

# BIODIVERSITY AND AGRICULTURE

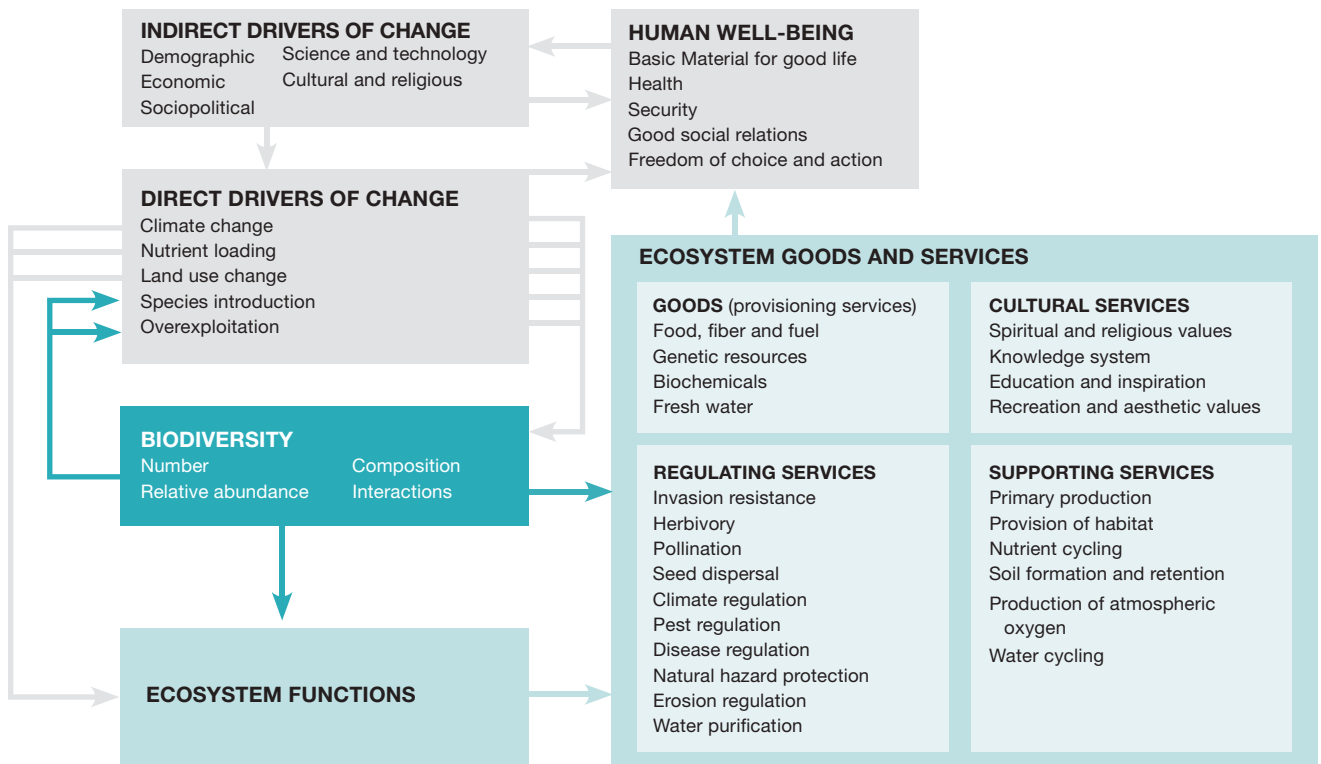
## Ecosystem Services for Human Well-Being

Healthy ecosystems provide services that are the foundation for human well-being including health. Ecosystem services are the benefits people obtain from ecosystems: provisioning services (also known as goods) such as food and water; regulating services such as flood, pest, and disease control; cultural services such as spiritual and recreational benefits; and supporting services, such as nutrient cycling, that maintain the conditions for life on Earth.

Biodiversity underpins ecosystem functioning. Figure 1 taken from Global Biodiversity Outlook 2 demonstrates the link between ecosystem services and human well-being and drivers of change.<sup>1</sup> The different levels (genes, species, ecosystems) and aspects of biodiversity directly and indirectly contribute to ecosystem goods and services, which not only deliver the basic materials needed for survival but also underlie other aspects of a good life: health, security, good social relations, and freedom of choice. Humans, through social and economic activities and environmental management, create indirect and direct drivers of change that can affect, positively and negatively, biodiversity and ecosystem functioning.

The Millennium Ecosystem Assessment, completed in 2005 by more than 1360 scientists working in 95 countries, examined the state of 24 services. The assessment concluded that 15 of the 24 services are in decline, including the provision of fresh water, marine fisheries production, the number and quality of places of spiritual and religious value, the ability of the atmosphere to cleanse itself of pollution, and the capacity of agro-ecosystems to provide pest control.<sup>2</sup>

**Figure 1: Biodiversity, ecosystem functioning, and drivers of change**





Overall, the multitude of human drivers of change has significant negative repercussions on the ability of ecosystems to provide these services to all species. Table 1 provides some statistics about human impacts, especially through agriculture, on some ecosystem services.<sup>3</sup> The harmful consequences of this degradation could grow significantly worse in the next 50 years if the important drivers of ecosystem change do not diminish. Two drivers—climate change and excessive nutrient loading—are predicted to become more severe.<sup>4</sup> Adoption of sustainable and equitable practices for now and future generations become more and more significant as each day goes by.

**Table 1: Summary of human impacts on some ecosystem services**

| Service                                    | Condition and Trends  |
|--|---|
| FOOD PROVISIONING SERVICE                  | <ul style="list-style-type: none"> <li>▶ Food production increase by 160% from 1961 to 2003, as a result of intensification and expansion.</li> <li>▶ Gains in food services have come at the expense of other services, such as disease regulation.</li> </ul>   |
| WATER PROVISIONING AND SUPPORTING SERVICES | <ul style="list-style-type: none"> <li>▶ Human use of freshwater runoff has increased dramatically at a mean rate of 20% per decade between 1960 and 2000, with 70% worldwide used for agriculture.</li> <li>▶ Inorganic nitrogen pollution of inland waters has increased more than twofold globally since 1960.</li> <li>▶ More than 1 billion people live in areas without appreciable supplies of renewable fresh water to meet their needs.</li> </ul>   |
| TIMBER, FIBER, FUEL PROVISIONING SERVICES  | <ul style="list-style-type: none"> <li>▶ Global timber harvests increased by 60% since 1960.</li> <li>▶ Fuelwood is the primary source of energy for heating and cooking for some 2.6 billion people, although they account for less than 7% of world energy use.</li> <li>▶ Among agricultural fibres, global cotton production has doubled and silk has tripled since 1961.</li> </ul>  |
| CLIMATE REGULATION                         | <ul style="list-style-type: none"> <li>▶ About 40% of historical emissions (over the last 2 centuries) and about 20% of CO<sub>2</sub> emissions (1990s) originated from land use changes, mostly deforestation.</li> <li>▶ Terrestrial ecosystems become a source of carbon dioxide (CO<sub>2</sub>) and other greenhouse gases when they are broken down, but they become a net sink during regrowth (afforestation and reforestation for example). Terrestrial ecosystems were on average a net source of CO<sub>2</sub> during the 19th and early 20th centuries.</li> </ul>  |
| DISEASE REGULATION                         | <ul style="list-style-type: none"> <li>▶ Intensive livestock production that uses subtherapeutic doses of antibiotics has led to the emergence of antibiotic-resistant strands of <i>Salmonella</i>, <i>Campylobacter</i> and <i>Escherichia coli</i> bacteria.</li> <li>▶ Deforestation has increased the risk of malaria in Africa and South America by increasing habitat suitable for malaria-transmitting mosquitoes.</li> <li>▶ Natural systems with preserved structure and characteristics, such as the Amazon forest, generally resist the introduction of invasive human pathogens brought by migration.</li> </ul> |

1. Secretariat of the Convention on Biological Diversity, 2006. *Global Biodiversity Outlook 2*. SCBD, Montreal.  
 2. Millennium Ecosystem Assessment, 2005. *Ecosystems and Human Well-being: Synthesis*. Island Press, Washington, DC.  
 3. Ibid: 103–122.  
 4. Ibid: 2.