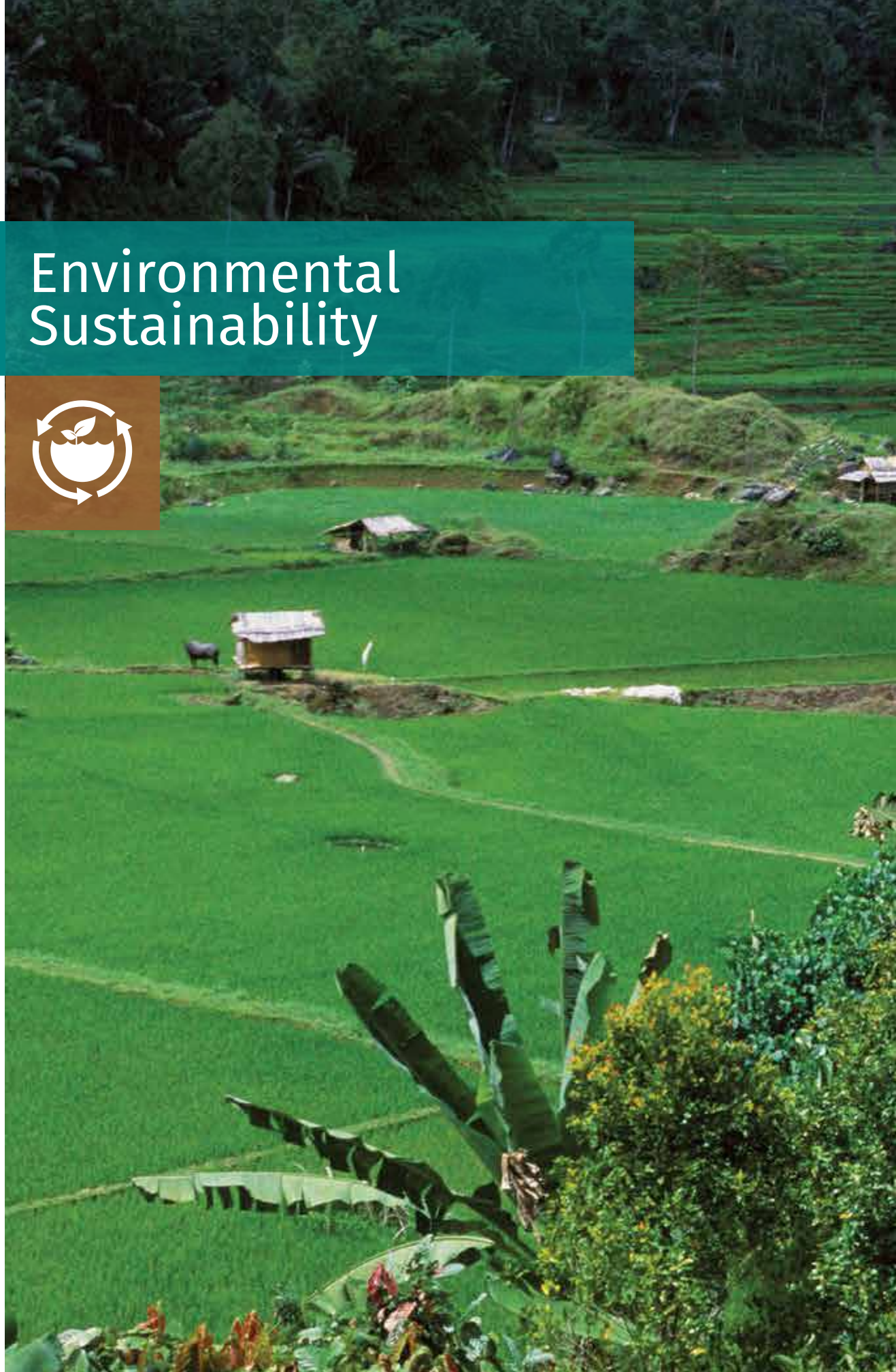
10 Environmental Sustainability



Tar spot complex (TSC), a disease affecting maize crops, has decimated the yields of farmers in the high valleys in Mexico. Most of the maize varieties planted in Mexico are susceptible to it, which means that farmers' have to pay for fungicides throughout the year to protect their crops. Developing a variety that is resistant to TSC is an environmentally and economically sustainable alternative. Testing carried out from 2011 to 2014 successfully identified two local varieties with outstanding genetic disease resistance and scientists are now using them to develop germplasms with a view to make them available to breeders by 2017. This process will help produce new varieties that combine the higher yields of elite lines with local varieties' resistance to TSC, to reduce fungicide use and improve farmer's productivity.[1]

Agriculture uses a range of natural resources that include water, soil and plant genetic resources. The quality and availability of these resources are fundamental to sustain production and respond to increasing global food demand. However, farming can also contribute to the depletion of natural resources including the loss of biodiversity, pollution of soil and water resources, and accelerated rates of soil erosion.

Despite its dependence on diverse genetic resources, modern farming can pose a challenge for the preservation of biodiversity. The increased use of improved seed varieties over local varieties, together with environmental degradation, urbanization and land clearing have contributed to genetic erosion. It is estimated that during the last century nearly 75% of plant genetic diversity has been lost, as farmers have replaced their genetically richer local varieties with genetically uniform, high-yielding varieties.[2]

As the largest user of water resources globally, the agricultural sector consumes approximately 69% of all water withdrawn[3] and accounts for 36% of the land surface that is suitable for crop production.[4] For example, chemical pesticides can pollute surface and groundwater through leaching and run off, causing negative effects in aquatic ecosystems and human health. Furthermore, deforestation and poor agricultural practices such as over cultivation and excessive grazing and water use can contribute to land degradation and desertification.[5] A study conducted in Brazil shows that pasture and agricultural expansions have been the main causes of deforestation in the Amazon between 2000 and 2006.[6]

Mitigating the impact of farming on the environment is an important challenge to guarantee the long-term sustainability of agricultural production.

Landscape of fields and homes, Indonesia.
Photo: Curt Carnemark / World Bank.

What do the EBA environmental sustainability indicators measure?

The EBA environmental sustainability indicators measure the legal and regulatory framework applicable to the management and sustainable use of natural resources that are vital for agricultural production. The data cover the following areas:

Conservation of plant genetic resources: The conservation of a diverse pool of genetic resources supports future crop production, since the development of adapted and improved seed varieties relies on the use of genetic variability, mainly found in local varieties and crop wild relatives.[7] Data in this area cover the laws, regulations and policies that address the conservation of plant genetic resources in national genebanks.[8] It also includes alternative conservation mechanisms at the farm and local level, such as community seed banks, diversity fairs or participatory plant breeding. These alternatives allow farmers to participate in the conservation, breeding and circulation of diverse seed.

Access and sustainable use of plant genetic resources: Farmers will preserve diverse genetic resources depending on the commercial value such resources can command in the market. Regulations and policies that facilitate the commercialization of seeds of local varieties through registries[9] or simplified registration requirements are important ways to increase the availability of these genetically rich varieties in markets. Data cover laws and regulations that facilitate the circulation of seed in the informal sector, by recognizing farmer's rights to reuse seed from their own harvests, and establish clear rules for accessing plant genetic resources.

Water quality management: Agriculture is a major cause of the degradation of surface and groundwater resources. Erosion and chemical runoff, such as nitrate pollution from excessive use of fertilizers and intensive livestock rearing,[10] affect water quality. Data cover the institutional framework and regulations aimed at minimizing the contamination of water bodies from agricultural activities, such as buffer zones and setbacks, and regulations on hazardous and obsolete pesticides.

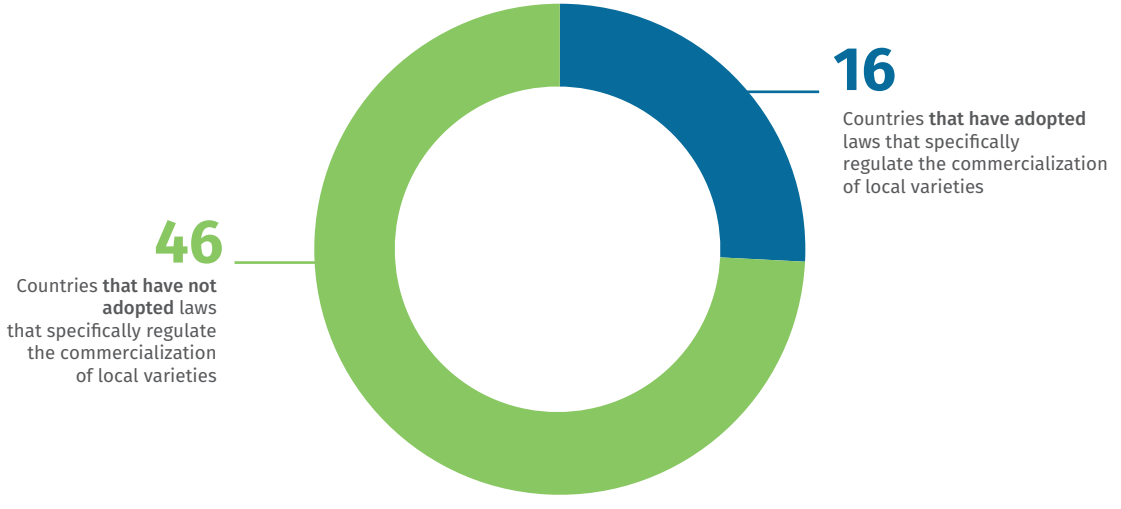
Soil health management: Land use plans allow governments to assess all current and potential uses in a territory and adopt the land use structure that best meets users' needs[11] while safeguarding valuable resources for future generations. Soil quality indicators are useful to better understand and monitor the impact of soil management practices.[12] Data are collected on the legal and institutional frameworks applicable to land use planning and soil monitoring.

Some insights emerging from the data

Plant genetic resources

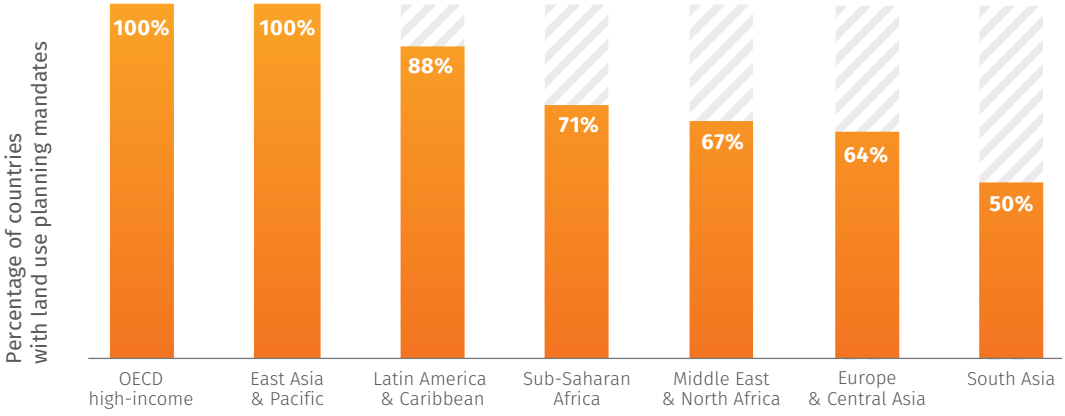
Improved seed varieties can provide significant benefits to farmers such as higher yields, resistance to certain diseases and more stable production. The development of these modern varieties relies on the use of genetic variability. National genebanks play a critical role in the preservation of genetic diversity, performing important functions such as the provision of genetic material to researchers, breeders and farmers for the development of new plant varieties or rebuilding agricultural production after conflicts or natural disasters. Among the 62 countries studied, 32 countries have established a national genebank.

Figure 10.1 | A limited number of countries have adopted laws that specifically regulate the commercialization of local varieties



Source: EBA database.

Figure 10.2 | Land use planning mandates are less frequent in the Middle East and North Africa, Europe and Central Asia, and South Asia



Source: EBA database.

In addition to conserving plant genetic resources, genebanks also publish information associated with the plant material conserved to facilitate its use by potential users.[13] Among the 32 countries that have established a national genebank, 16 publish information associated with their activities online. Although most of these countries are OECD high-income and upper-middle-income countries, Bolivia—a lower-middle-income country that recently joined the International Treaty on Plant Genetic Resources for Food and Agriculture—has a national genebank holding 18,434 collections of significant value to agricultural biodiversity, detailed information on which is available online.[14]

The commercialization of local varieties has been recognized as a pathway to enhance the utilization and conservation of diverse genetic resources.[15] Registries[16] or simplified registration requirements can facilitate the commercialization of seed of local varieties. Registering local varieties in order to integrate them into formal channels can result in increased availability of diverse seed in the market.

To be registered and accepted for commercialization, most countries require a new variety to pass tests that evaluate distinctiveness, uniformity, and stability (DUS) and value of cultivation and use (VCU). However, as these tests are not appropriate for local varieties, which are genetically heterogeneous and adapted to local conditions, laws should provide for certain exceptions.[17] Only one-quarter of the countries studied explicitly support this practice (figure 10.1). Of these, Denmark, Greece, Italy, the Netherlands, Poland, Romania and Spain, and as European Union (EU) members, have implemented EU Directive 2008/62/EC establishing certain exceptions for the acceptance and marketing of certain crop varieties that are adapted to local conditions and threatened by genetic erosion. Other countries with similar exceptions include Bangladesh, India, Nepal, Peru, Thailand and Uruguay. In Uruguay, for example, the range of genetic heterogeneity allowed for local varieties during testing is higher than for conventional varieties and VCU tests are not required.

Water quality management

As stated above, agricultural production is a principal cause of surface and groundwater resources degradation. Forest buffers, a type of restrictions on land use, can address pollution caused by pesticides and excess fertilizers by functioning as filters that trap sediment, excess nutrients, pesticides and other chemical contaminants that would otherwise reach water sources.[18] These practices are infrequently adopted by the countries studied; only 26 countries have regulations that provide for buffer zones or setbacks adjacent to water bodies, most of which are high-income and upper-middle-income countries. In Rwanda, for example, the law on environmental protection specifically restricts agricultural activities within 10 meters of streams and rivers, and 50 meters of lakes; instead, these areas have been reserved for protection and conservation activities.

Pesticides should also be controlled to guard against water and soil pollution. Because their ingredients are toxic and have the potential to harm human and ecosystem health,[19] governments should establish legal frameworks that regulate their distribution and use, especially in the case of hazardous pesticides.[20] Fifty-seven of the countries studied (92%) have

Sifting grain. India. Photo: Ray Witlin / World Bank.

regulations that restrict the distribution and management of hazardous pesticide products. A large majority of high-income and upper-middle-income countries also impose specific rules to deal with obsolete or unwanted pesticides, which remain hazardous to the environment if improperly stored or disposed of. The adoption of this practice is less common in regions such as Sub-Saharan Africa, where only 12 of the 21 countries studied have regulations addressing obsolete pesticides, and South Asia, where only one of the four countries studied has such regulations in place. Regulations on this issue vary, from an obligation to include disposal methods on the pesticide label in Tanzania, to specialized facilities or collection services to safely collect and dispose of pesticides in Denmark and India.

Soil health management

Land use plans allow governments to assess all current and potential uses in a territory and adopt the land use structure that best meets users' needs,[21] while safeguarding valuable resources for future generations. Soil quality data provide useful information that governments, farmers and other stakeholders can use to monitor the impact of agricultural activities and inform land management decisions and farming practices.[22]

Forty-eight of the countries studied have regulations mandating the development of land use plans, and 50 countries have an authority that monitors agricultural soil. While land use planning is mandated in all high-income OECD countries and East Asian and Pacific countries, it is less common in other regions such as South Asia, where only Nepal and India have such regulations (figure 10.2). In India, where land use planning is regulated by state-level governments, two of the studied states, Odisha and Maharashtra, mandate the development of land use plans, while Bihar and Uttar Pradesh do not make it a requirement. India is also implementing a soil monitoring program at the national level that aims to provide farmers with relevant data on soil health.

Conclusion

Agriculture depends on the availability of certain natural resources that are essential production inputs. In this context, the preservation of soil, water and plant genetic resources must remain a policy priority for governments and form part of their broader efforts to increase agricultural productivity. In particular, regulations that protect soil and water quality from the negative effects of fertilizers, pesticides and intensive livestock rearing are necessary to maintain vital ecosystems and guarantee the availability and utility of these resources for future generations. Institutions and regulations that safeguard diverse plant genetic resources are also crucial to ensure that the agricultural sector can respond to increased food demand and changing environmental conditions.

NOTES

1 Johnson et al. 2016.

2 FAO 1999.

3 http://www.fao.org/nr/water/aquastat/tables/WorldData-Withdrawal_eng.pdf.

4 Bruinsma 2003.

5 Horrigan et al. 2002.

6 Barona et al. 2010.

7 Ford-Lloyd et al. 2011.

8 Genebanks are repositories where genetic material of plants is stored and preserved in forms such as seeds or cuttings.

9 Spataro and Negri 2013.

10 Morris et al. 2003.

11 Van Lier and De Wrachien 2002.

12 Arshad and Martin 2002.

13 FAO 2014.

14 FAO 2016.

15 Gautam and Pant 2011.

16 Spataro and Negri 2013.

17 Paavilainen 2009.

18 Aguiar et al. 2015.

19 Horrigan et al. 2002.

20 FAO and WHO 2016.

21 Van Lier and De Wrachien 2002.

22 Arshad and Martin 2002.

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