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Attila Borovics and Éva Király

Nature Protection Policy

University Coursebook



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1. The Emergence of Environmental Issues and Nature Conservation

The history of nature conservation is often portrayed as a reaction to the excesses of the Industrial Revolution—pollution, resource depletion, species loss, and social transformation. While this view captures an essential dimension of the modern environmental movement, it oversimplifies a much deeper and longer trajectory. Conservation thinking has roots in early modern Europe, in Enlightenment scientific inquiry, and in pre-industrial concerns about forest decline. Over several centuries, the field evolved from practical resource management to a multifaceted scientific, ethical, and political movement focused on the protection of natural systems and cultural heritage.

This chapter traces the emergence of environmental issues and the development of nature conservation from the 17th century to the present, highlighting key milestones, scientific advancements, and philosophical debates that shaped modern environmental governance.

1.1 Early Foundations: Resource Concerns Before the Industrial Age

1.1.1 John Evelyn and Early Forestry Thought

The origins of Western conservation philosophy can be linked to the 17th century, long before industrialization had fully transformed Europe. A landmark publication was **John Evelyn's Sylva (1662)**, first presented to the Royal Society. Requested due to growing anxieties about timber shortages—exacerbated by Charles II's massive building projects—Sylva warned of widespread deforestation in England and advocated the systematic replanting of trees.

Although written without reference to modern ecological concepts such as biodiversity or ecosystem services, Sylva was revolutionary in its call for sustainable forest management. It revealed early recognition that natural resources were not inexhaustible, and that planned regeneration was necessary if society wished to maintain long-term supplies.



Figure 1: John Evelyn (1620-1706) Source: <https://commons.wikimedia.org/wiki/File:JohnEvelyn1687.jpg>.

1.1.2 Hans Carl von Carlowitz and the Origin of Sustainability in Forestry

The idea of sustainability emerged from a concrete resource crisis rather than abstract environmental concern. Around 1700, Saxony's mining-based economy was threatened not by depleted ore reserves, but by an acute **shortage of timber**. Mining, smelting, construction, and energy production had consumed vast forest areas, eliminating old-growth forests near mining centres in the Erzgebirge. Technical measures such as river-based log transport from distant regions only delayed collapse, while rising timber prices led to mine closures and economic decline.

Hans Carl von Carlowitz, a Saxon tax accountant and mining administrator, was directly confronted with the consequences of forest depletion. Through extensive travels, he became familiar with early state-led forestry reforms, notably those associated with Jean-Baptiste Colbert in France, and possibly with John Evelyn's *Sylva* (1662). These influences, combined with local administrative experience, shaped his systematic response to Saxony's timber crisis.

Carlowitz's *Sylvicultura oeconomica* (1713) is regarded as the first systematic work on sustainable forest management. It compiled existing knowledge and expanded it with practical guidance on forest regeneration, seed collection, planting, species selection, harvesting, and wood utilization. Forestry was framed as a strategic sector underpinning mining, smelting, construction, and household energy supply. Carlowitz was the first to clearly formulate **Nachhaltigkeit**—the principle that forests must be used in a way that ensures **continuous and lasting yields**. Sustainability was not conceived as preservation, but as regulated use within ecological limits. Forest exploitation had to remain compatible with natural regeneration, as wood was considered indispensable for the stability of the state.

Carlowitz's work illustrates a recurring pattern in environmental governance: sustainability concepts arise under conditions of scarcity and systemic risk. His integration of ecological limits, economic necessity, and long-term planning laid the foundation for sustainable yield forestry and continues to inform modern forest management and climate-policy debates.



Figure 2: Portrait of Hans Carl von Carlowitz (left) and the title page of Sylvicultura oeconomica (right). (Sources: https://en.wikipedia.org/wiki/File:Carlowitz_Bernigeroth.jpg; https://en.wikipedia.org/wiki/File:Carlowitz_Sylvicultura.jpg)

1.1.2 Enlightenment Science and Early Environmental Governance

By the 18th century, European states increasingly formalized management of forests and agricultural lands. Prussia and France developed early systems of regulated forestry, combining state oversight, scientific principles, and economic interests. These systems spread to colonial administrations, notably in British India, where teak forests were being overharvested to supply naval shipyards during the Napoleonic Wars.

The first conservation laws—such as restrictions on cutting teak trees below a certain size—were attempts to secure strategic resources. Although enforcement was often minimal, these policies signaled emerging concerns over sustainability.

1.2. Industrialization and the Birth of Modern Conservation

1.2.1 Industrial Impacts and the Rise of Environmental Awareness

The Industrial Revolution dramatically intensified human pressures on the environment. Rapid urbanization, mechanized agriculture, expansion of coal mining, and increased reliance on fossil fuels created new ecological threats. For the first time, environmental problems were recognized on a national and even global scale.

Natural resource scarcity became a major public issue. Coal, the engine of industrial growth, was understood to be finite. Scientists warned that destroying forests or exhausting fossil fuels could destabilise economies and ecosystems. Early climatologists even noted the potential atmospheric consequences of burning coal, recognizing that carbon emissions could alter global climate.

1.2.2 Ethical and Scientific Roots of Conservationism

Thinkers such as George Perkins Marsh, in his influential book *Man and Nature* (1864), argued that humans had fundamentally altered the Earth's surface and bore ethical responsibility for mitigating the damage. Marsh's arguments—combining moral philosophy with empirical observations—became foundational to modern conservation thought.

During the 19th century, governments responded by establishing formal forestry departments, research institutions, and land management agencies. Conservation was no longer merely a resource concern; it became a scientific and political movement.

1.3 Protected Areas and the Rise of Environmental Governance

1.3.1 Early National Parks

The world's first protected natural area, Bogd Khan Uul (Mongolia), was designated in 1778. However, national park systems as we understand them today emerged only in the late 19th century.

The United States established Yellowstone National Park in 1872, marking a turning point in global conservation. Unlike the resource-driven policies in Europe, American conservation was heavily influenced by the vast, relatively undisturbed landscapes of North America and shaped by competing pressures:

- Over-hunting (e.g., bison decline)
- Rapid industrialization and increasing urban populations
- Romantic and transcendentalist philosophies (e.g., Henry David Thoreau)

The U.S. model of national parks became highly influential globally and helped institutionalize conservation.

1.3.2 Conservation vs. Preservation: A Philosophical Divide

During the Progressive Era (1890–1920), American conservationism split into two camps:

- **Conservationists**, led by Gifford Pinchot and politically championed by President Theodore Roosevelt, argued for wise use of natural resources—scientific management to ensure long-term sustainability.
- **Preservationists**, led by John Muir, sought to keep nature in a pristine state, protected from economic exploitation.

The debate shaped U.S. land policy and remains central to environmental governance.

Roosevelt’s administration protected over 230 million acres, created the U.S. Forest Service, and established five national parks. Meanwhile, preservationists won key victories such as the 1964 Wilderness Act, which designated protected wilderness areas where extractive activities are prohibited.

1.4 The Emergence of Environmental Issues in the 20th Century

1.4.1 The 1960s: A Turning Point

By the mid-20th century, environmental issues expanded beyond resource depletion to include pollution, chemical contamination, and global ecological risks. **Rachel Carson’s *Silent Spring* (1962)** catalyzed public concern by exposing the ecological and health effects of pesticide use, particularly DDT, in a way that was accessible to the general public. Rachel Carson demonstrated how toxic substances accumulated through food chains, affecting birds, wildlife, and human health. The book challenged prevailing assumptions about technological progress and played a key role in stimulating environmental legislation, including pesticide regulation and the establishment of environmental protection agencies.

Governments responded with major legislative initiatives. In the United States:

- The Clean Air Act (1963; expanded in 1970)
- The National Environmental Policy Act (1969)
- The creation of the Environmental Protection Agency (EPA) in 1970

Similar movements occurred worldwide, institutionalizing environmental protection within national law.

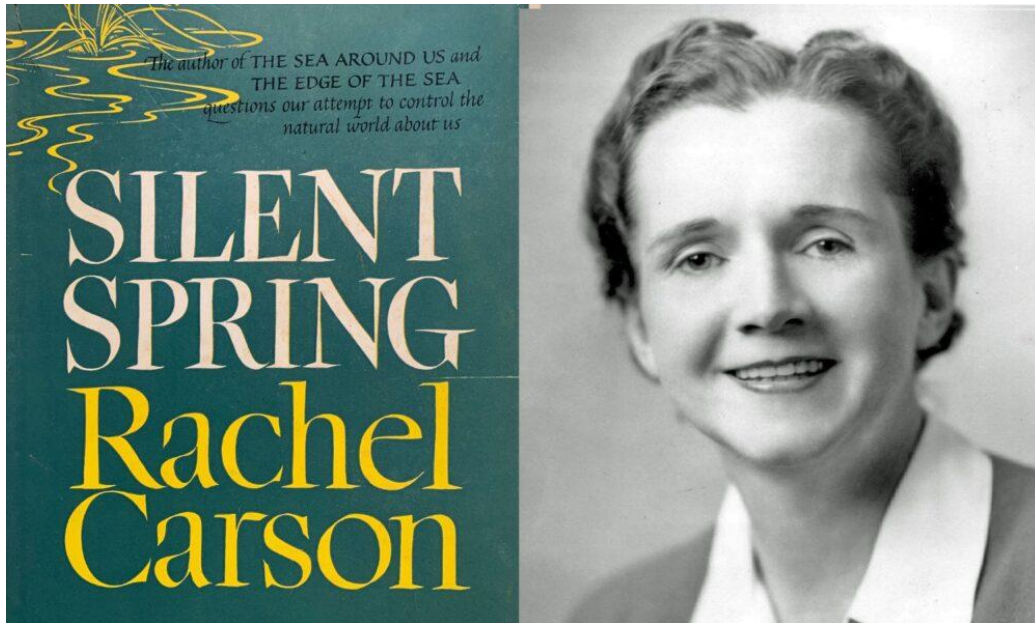


Figure 3: Rachel Carson and the cover of her influential 1962 book *Silent Spring*. Source: <https://blog.ucs.org/anita-desikan/why-rachel-carsons-silent-spring-still-resonates-today/>

1.4.2 Globalization of Environmental Concerns

Growing scientific understanding revealed new global challenges:

- Climate change and rising greenhouse gas emissions
- Ozone depletion
- Ocean and freshwater pollution
- Rapid species extinction rates
- Industrial disasters and radioactive contamination

In response, international agreements emerged, and global organizations such as the United Nations increasingly addressed environmental governance.

1.5 Conservation in the 21st Century: Integrating Science, Policy, and Society

Modern conservation is a highly interdisciplinary field encompassing:

- Biodiversity protection
- Climate change mitigation and adaptation
- Sustainable resource management
- Indigenous rights and local knowledge

- Ecosystem services and nature-based solutions
- Cultural and archaeological heritage protection

Environmental concerns now involve complex interactions between ecological science, socio-economic systems, and global governance institutions. Issues such as habitat fragmentation, carbon markets, and landscape-level management illustrate how deeply conservation is embedded in sustainability policy.

The emergence of environmental issues and nature conservation reflects centuries of evolving thought and practice. What began as practical resource management gradually transformed into a sophisticated global movement that integrates science, ethics, law, and public policy. As the challenges of the 21st century—climate change, biodiversity loss, and cultural heritage degradation—become increasingly urgent, the historical foundations of conservation remain vital for informing effective governance and sustainable futures.

1.6 The Emergence of Nature Conservation in Hungary

Hungary's nature conservation history reflects a long, gradual evolution from early forest protection efforts to a modern, institutionally embedded system of environmental governance. Although formal conservation policies emerged in the 19th and 20th centuries, the roots of Hungarian environmental awareness can be traced back several centuries earlier, driven primarily by concerns about forest depletion and landscape degradation.

1.6.1 Early Initiatives and the Pre-History of Hungarian Conservation

As early as the Middle Ages, unsustainable land use and widespread forest clearing prompted the first regulatory responses. One of the earliest known decrees was issued by King Zsigmond in **1426**, prescribing the careful management of forests and prohibiting the cultivation of lands where trees had recently been felled. The intention was clear: deforested lands should be allowed to regenerate, ensuring long-term timber supply and preventing soil degradation.

Over the following centuries, industrial activities, military conflicts, and the Ottoman occupation caused severe declines in forest cover and biodiversity. These pressures led to growing awareness of the need for state-level forest regulation. The landmark **1879 Forest Act** introduced protective status for forests in ecologically sensitive areas such as mountain scree slopes. While its primary focus was on erosion control and resource management, it effectively safeguarded several landscapes, geological formations, and forest habitats.

This period is often referred to as the **pre-history of Hungarian conservation**, characterized largely by advocacy, scientific warnings, and unsuccessful early initiatives. Nevertheless, it laid important foundations for the more systematic measures that followed.

1.6.2 Institutional Beginnings and the Role of Natural Scientists (Late 19th – Early 20th Century)

The late 19th century marked the formal institutionalization of nature protection in Hungary, with ornithology and forestry playing central roles.

The Hungarian Ornithological Centre and Scientific Leadership

A significant milestone was the establishment of the **Hungarian Ornithological Centre** in **1893**, led by **Ottó Herman**, one of the country’s most influential natural scientists. Herman’s research, advocacy, and public engagement helped building social support for wildlife protection and scientific conservation.

Complementing institutional development, the Hungarian Parliament adopted the **1894 Act XII** on agriculture and rural policing, which provided legal protection for beneficial bird and mammal species. Importantly, it extended protection not only to adult animals but also to their nests and eggs—one of the earliest examples of comprehensive wildlife protection legislation in Europe.

Scientific Works and Public Education

This era also saw major scientific contributions. In **1899**, **István Chernel** published “The Birds of Hungary”, linking avian ecology to agricultural value. In **1901**, Herman released “The Use and Harm of Birds”, followed by numerous other influential works, including “The Book of Hungarian Fisheries”.

Public environmental education gained momentum when, in **1906**, the Ministry of Religion and Public Education mandated the celebration of **Birds and Trees Day** in Hungarian folk schools, fostering early environmental awareness among youth.

Forest Nationalization and Geological Contributions

During the short-lived Hungarian Soviet Republic in **1919**, forests were temporarily nationalized—a move that, though short-lived, reflected growing recognition of forests as collective assets requiring coordinated management.

Simultaneously, scientific societies such as the **Hungarian Geological Society** played key roles in identifying and promoting natural features worthy of protection. A particularly influential publication was **Károly Kaán’s “Nature Conservation and Natural Monuments”** (1932), which provided the first comprehensive overview of Hungarian nature conservation philosophy and practice.

1.6.3 Interwar and Postwar Conservation Legislation

The Foundation of the National Conservation Council

The **1935 Forest Act** and later the **1954 Act IV** provided the first high-level legal framework specifically addressing nature protection. The latter also established the **National Conservation Council**, with Károly Kaán as its first president. Under its mandate, **197 natural values** were officially designated as protected.



Figure 4: Károly Kaán (1867–1940), a leading Hungarian forester and one of the founding figures of nature conservation in Hungary. His seminal work, “**Nature Conservation and Natural Monuments**” (1931), laid the foundations of modern Hungarian conservation policy. As the first president of the **Nature Conservation Council**, he played a key role in designating the country’s earliest protected natural sites. Sources:

http://www.termeszetvedelem.hu/user/browser/File/Publikaciok/KaanK_1931_Termeszetvedelem_es_a_termeszeti_emlekek_ocr.pdf and https://hu.wikipedia.org/wiki/F%C3%A1jl:K%C3%A1roly_Ka%C3%A1n_portrait.jpg

Post-War Reconstruction and Expanding Protection

Following World War II, the National Conservation Council was re-established in **1947**, signaling renewed commitment to environmental management. Bird protection was strengthened by the **1954 Government Decree 59/1954**, which placed numerous species under strict protection in agricultural and forested landscapes.

A major step forward came with the **1961 Decree No. 18**, which systematically defined the categories of natural values requiring protection and outlined procedures for their designation, management, and legal administration. It established the **National Nature Conservation Office**, marking the first time Hungarian law clearly separated forest management from nature conservation governance.

During the 1960s, the total area of protected lands increased to approximately **15,000 hectares**, with particular advances in bird and cave protection.

1.6.4 The Establishment of National Parks and Modern Conservation (1970s–1980s)

Legal Framework for National Parks

A pivotal transformation occurred with the **12/1971 (VI.11.) Government Decree**, which enabled the creation of **national parks** in Hungary. Based on this regulation, the **Hortobágy National Park**—Hungary’s first—was established in **1972**, marking the beginning of a new era of large-scale landscape conservation.

The decree also distinguished between **national** and **local** categories of protected natural assets, laying the groundwork for a multi-level conservation system.

A long-term (15-year) national conservation program was completed in the mid-1970s, accelerating protected-area expansion. Over the subsequent decade and a half, the total area of protected land increased dramatically—surpassing **600,000 hectares**.

Integration with Environmental Law and Constitutional Rights

Hungary adopted its first comprehensive environmental protection act in **1976 (Act II)**. Although broader in scope than nature conservation alone, it established key principles for environmental governance, recognizing soil, water, fauna, flora, and landscapes as protected environmental elements. It also articulated the principle that all citizens have the right to a dignified environment.

This legal shift was reinforced by the **1989 Constitution**, which enshrined the right to a healthy environment in **Article 18** and further linked environmental quality to physical and mental health in **Article 70/D**.

Institutional Consolidation and Species Protection

Institutional reforms in **1977** merged the separate environment and nature protection councils into a unified system under the **National Environment and Nature Conservation Office**.

By the 1980s, species protection had become a key focus. Regulations in **1982** listed **340 protected plant species**, a number that grew to **619 protected plant and animal species** by **1988**, reflecting the rapid maturation of biodiversity protection policies.

Hungary’s conservation history reflects a continuous progression from medieval forest regulations to a sophisticated 20th-century conservation regime. While rooted in resource protection—much like early forestry practices elsewhere in Europe—Hungarian conservation gradually incorporated scientific research, biodiversity protection, environmental rights, and public engagement. By the late 20th century, Hungary had developed a robust framework aligned with international standards and ready to integrate into the evolving European and global environmental governance architecture.

Core Concepts and Review Questions – Chapter 1

1. Why is it misleading to interpret nature conservation solely as a reaction to the Industrial Revolution?

Interpreting nature conservation only as a response to the Industrial Revolution overlooks its much older intellectual and practical roots. Long before large-scale industrialization, early modern societies were already concerned about deforestation, soil degradation, and the long-term availability of key natural resources. Early forestry regulations, Enlightenment scientific inquiry, and state-led resource management in Europe reflect a recognition that natural resources were finite and required planned use. These pre-industrial concerns formed the conceptual foundation on which later environmental movements built, even though industrialization greatly intensified environmental pressures.

2. What was the main purpose of John Evelyn's *Sylva* (1662)?

The main purpose of John Evelyn's *Sylva* was to draw attention to the serious problem of timber shortages in 17th-century England and to advocate systematic replanting of forests. Written at the request of the Royal Society, the work responded to increasing demand for wood driven by shipbuilding, urban construction, and royal projects under Charles II. Although Evelyn did not use modern ecological concepts, his call for planned regeneration and long-term forest stewardship represents an early expression of sustainable resource management.

3. Which feature best characterizes Enlightenment-era forest governance in Europe?

Enlightenment-era forest governance is best characterized by increasing state regulation informed by scientific and economic principles. Governments in countries such as Prussia and France developed centralized forestry administrations aimed at ensuring sustained timber yields and protecting strategic resources. These approaches were later exported to colonial contexts, such as British India, where regulations were introduced to prevent overharvesting of teak forests for naval use. Although enforcement was often imperfect, these systems marked a shift toward systematic environmental governance.

4. What new environmental concern emerged during the Industrial Revolution?

During the Industrial Revolution, environmental concerns expanded from local resource problems to national and global-scale issues. Rapid industrialization, coal mining, mechanized agriculture, and urbanization generated unprecedented levels of pollution and resource consumption. Scientists began to warn that fossil fuels were finite and that deforestation and industrial emissions could destabilize both economies and natural systems. Early climatological observations even suggested that large-scale coal burning might alter atmospheric conditions, foreshadowing modern climate change debates.

5. What was George Perkins Marsh's central argument in *Man and Nature* (1864)?

George Perkins Marsh argued that human activity had fundamentally transformed the Earth's surface and that societies bore moral and practical responsibility for repairing environmental

damage. Drawing on historical examples of deforestation, soil erosion, and landscape degradation, Marsh rejected the idea that nature was infinitely resilient. His work combined empirical observation with ethical reasoning, influencing later conservation policies and reinforcing the idea that environmental protection was a matter of societal responsibility.

6. Why are early national parks considered a milestone in conservation history?

Early national parks are considered a milestone because they established legal protection for large natural landscapes based on ecological, cultural, and public values rather than immediate economic use. The designation of Bogd Khan Uul in Mongolia and Yellowstone National Park in the United States represented a new governance model in which nature was protected at a landscape scale. These parks helped institutionalize conservation, inspired protected-area systems worldwide, and shifted thinking toward long-term preservation of natural heritage.

7. What distinguishes conservation from preservation in the Progressive Era debate?

The distinction between conservation and preservation lies primarily in attitudes toward human use of natural resources. Conservationists, such as Gifford Pinchot, promoted the scientific management of forests and other resources to ensure sustainable use over time. Preservationists, led by figures like John Muir, argued that certain areas should remain untouched by economic activity. This debate shaped U.S. land policy, influencing institutions such as the U.S. Forest Service and legislation like the Wilderness Act.

8. Why is Rachel Carson's *Silent Spring* (1962) regarded as a turning point?

Silent Spring is regarded as a turning point because it exposed the ecological and health impacts of chemical pesticides, particularly DDT, in a way that was accessible to the general public. Rachel Carson demonstrated how toxic substances accumulated through food chains, affecting birds, wildlife, and human health. The book challenged prevailing assumptions about technological progress and played a key role in stimulating environmental legislation, including pesticide regulation and the establishment of environmental protection agencies.

9. What was Károly Kaán's key contribution to Hungarian nature conservation?

Károly Kaán's key contribution was his role in systematizing nature conservation in Hungary through scientific analysis, legal frameworks, and institutional leadership. His work *Nature Conservation and Natural Monuments* provided the first comprehensive overview of Hungarian conservation principles. As president of the National Conservation Council, he helped designate protected natural sites and embed conservation into state administration, laying the foundations for modern Hungarian environmental governance.

10. Which feature best characterizes nature conservation in the 21st century?

Nature conservation in the 21st century is characterized by its integrated and interdisciplinary approach. Modern conservation addresses biodiversity loss, climate change mitigation and adaptation, ecosystem services, and cultural heritage within complex socio-economic systems. Examples include landscape-level management, nature-based solutions, and the use of policy instruments such as protected-area networks and carbon markets. Conservation is therefore no

longer a sectoral activity but a central component of sustainability policy and global environmental governance.

2 Major Global Environmental Issues

2.1 What Makes a Problem “Global”?

An environmental problem is considered global when its causes, consequences, or feedback mechanisms transcend local and national boundaries and affect the functioning of the Earth system as a whole. Globality thus refers not only to geographic scale but also to **systemic reach, temporal persistence, and governance complexity**. Many global environmental problems unfold over long time horizons, involve delayed or irreversible effects, and interact across environmental media and societal sectors.

From an analytical perspective, global environmental problems are characterized by several distinguishing features. They are typically driven by cumulative human activities rather than single point sources; their impacts are often spatially disconnected from their origins; and their management exceeds the regulatory capacity of individual states. As a result, global environmental problems inherently challenge traditional concepts of sovereignty and demand multilateral cooperation, shared scientific knowledge, and coordinated policy responses.

The global dimension of environmental problems has become increasingly visible since the mid-20th century. Already in the late 1950s, scientific projections warned that anthropogenic greenhouse gas emissions could alter the global climate system in ways that might ultimately threaten the survival conditions of human societies. Earlier historical cases of environmental degradation—such as deforestation around the Mediterranean basin in antiquity or large-scale soil salinization in ancient Mesopotamia—were undoubtedly severe, yet their impacts remained largely regional. While such processes sometimes contributed to the decline of individual societies, they did not destabilize the planetary life-support system as a whole.

In contrast, contemporary environmental pressures operate at unprecedented **scale, speed, and interconnectedness**. Industrialization, fossil energy use, mechanized agriculture, global trade, and mass consumption have dramatically intensified human influence on biogeochemical cycles, land systems, and biodiversity. Many environmental changes now accumulate faster than natural recovery processes can compensate for, transforming local disturbances into global risks.

Two fundamental drivers explain why global environmental problems have become so acute:

1. **The magnitude of human pressure on the biosphere:** Human activities now rival or exceed natural Earth-system processes in their intensity. Large-scale land conversion, energy consumption, and resource extraction alter carbon, nitrogen, and water cycles, reduce ecosystem resilience, and push natural systems toward critical thresholds. This disproportion between human demand and ecological capacity is a defining feature of the contemporary global crisis.
2. **Globalization of economic and social systems:** The increasing integration of global markets, supply chains, and information flows has spatially separated production and

consumption. Environmental burdens are often externalized across borders, while environmental impacts—such as climate change, biodiversity loss, or marine pollution—are transmitted globally through atmospheric, hydrological, and ecological pathways.

As a result, researchers frequently describe the current situation as a **combined ecological and human world crisis**, in which environmental degradation and social stresses are mutually reinforcing. Environmental decline can exacerbate poverty, food insecurity, health risks, and displacement, while social inequality, weak governance, and economic pressure intensify unsustainable resource use.

Three structural characteristics of modern societies play a central role in sustaining this crisis:

- **Technological lock-in**, whereby societies remain dependent on resource-intensive and polluting technologies due to long-lived infrastructure, economic interests, and institutional inertia.
- **Consumption patterns in affluent societies** that are characterized by high material throughput, short product life cycles, and disproportionate waste generation relative to global averages.
- **The growth imperative**, embedded in dominant economic systems that prioritize continuous expansion of production and consumption, often without adequately accounting for ecological limits or long-term environmental costs.

For analytical clarity, global environmental problems can be grouped into two closely interlinked dimensions. The **human (social) world crisis** encompasses demographic dynamics, unequal population distribution, persistent poverty and hunger, limited access to education and health services, and widening socio-economic inequalities within and between countries. The **ecological world crisis** includes the depletion of non-renewable resources, the overuse and pollution of renewable resources, biodiversity loss, water scarcity, soil degradation, climate change, and the limited assimilative capacity of the biosphere to absorb waste and emissions.

Importantly, these two dimensions cannot be separated in practice. Environmental degradation often disproportionately affects vulnerable populations, while social and economic pressures drive further environmental exploitation. This interdependence underscores the need for integrated approaches that address environmental sustainability, social equity, and economic development simultaneously.

Against this conceptual background, the present chapter examines the major manifestations of global environmental change, including:

- the condition of key environmental media (air, water, and soil) and climate change,
- land degradation and desertification,
- demographic change and urbanization,

- biodiversity loss,
- the energy and resource crisis,
- impacts on human health, and
- the global waste problem.

Together, these issues illustrate how environmental limits, technological systems, and socio-economic structures interact at the planetary level. Understanding what makes an environmental problem global therefore provides the conceptual foundation for analyzing environmental governance, policy instruments, and sustainability transitions, which are addressed in subsequent chapters.

2.2 The State of the Atmosphere and Climate Change

2.2.1 Air Pollution and Greenhouse Gases

The composition of the Earth’s atmosphere has never been static: over geological time it has been shaped by volcanic activity, biological evolution, and large-scale geochemical cycles. Since the Industrial Revolution, however, **human activities have become the dominant driver of atmospheric change**, altering atmospheric chemistry, aerosol concentrations, and the planet’s radiative balance at a pace unprecedented in Earth’s history.

The most important anthropogenic sources of air pollutants include:

- **energy production**, particularly fossil-fuel-based electricity and heat generation,
- **heavy industry** and material processing (cement, steel, chemicals),
- **transport**, including road traffic, aviation, and shipping,
- **combustion processes** in power plants, factories, vehicles, and households,
- and **agricultural and industrial activities**, such as fertilizer application, livestock production, and chemical manufacturing.

These activities release a complex mixture of gases and particles into the atmosphere. Their environmental relevance depends on their concentration, chemical reactivity, atmospheric lifetime, and capacity for long-range transport.

Greenhouse Gases and Radiative Forcing

Greenhouse gases (GHGs) influence the climate system by absorbing and re-emitting outgoing long-wave (infrared) radiation, a process known as the **greenhouse effect**. Anthropogenic enhancement of this effect leads to **positive radiative forcing**, meaning a net energy gain in the Earth system.

The most important anthropogenic greenhouse gases are:

- **carbon dioxide (CO₂)**, emitted primarily from fossil fuel combustion, cement production, and land-use change; it is the single largest contributor to long-term climate change due to its high cumulative emissions and long atmospheric lifetime;
- **methane (CH₄)**, originating from agriculture (especially ruminant livestock and rice cultivation), fossil fuel extraction and transport, and waste decomposition; it has a strong warming effect over short time horizons;
- **nitrous oxide (N₂O)**, released mainly from agricultural soils through nitrogen fertilizer use and from certain industrial processes; it is both a potent greenhouse gas and an ozone-depleting substance;
- **halogenated hydrocarbons** (including CFCs, HCFCs, and HFCs), synthetic gases used in refrigeration, foams, and industrial applications, many of which have extremely high global warming potentials.

Greenhouse gases differ markedly in their **global warming potential (GWP)** and **atmospheric lifetime**. While methane is a short-lived climate pollutant with strong near-term warming effects, carbon dioxide persists in the climate system for centuries. This distinction is crucial for climate policy, as it shapes the balance between short-term climate benefits and long-term stabilization objectives.

Ozone: Protection and Pollution

Ozone plays a dual role in the atmosphere, depending on its altitude.

- **Tropospheric ozone**, formed near the Earth's surface from nitrogen oxides (NO_x) and volatile organic compounds (VOCs) under sunlight, is a key component of photochemical smog. It is a powerful oxidant that damages human lung tissue, exacerbates asthma and cardiovascular disease, reduces crop yields, and impairs forest growth. Its formation links air quality directly to transport, industry, and urbanization.
- **Stratospheric ozone**, concentrated at altitudes of roughly 20–25 km, forms the ozone layer that absorbs harmful ultraviolet (UV-B) radiation. Depletion of this layer by chlorine- and bromine-containing substances—most notably chlorofluorocarbons (CFCs)—led to increased UV exposure, with risks for human health, ecosystems, and agricultural productivity. The ozone hole phenomenon represents a key example of global atmospheric change triggered by relatively small concentrations of synthetic chemicals.

Particulate Matter and Aerosols

Particulate matter (PM) consists of solid and liquid particles suspended in the air, ranging from coarse dust to fine and ultrafine particles (PM_{2.5} and smaller). These particles originate from:

- direct emissions (soot, ash, mineral dust),

- secondary formation from gaseous precursors such as sulfur dioxide (SO₂), nitrogen oxides, and ammonia.

Fine particles penetrate deep into the respiratory system and bloodstream, making particulate air pollution one of the most serious environmental health risks worldwide. In addition to health impacts, aerosols influence climate by scattering and absorbing solar radiation and by affecting cloud formation. Some aerosols exert a **cooling effect**, partially masking greenhouse-gas-induced warming, while others—such as black carbon—contribute to warming and accelerate ice and snow melt.

Persistent Organic Pollutants and Heavy Metals

Persistent organic pollutants (POPs), including dioxins, polychlorinated biphenyls (PCBs), and certain pesticides, are characterized by chemical stability, long atmospheric lifetimes, and the ability to undergo long-range transport. They accumulate in soils, sediments, and living organisms, biomagnifying along food chains and posing long-term toxic, endocrine-disrupting, and carcinogenic risks.

Heavy metals, such as lead, mercury, cadmium, chromium, and arsenic, enter the atmosphere through industrial emissions, coal combustion, mining, and waste incineration. While many heavy metal impacts are most severe at local or occupational scales, some—particularly mercury—are transported globally and accumulate in aquatic food webs, creating significant health risks for humans and wildlife.

Mitigation Co-benefits

Air pollution and climate change are closely interlinked. Many pollutants share common sources, and atmospheric processes create interactions between gases and particles. Consequently, mitigation strategies often produce multiple co-benefits, as reductions in fossil fuel use lead to concurrent decreases in greenhouse gas emissions, particulate matter, and sulfur and nitrogen oxides, with positive implications for climate objectives and public health. Conversely, poorly designed measures may reduce one pollutant while increasing another, highlighting the need for integrated air quality and climate governance.

In sum, air pollution and greenhouse gas emissions exemplify how local environmental health issues and global climate change are tightly connected. A comprehensive understanding of their sources, chemical behavior, health effects, and climatic impacts is essential for designing effective environmental policy and for linking air quality management with long-term climate mitigation strategies.

2.2.2 Climate, Climate Change and Global Warming

Climate refers to the long-term statistical characteristics of weather, typically assessed over periods of at least 30 years. On the basis of multiple, independent lines of evidence—including instrumental observations, satellite measurements, paleoclimate reconstructions, and climate

modelling—it is now **scientifically undisputed** that the Earth’s climate system is undergoing rapid change driven predominantly by human activities. Key observed trends include:

- sustained warming of the **lower atmosphere (troposphere)** and the **global ocean**,
- sharply increased atmospheric concentrations of major greenhouse gases since the Industrial Revolution,
- widespread retreat of **mountain glaciers, polar ice sheets, and sea ice**, with particularly rapid change in the Arctic.

This long-term increase in global mean temperature is commonly referred to as **global warming**, which represents the central physical manifestation of **anthropogenic climate change**. However, climate change extends far beyond warming alone, encompassing large-scale alterations in atmospheric circulation, precipitation regimes, cryosphere dynamics, and ocean chemistry.

Climate System Dynamics and Feedbacks

Climate change is shaped by a range of **feedback mechanisms** that can amplify or dampen initial warming. Positive feedbacks include:

- the **ice–albedo feedback**, whereby melting ice reduces surface reflectivity and accelerates warming;
- increased atmospheric **water vapour**, itself a powerful greenhouse gas;
- carbon-cycle feedbacks, such as reduced carbon uptake by warming oceans and stressed terrestrial ecosystems.

These processes raise concerns about potential **tipping points**, where gradual warming could trigger abrupt and irreversible changes in components of the climate system, such as ice-sheet collapse or large-scale ecosystem dieback.

Observed and Projected Impacts

Climate change affects natural and human systems through multiple, interacting pathways. Observed and projected impacts include:

- **more frequent and intense heatwaves**, increasing heat-related mortality, labour productivity losses, and energy demand;
- **changes in precipitation patterns**, with heightened flood risk in some regions and prolonged droughts in others;
- **declining snow cover and glacier mass**, altering seasonal water availability for agriculture, hydropower, and ecosystems;
- **sea-level rise**, driven by thermal expansion and land-ice melt, threatening coastal zones, deltas, and small island states;

- **increased frequency and intensity of forest and bush fires**, linked to hotter and drier conditions;
- **shifts in species distributions and phenology**, intensifying pressure on ecosystems, agriculture, and food security.

Many of these impacts interact and compound one another, producing cascading risks—for example, heat and drought increasing wildfire risk, which in turn degrades air quality and ecosystem services.

Regional Climate Change: The Carpathian Basin

Climate change manifests unevenly across regions. In the **Carpathian Basin**, including Hungary, long-term observations reveal:

- a clear and accelerating **warming trend**, exceeding the global average in some seasons;
- increasing **precipitation variability**, characterized by both more intense rainfall events and more frequent drought periods;
- an overall **decline in annual precipitation**, particularly during the vegetation period.

These trends pose serious challenges for agriculture, forestry, water management, and biodiversity conservation, increasing vulnerability to heat stress, soil degradation, and hydrological extremes.

Social Inequality, Vulnerability, and Climate Justice

Climate change is not socially neutral. Its impacts are distributed unevenly across regions, social groups, and generations. Poorer populations and countries—often those least responsible for historical greenhouse gas emissions—are typically the most vulnerable. They tend to:

- rely more heavily on climate-sensitive livelihoods such as agriculture and fisheries,
- have limited financial, technological, and institutional capacity to adapt,
- face compounding risks related to poverty, health, and political instability.

These asymmetries have led to the framing of climate change as an issue of **climate justice**, emphasizing responsibility, equity, intergenerational fairness, and the need for support mechanisms such as adaptation finance and loss-and-damage arrangements.

International Climate Policy Framework

In response to growing scientific evidence and societal concern, the international community has developed a sequence of multilateral agreements aimed at stabilizing the climate system.

- The **Montreal Protocol** demonstrated that coordinated international action can successfully reverse global atmospheric damage by phasing out ozone-depleting substances.

- The **UN Framework Convention on Climate Change** established the foundational principles of global climate governance, including precaution, equity, and common but differentiated responsibilities.
- The **Kyoto Protocol** introduced legally binding emission reduction targets for industrialized countries and pioneered market-based mechanisms such as emissions trading.
- The **Paris Agreement** marked a shift toward universal participation, aiming to hold global warming to well below 2 °C and pursue efforts to limit it to 1.5 °C. It emphasizes long-term decarbonization pathways, adaptation planning, transparency, and climate finance.

Challenges and Limits of Climate Governance

Despite this evolving governance architecture, current global emission trajectories remain inconsistent with agreed temperature goals. Implementation gaps, uneven ambition, and structural dependence on fossil energy continue to hinder progress.

Effective climate action therefore requires not only international agreements, but **deep, systemic transformation**, including:

- decarbonization of energy systems,
- changes in land use and food production,
- shifts in consumption patterns and lifestyles,
- integration of climate considerations into economic, social, and development policy.

Climate change thus exemplifies a global environmental problem in its most comprehensive form: scientifically well established, socially unequal in its impacts, politically contested in its solutions, and deeply embedded in the organization of modern economies and societies.

2.3 Integrated Water Challenges: Freshwater Scarcity and Marine Pollution

2.3.1 Freshwater Availability and Access

Freshwater is a fundamental prerequisite for life, ecosystem functioning, and socio-economic development. It underpins food production, energy generation, industrial activity, sanitation, and public health. Despite the visual dominance of water on the Earth's surface, **freshwater is both limited and unevenly accessible**. Approximately 97.4% of global water resources are saline, while only about 2.6% constitute freshwater. Of this freshwater fraction, the majority is stored in glaciers, ice caps, and deep groundwater, leaving only a very small share—estimated at roughly **0.03% of total global water resources**—readily available in rivers, lakes, wetlands, and shallow aquifers.

As a result, global freshwater challenges are less a question of absolute scarcity than of **spatial distribution, temporal variability, quality, and governance capacity**. Several interrelated problems define the contemporary freshwater crisis:

- **Strongly uneven distribution of freshwater resources** between regions, with water abundance in some areas and chronic scarcity in others;
- **Rapidly growing water demand**, driven by population growth, irrigation-intensive agriculture, industrial expansion, and urbanization;
- **Over-abstraction of surface waters and aquifers**, frequently exceeding natural recharge rates and leading to declining groundwater levels, river desiccation, land subsidence, and saltwater intrusion in coastal zones;
- **Insufficient access to safe drinking water and sanitation**, affecting hundreds of millions of people and contributing to preventable disease, malnutrition, and mortality.

Agriculture remains by far the largest global water user, accounting for roughly 70% of freshwater withdrawals worldwide. This dominance links water scarcity directly to food security and land-use systems. Industrial water use and household consumption are also increasing, particularly in rapidly urbanizing regions. At the same time, climate change is altering the hydrological cycle, intensifying droughts and floods, increasing evaporation, and reducing the reliability of water supplies in many regions reported by long-term observations.

Freshwater scarcity increasingly has a **strategic and geopolitical dimension**. Many of the world's major rivers and aquifers cross national borders, creating upstream–downstream dependencies and potential conflicts. In this context, water is often described as the “blue gold” of the 21st century, highlighting its growing economic, political, and security relevance. Sustainable freshwater management therefore requires integrated river basin governance, international cooperation, and long-term planning that balances human demands with ecological needs.

2.3.2 Water Pollution and Aquatic Ecosystems

Alongside increasing water scarcity, **water pollution constitutes one of the most significant global threats to freshwater and marine ecosystems**. The quality of water resources determines their suitability for drinking water supply, irrigation, industrial production, recreation, and the maintenance of aquatic biodiversity. Over recent decades, water quality degradation has intensified as a result of rapid urbanization, industrial expansion, and the intensification of agricultural practices.

The principal sources of freshwater pollution include:

- **untreated or inadequately treated municipal wastewater**, which introduces pathogens, organic matter, nutrients, pharmaceuticals, and various micro-pollutants into rivers, lakes, and groundwater;

- **industrial discharges**, frequently containing heavy metals, acids, solvents, persistent organic compounds, and heat, all of which can have toxic or disruptive effects on aquatic systems;
- **agricultural runoff**, which transports surplus nutrients (notably nitrogen and phosphorus), pesticides, and sediments from cultivated land into surface waters and aquifers.

These pollutants degrade aquatic environments through processes such as **eutrophication, oxygen depletion, and chemical toxicity**. Elevated nutrient inputs stimulate excessive algal growth, reducing light penetration, altering food-web dynamics, and, in some cases, producing harmful algal toxins. Subsequent decomposition of organic matter can lead to hypoxic or anoxic conditions, resulting in fish kills and the loss of sensitive aquatic species.

Beyond chemical pollution, freshwater ecosystems are increasingly affected by **hydromorphological and biological pressures**, including:

- the spread of **invasive alien species**, which can outcompete native organisms, disrupt ecological interactions, and fundamentally alter ecosystem structure and functioning;
- **river regulation and habitat modification** through dam construction, channelization, and wetland drainage, which interrupt natural flow regimes, sediment transport, and migratory pathways;
- **excessive water abstraction**, which reduces ecological flows and weakens the natural self-purification capacity of rivers and lakes.

Marine and coastal ecosystems are subject to additional, often cumulative pressures originating from both terrestrial and marine activities. Major stressors include:

- **overfishing and destructive fishing practices**, which deplete fish stocks, simplify food webs, and reduce ecosystem resilience;
- **oil spills and chronic hydrocarbon pollution** linked to offshore extraction and maritime transport;
- **nutrient inputs from land-based sources**, giving rise to extensive hypoxic “dead zones” in coastal waters;
- **plastic and chemical pollution**, including microplastics that persist in marine environments and accumulate along food chains;
- **climate-related stressors**, particularly ocean warming and ocean acidification resulting from increased absorption of atmospheric carbon dioxide.

Among marine ecosystems, **coral reefs serve as especially sensitive indicators of environmental stress**. Elevated sea surface temperatures disrupt the symbiotic relationship between reef-building corals and their photosynthetic algae, leading to coral bleaching. When bleaching events are frequent or prolonged—especially in combination with pollution, overfishing, and acidification—reef systems may undergo large-scale degradation or collapse.

The loss of coral reefs has profound implications for marine biodiversity, fisheries productivity, coastal protection, and tourism-based livelihoods.

Taken together, water pollution and aquatic ecosystem degradation demonstrate how environmental pressures originating on land propagate through freshwater systems into coastal and marine environments. Addressing these interconnected challenges requires **integrated water and ecosystem management**, combining pollution prevention, sustainable water use, habitat conservation and restoration, and climate adaptation across the entire land–freshwater–marine continuum.

2.4 Soil Degradation, Desertification and Land Use

2.4.1 Soil as a Critical Resource

Soils are complex, living systems that develop over long time periods through the interaction of the **original geological material, climate, organisms, topography, and time**. Under natural conditions, the formation of a few centimeters of fertile topsoil may take centuries, which means that soils are effectively **non-renewable on human time scales**. Their physical, chemical, and biological diversity underpins terrestrial ecosystems, agricultural productivity, and a wide range of ecosystem services essential for human well-being.

Beyond food production, soils play a critical role in:

- **water regulation**, by storing, filtering, and slowly releasing water;
- **nutrient cycling**, supporting plant growth and microbial activity;
- **carbon sequestration**, as soils store more carbon globally than the atmosphere and terrestrial vegetation combined;
- **biodiversity conservation**, providing habitat for an immense diversity of microorganisms, invertebrates, and plant roots.

Despite their importance, soil quality and quantity are being degraded at an accelerating pace due to human activities. Major forms of soil degradation include:

- **Erosion by water and wind**, which removes fertile topsoil, reduces soil depth, and transports sediments, nutrients, and pollutants into rivers and lakes;
- **Chemical degradation**, including salinization, acidification, and contamination by heavy metals, pesticides, and industrial chemicals;
- **Physical degradation**, such as compaction caused by heavy machinery and **soil sealing** through urban development, roads, and other infrastructure, which permanently eliminates soil functions;
- **Decline in soil organic matter and nutrient stocks**, often linked to intensive tillage, monoculture cropping, insufficient residue return, and overuse of mineral fertilizers without organic inputs.

These degradation processes frequently interact and reinforce one another. For example, the loss of organic matter weakens soil structure, reduces water-holding capacity, and increases vulnerability to erosion and drought. Degraded soils require higher external inputs to maintain yields, reducing economic efficiency and increasing environmental pressures.

Soil degradation has far-reaching consequences beyond agriculture. Reduced infiltration capacity increases surface runoff and flood risk, while diminished filtration capacity contributes to water pollution. Carbon losses from degraded soils exacerbate climate change, creating feedback loops between land use and the climate system. Consequently, soil protection and restoration are increasingly recognized as central pillars of **sustainable land management**, climate mitigation, and long-term food security.

2.4.2 Desertification and Land Degradation in Drylands

In arid, semi-arid, and dry sub-humid regions—collectively referred to as **drylands**—natural climatic variability interacts with human land-use practices to produce **desertification**, more precisely described as **land degradation in drylands**. Rather than the simple advance of deserts, desertification refers to a long-term decline in the biological productivity, ecological integrity, and socio-economic value of land.

The main drivers of desertification and dryland degradation include:

- **Deforestation and removal of natural vegetation**, which exposes soils to erosion and disrupts local water and nutrient cycles;
- **Overgrazing and frequent burning**, reducing plant cover, compacting soils, and preventing natural regeneration;
- **Poorly designed or managed irrigation systems**, leading to secondary salinization and waterlogging, particularly in closed basins;
- **Unsustainable cultivation practices** on fragile soils, such as continuous cropping, insufficient fallow periods, and inappropriate mechanization;
- **Climate change**, which increases temperatures, alters rainfall patterns, and intensifies the frequency and severity of droughts.

These environmental drivers are often amplified by **socio-economic factors**, including population pressure, poverty, insecure land tenure, limited access to education and technology, and weak governance. In many dryland regions, land users face short-term survival constraints that encourage practices which degrade land further, creating self-reinforcing degradation cycles.

Globally, land degradation in drylands affects extensive areas and hundreds of millions of people. Desertified and degraded lands are estimated to expand by **millions of hectares each year**, particularly in parts of Africa, the Middle East, Central and South Asia, the Americas, and Australia. The consequences extend well beyond environmental damage and include declining agricultural yields, food insecurity, loss of livelihoods, increased vulnerability to climate extremes, forced migration, and heightened risks of social tension and conflict.

Combating desertification requires **integrated and context-specific strategies**. Effective responses combine soil and water conservation, sustainable grazing and cropping systems, restoration of degraded ecosystems, and improved irrigation management with broader socio-economic measures such as land tenure security, rural development, and climate adaptation planning. In the context of accelerating climate change, addressing land degradation in drylands is increasingly viewed as a critical component of global efforts to ensure food security, ecological resilience, and long-term regional stability.

2.5 Demographic Change, Urbanization and Social Issues

2.5.1 Population Growth and Distribution

Human population dynamics constitute a fundamental driver of environmental change, shaping the scale and spatial distribution of resource use, emissions, and land transformation. Since the beginning of the twentieth century, global population has grown at an unprecedented rate, increasing from less than two billion to more than eight billion people. Current projections suggest that world population may approach **nine billion by around 2050**, although growth rates are slowing at the global level and differ markedly between regions.

Population change is commonly interpreted through the **demographic transition model**, which describes the long-term shift from high to low birth and death rates as societies undergo economic and social development:

1. **High birth and death rates**, resulting in limited population growth, characteristic of pre-industrial societies.
2. **Declining death rates with persistently high birth rates**, leading to rapid population growth as a result of improvements in nutrition, sanitation, and health care.
3. **Declining birth rates**, associated with rising incomes, urbanization, expanded education—particularly of women—and improved access to family planning.
4. **Low birth and death rates**, producing population stabilization or decline and increasingly ageing populations.

Most industrialized and high-income countries have entered **stage 3 or 4**, facing challenges related to population ageing, shrinking workforces, and changing dependency ratios. In contrast, many low- and middle-income countries—especially in **Sub-Saharan Africa and parts of Asia and Latin America**—remain in **stage 2 or early stage 3**, where high population growth continues to place pressure on economic systems, infrastructure, and natural resources.

From an environmental perspective, population growth and spatial distribution influence:

- **demand for land, water, energy, and food**, intensifying competition among sectors;
- **levels of waste generation and emissions**, particularly where infrastructure and environmental regulation are insufficient;

- **pressure on ecosystems and biodiversity**, driven by land-use change, habitat fragmentation, and resource extraction.

However, population size alone does not determine environmental impact. Consumption patterns, technological choices, institutional capacity, and governance frameworks critically mediate the relationship between population dynamics and environmental sustainability. High per-capita resource use in affluent societies often outweighs the environmental impact of population growth in poorer regions.

2.5.2 Poverty, Hunger and Inequality

Despite substantial increases in global economic output, **poverty and hunger remain persistent and widespread**. Hundreds of millions of people continue to experience chronic undernourishment, inadequate access to safe water and sanitation, and limited health care and education opportunities. These challenges are most acute in rapidly growing and highly indebted developing countries, where economic growth often fails to translate into equitable improvements in living conditions.

In many regions, **agricultural productivity has not kept pace with population growth**, due to land degradation, water scarcity, limited access to technology and inputs, and increasing climate variability. As a result, food insecurity remains chronic, and households are highly vulnerable to climatic shocks, price volatility, and disruptions in global supply chains.

At the same time, global inequality is reflected in starkly divergent consumption patterns. While large segments of the world's population struggle to meet basic needs, **overconsumption in affluent societies** drives disproportionate levels of energy use, material extraction, greenhouse gas emissions, and waste generation. On a per-capita basis, high-income countries contribute far more to climate change and resource depletion than low-income countries.

Poverty and inequality thus interact closely with environmental degradation. Poverty can force households into environmentally damaging coping strategies, such as deforestation, overgrazing, or cultivation of marginal land. Conversely, environmental degradation undermines livelihoods, health, and food security, reinforcing poverty traps. Addressing poverty, hunger, and inequality is therefore both a social and an environmental imperative.

2.5.3 Urbanization and the Built Environment

Urbanization represents one of the most profound spatial transformations of contemporary societies. Today, approximately **70–80% of the global population lives in urban areas**, a share that continues to increase, particularly in Africa and Asia. Cities concentrate population, economic activity, infrastructure, and consumption, making them focal points of environmental pressure as well as potential hubs for sustainability transitions.

Rapid urban expansion is associated with multiple environmental challenges:

- **conversion of agricultural land and natural habitats** into built-up areas;

- **soil sealing by buildings, roads, and pavements**, which disrupts natural water infiltration, increases runoff, and heightens flood risk;
- **high concentrations of air and noise pollution**, primarily from transport, industry, and energy use;
- **urban heat island effects**, where reduced vegetation and heat-absorbing surfaces raise local temperatures;
- **social challenges**, including overcrowding, housing shortages, and the growth of informal settlements and slums in fast-growing cities.

Urban areas also concentrate vulnerability to climate change, as heatwaves, floods, and infrastructure failures disproportionately affect dense populations. At the same time, cities offer significant opportunities for reducing environmental impacts. High population density can enable more efficient public transport, lower per-capita energy use, and centralized provision of water, waste, and energy services.

Sustainable urban development therefore plays a central role in addressing global environmental challenges. Integrated urban planning, green infrastructure, energy-efficient buildings, sustainable mobility systems, and inclusive governance can reduce environmental pressures while improving social equity and quality of life. Urban systems are thus simultaneously major contributors to environmental degradation and critical arenas for implementing solutions that align demographic trends with ecological limits and social well-being.

2.6 Biodiversity Loss

Biodiversity, defined as the diversity of genes, species, and ecosystems, is a fundamental component of the Earth system. It underpins **ecosystem resilience**, supports food security and human health, stabilizes biogeochemical cycles, and contributes to cultural identity, recreation, and overall well-being. High levels of biodiversity enhance the capacity of ecosystems to absorb disturbances, adapt to environmental change, and continue to provide essential ecosystem services.

Despite its central importance, biodiversity is currently declining at an unprecedented rate. Multiple scientific assessments indicate that the **current rate of species extinction far exceeds natural background levels**, leading many researchers to characterize the present period as a human-driven biodiversity crisis or, in broader terms, a sixth mass extinction. Unlike earlier mass extinction events driven by geological or astronomical forces, contemporary biodiversity loss is overwhelmingly the result of human activities.

Drivers of Biodiversity Loss

The decline of biodiversity is driven by several interacting pressures, most notably:

- **Habitat loss and fragmentation**, resulting from the expansion and intensification of agriculture, forestry, infrastructure development, mining, and urbanization;
- **Overexploitation of biological resources**, including unsustainable hunting, logging, fishing, and harvesting practices that exceed regenerative capacities;
- **Pollution**, such as nutrient enrichment, pesticides, plastics, and toxic substances, which degrade habitats and impair organism health and reproduction;
- **Invasive alien species**, which can outcompete native species, alter ecosystem structure, and introduce novel diseases;
- **Climate change**, which modifies temperature and precipitation regimes, shifts species distributions, disrupts phenological processes, and amplifies other drivers of biodiversity loss.

These drivers frequently act in combination, reinforcing one another and reducing the adaptive capacity of species and ecosystems.

Scale and Evidence of Biodiversity Decline

Historical documentation suggests that, over the past few centuries, **hundreds of bird, mammal, and flowering plant species have become extinct** due to human activities. This documented loss likely underestimates the true scale of biodiversity decline, as many species—particularly invertebrates, microorganisms, and taxa in poorly studied regions—may disappear before being scientifically described.

The global conservation status of species is systematically assessed by the **International Union for Conservation of Nature**, whose Red List of Threatened Species represents the most comprehensive global inventory of extinction risk. The Red List plays a key role in conservation planning, policy development, and the prioritization of protection and restoration efforts.

Consequences of Biodiversity Loss

Biodiversity loss has wide-ranging ecological, economic, and social implications. Major consequences include:

- **reduced availability of wild food resources and genetic diversity**, critical for food security, medicine, and breeding programs;
- **declining ecosystem services**, including pollination, water purification, soil formation, nutrient cycling, and climate regulation;
- **disruption of biogeochemical cycles**, potentially amplifying climate change and environmental instability;

- **loss of cultural, aesthetic, and recreational values**, affecting human well-being and nature-based livelihoods.

Beyond these direct effects, biodiversity loss undermines **ecosystem resilience**, increasing vulnerability to additional pressures such as climate extremes, invasive species, and further land-use change.

Biodiversity Loss as a Governance Challenge

Biodiversity loss is not solely an ecological issue but also a reflection of land-use decisions, consumption patterns, and governance structures. Conservation strategies increasingly recognize that protected areas alone are insufficient. Effective biodiversity protection requires **integrated approaches** that combine habitat conservation, sustainable resource management, ecosystem restoration, and the mainstreaming of biodiversity considerations across agriculture, forestry, fisheries, urban development, and climate policy.

In the context of global environmental change, biodiversity loss is deeply interconnected with other sustainability challenges addressed in this chapter. Addressing it is therefore essential not only for nature conservation, but also for maintaining ecosystem resilience and ensuring a sustainable and equitable future for human societies.

2.7 Energy, Resources and the Energy Crisis

Modern societies are fundamentally dependent on large and reliable energy supplies. Energy constitutes a **structural foundation of economic and social systems**, enabling industrial production, transportation, agriculture, heating and cooling of buildings, and the provision of essential services such as water supply, health care, and communication. Consequently, patterns of energy production and consumption exert a decisive influence on resource use, environmental pressures, and long-term sustainability.

At present, the global energy system remains dominated by **non-renewable energy sources**, most notably:

- coal,
- oil,
- natural gas, and
- uranium, used for nuclear power generation.

These energy sources have historically supported rapid industrialization and economic growth due to their **high energy density**, relative ease of storage and transport, and compatibility with centralized energy infrastructures. At the same time, their continued dominance has generated a series of interconnected environmental, economic, and geopolitical challenges.

Limits and Risks of Fossil and Nuclear Energy

Non-renewable energy sources are inherently **finite**, and their extraction becomes increasingly capital-intensive, energy-intensive, and environmentally disruptive over time. Although technological advances have temporarily expanded accessible reserves, long-term reliance on fossil fuels is constrained by resource depletion and declining energy returns.

From an environmental perspective, fossil fuel combustion represents the **single largest source of anthropogenic carbon dioxide emissions**, making the energy sector the principal driver of climate change. In addition, fossil energy use produces significant quantities of air pollutants—including sulfur dioxide, nitrogen oxides, and particulate matter—which impose substantial costs on human health and ecosystems.

Nuclear energy involves a distinct set of trade-offs. While operational greenhouse gas emissions are low, nuclear power is associated with **systemic risks and governance challenges**, including:

- the potential for severe accidents with long-lasting ecological and social impacts,
- unresolved issues of long-term radioactive waste management,
- high capital costs and extended construction times,
- concerns related to security and proliferation.

Together, these constraints contribute to what is commonly referred to as the **energy crisis**, understood not as a temporary shortage but as a structural problem encompassing resource limits, environmental degradation, climate change, price volatility, and energy security.

Renewable Energy Sources: Potential and Constraints

In contrast, **renewable energy sources**—including solar, wind, hydropower, geothermal energy, and biomass—are replenished on human time scales and are geographically widespread. During operation, most renewables generate little or no greenhouse gas emissions, making them central components of climate mitigation strategies.

Renewable energy systems offer several advantages, including reduced dependence on finite resources, lower operational emissions, and the potential for decentralized energy production. At the same time, their large-scale deployment faces important constraints:

- high **upfront investment costs**, despite low long-term operating expenses;
- dependence on **specific geographic and climatic conditions**;
- the need for substantial **grid expansion and system integration**;
- unresolved challenges related to **variability, storage, and system flexibility**.

Moreover, the expansion of renewable energy increases demand for land and critical raw materials, raising new questions of spatial planning, supply security, and environmental trade-offs.

Energy Efficiency, Demand, and Systemic Transformation

Addressing the energy crisis requires more than a substitution of energy sources. **Energy efficiency improvements and demand-side measures** are equally essential. Enhancing efficiency in buildings, transport, industrial processes, and appliances can significantly reduce energy demand while maintaining service provision.

Equally important are **changes in consumption patterns**, including shifts toward low-carbon mobility, energy-efficient buildings, circular production systems, and reduced material throughput. From a systems perspective, the energy transition represents a **structural transformation of economic and social systems**, involving changes in infrastructure, markets, regulation, behavior, and governance.

The Energy Crisis as a Sustainability Challenge

The transition toward a low-carbon, resource-efficient energy system is one of the defining challenges of sustainable development. It directly affects climate mitigation, air quality, resource security, and economic stability, while also raising issues of social equity and energy access.

In this sense, the energy crisis is not merely a technical problem of supply, but a broader sustainability challenge situated at the intersection of **resource limits, environmental protection, economic organization, and social justice**. Addressing it requires integrated policy frameworks that combine technological innovation, regulatory instruments, economic incentives, and societal change.

2.8 Human Health and Environmental Quality

Environmental quality is a fundamental determinant of human health and well-being. Degradation of air, water, soil, and ecosystems affects health both **directly**, through exposure to harmful substances and physical stressors, and **indirectly**, by undermining ecosystem services, livelihoods, and social stability. Environmental change is therefore increasingly recognized not only as an ecological or economic concern, but as a core issue of **public health and societal resilience**.

Health impacts arise through multiple and often interacting pathways, and they are unevenly distributed across populations. Children, older adults, people with pre-existing health conditions, and socio-economically disadvantaged groups are typically the most vulnerable. Importantly, many environmental health risks are **chronic, cumulative, and long-term**, complicating causal attribution and policy responses.

Air Pollution and Health

Air pollution is one of the leading environmental risk factors for premature mortality worldwide. Exposure to:

- **particulate matter (PM_{2.5} and PM₁₀)**,

- **ozone (O₃),**
- **sulfur dioxide (SO₂),**
- **nitrogen dioxide (NO₂),**
- **and toxic organic compounds,**

is associated with respiratory diseases, cardiovascular illness, stroke, and certain cancers. Fine particulate matter is particularly harmful due to its ability to penetrate deep into the lungs and enter the bloodstream, triggering systemic inflammation and oxidative stress. Long-term exposure reduces life expectancy and imposes substantial costs on health systems and economies.

Water, Sanitation, and Hygiene

Access to **safe drinking water, adequate sanitation, and hygiene** is essential for disease prevention. In many regions, insufficient water supply, inadequate wastewater treatment, and poor sanitation infrastructure lead to the spread of waterborne diseases such as diarrhea, cholera, typhoid fever, and parasitic infections.

Chemical contamination of water resources—through nitrates, pesticides, pharmaceuticals, heavy metals, and industrial chemicals—poses additional chronic health risks. Water insecurity also contributes indirectly to malnutrition, impaired child development, reduced educational outcomes, and heightened vulnerability during droughts and floods.

Soil, Food Contamination, and Toxic Exposure

Soil contamination constitutes an important but often overlooked pathway of human exposure. Heavy metals (including lead, mercury, cadmium, and arsenic) and persistent organic pollutants can accumulate in soils and enter the human body through crops, livestock, and drinking water. Chronic exposure may result in neurological damage, endocrine disruption, reproductive disorders, immune suppression, and increased cancer risk.

Food safety and nutrition are therefore closely linked to environmental quality, land management, and pollution control. Degraded soils and contaminated ecosystems undermine not only food production but also long-term public health outcomes.

Climate Change as a Health Risk Multiplier

Climate change acts as a major health risk multiplier, intensifying existing environmental and social vulnerabilities. Rising temperatures increase the frequency and severity of heatwaves, leading to heat stress, dehydration, and excess mortality, particularly among elderly and urban populations.

Climate change also alters the geographical distribution and seasonality of **infectious diseases**, especially vector-borne diseases transmitted by mosquitoes and ticks. Extreme weather events—such as floods, storms, droughts, and wildfires—cause injuries, displacement, mental health impacts, and long-term disruption of health services and infrastructure.

Noise and Light Pollution

Environmental health risks extend beyond chemical exposures. Chronic **noise pollution**, primarily from transport, industry, and dense urban environments, contributes to stress, sleep disturbance, impaired cognitive performance, and increased cardiovascular risk. These effects significantly reduce quality of life even when they do not result in acute illness.

Similarly, **light pollution**, caused by excessive artificial illumination at night, disrupts circadian rhythms and suppresses melatonin production. Growing evidence links long-term exposure to artificial light at night to sleep disorders, metabolic dysfunction, mental health impacts, and potentially elevated risks of certain cancers.

Environmental Quality and Preventive Public Health

Taken together, these pathways demonstrate that **environmental quality is a cornerstone of preventive public health**. Many of the most effective health interventions lie outside the traditional health sector and include:

- reducing air and water pollution,
- ensuring safe sanitation and waste management,
- protecting soils and food systems,
- mitigating and adapting to climate change,
- and designing healthier urban environments.

Improving environmental quality delivers substantial **co-benefits**, including reduced disease burden, lower health-care costs, increased productivity, and enhanced quality of life. Environmental protection and public health are therefore deeply interconnected objectives, and policies that address environmental degradation simultaneously contribute to healthier, more resilient, and more equitable societies.

2.9 The Global Waste Crisis

The generation of waste is an inherent characteristic of contemporary production and consumption systems. Across all stages of value chains—resource extraction, manufacturing, distribution, consumption, and end-of-life—materials are transformed into waste streams. As living standards rise, consumption expands, and global population grows, **waste generation has increased rapidly worldwide**, placing mounting pressure on ecosystems, public health, and governance systems.

The global waste crisis is not merely a consequence of inadequate disposal capacity; it reflects the structural features of predominantly **linear economic systems**, in which materials are extracted, processed, consumed, and discarded. This linear model results in inefficient resource use, loss of valuable materials, and escalating environmental burdens.

Scale and Structure of Global Waste Streams

Global waste streams are diverse and include municipal solid waste, industrial waste, construction and demolition waste, agricultural residues, hazardous waste, and rapidly expanding streams such as plastic waste and **electronic waste (e-waste)**. Key challenges associated with current waste management practices include:

- **insufficient waste prevention, reuse, and recycling**, leading to continued dependence on virgin materials;
- persistent **reliance on landfilling and incineration**, often without adequate environmental safeguards;
- **inadequate management of hazardous wastes**, including toxic, infectious, explosive, carcinogenic, and radioactive materials;
- **illegal dumping and transboundary waste trade**, frequently shifting environmental and health risks to regions with weaker regulatory frameworks.

These challenges are unevenly distributed across regions. High-income countries typically generate the largest amounts of waste per capita, while low- and middle-income countries often face rapid increases in waste volumes without corresponding investment in waste-management infrastructure.

Environmental and Health Implications

Poorly managed waste can contaminate **air, water, and soil**, generating significant environmental and public health risks. Landfills may emit methane—a potent greenhouse gas—and produce leachate containing heavy metals and organic pollutants. Open burning and inadequately controlled incineration release particulate matter, dioxins, and other hazardous substances. Plastic waste persists in terrestrial and marine environments, fragmenting into microplastics that accumulate in ecosystems and food webs.

Hazardous waste presents particularly severe risks. Improper handling of medical waste increases infection risks, while mismanaged chemical and electronic waste exposes workers and surrounding communities to toxic substances. Radioactive waste poses long-term challenges due to its persistence and the need for secure containment over extended time horizons.

The Waste Hierarchy as a Policy Framework

Policy responses to the waste crisis are commonly organized according to the **waste hierarchy**, which ranks waste management options based on their environmental effectiveness:

1. **Prevention and reduction**, focusing on minimizing material use, improving product design, extending product lifetimes, and avoiding unnecessary consumption;
2. **Reuse and repair**, which conserve materials and energy while supporting local economic activity;
3. **Recycling and recovery**, enabling the recapture of materials and energy when prevention and reuse are not feasible;

4. **Safe treatment and disposal**, required for residual waste and hazardous materials to protect human health and the environment.

Despite widespread recognition of this hierarchy, many waste-management systems remain dominated by disposal-oriented approaches, highlighting the need for structural change.

Toward Circular and Resource-Efficient Systems

Long-term solutions to the global waste crisis require a **systemic transition toward circular and resource-efficient economic models**. Such models aim to retain materials within economic systems for as long as possible, minimize waste generation by design, and reduce dependence on primary resource extraction.

This transition involves:

- redesigning products for durability, reparability, and recyclability;
- strengthening secondary raw material markets;
- integrating waste prevention into production and consumption decisions;
- implementing regulatory instruments such as extended producer responsibility;
- encouraging behavioral change among producers and consumers.

The waste crisis is closely interconnected with broader sustainability challenges, including resource depletion, energy use, pollution, and climate change. Addressing it effectively can deliver substantial co-benefits, including reduced environmental pressure, lower greenhouse gas emissions, improved public health, and more resilient economic systems. Waste management should therefore be understood not as an end-of-pipe activity, but as a central component of strategies aimed at transforming production and consumption patterns within ecological limits.

2.10 Global Environmental Change as a Systemic Challenge

The global environmental issues examined in this chapter emerge from the **dynamic interaction between ecological limits and human social, economic, and technological systems**. Air, water, and soil pollution; climate change; biodiversity loss; land degradation and desertification; resource depletion; demographic change and urbanization; human health impacts; and the global waste crisis are not independent challenges, but interconnected manifestations of a broader transformation of the Earth system driven by human activity. Their cumulative nature and mutual reinforcement distinguish contemporary environmental problems from earlier, more localized forms of environmental degradation.

A central finding is that many of these problems share **common structural drivers**. Fossil-energy-based production systems, intensive land use, linear material flows, and consumption patterns characterized by high resource throughput play a decisive role across multiple domains. These drivers link local actions to global consequences and explain why

environmental pressures increasingly exceed the regenerative and assimilative capacities of natural systems. As a result, environmental change unfolds not only through gradual trends but also through heightened risks, thresholds, and potentially irreversible impacts.

Equally important is the close coupling of environmental and social dimensions. Environmental degradation tends to affect vulnerable populations disproportionately, through exposure to pollution, climate extremes, water insecurity, and declining ecosystem services. At the same time, poverty, inequality, and weak institutional capacity can constrain sustainable resource management and intensify environmental pressures. This mutual reinforcement highlights why global environmental change must be understood simultaneously as an **ecological and social crisis**, raising questions of equity, responsibility, and governance alongside biophysical limits.

Taken together, the issues reviewed in this chapter underline the limitations of fragmented, sector-specific responses. While pollution control, conservation measures, and technological improvements remain essential, they are insufficient on their own. Effective responses require **integrated approaches** that address underlying drivers, consider cross-sector interactions, and align environmental objectives with social and economic development. Understanding the nature and interconnectedness of global environmental problems therefore provides the conceptual foundation for analyzing policy responses.

Building on this diagnosis, the subsequent chapters shift the focus from problem identification to solutions. They examine the instruments of environmental governance, including regulatory frameworks, economic and market-based tools, conservation strategies, and emerging transition pathways aimed at achieving a low-carbon, resource-efficient, and socially just future within planetary limits.

Core Concepts and Review Questions – Chapter 2

1. What best describes the relationship between global environmental problems?

Global environmental problems are closely interconnected and reinforce one another through multiple feedback mechanisms. Climate change, for example, accelerates biodiversity loss, land degradation, water scarcity and the spread of invasive species, while degraded ecosystems in turn lose their capacity to regulate climate and store carbon. Social dimensions such as poverty, inequality and resource conflicts further intensify ecological pressures, creating coupled human–environment systems in which problems cannot be addressed in isolation.

2. Why did environmental problems become global rather than regional in the 20th century?

Environmental problems became global as a result of the unprecedented scale of human activities combined with globalization. Industrial production, fossil fuel combustion, intensive agriculture and global trade expanded human pressures far beyond local ecosystems, while emissions, pollutants and resource flows increasingly crossed national boundaries. As a result, environmental impacts began to affect the Earth system as a whole and required international cooperation to manage.

3. Which combination best explains the “human–ecological world crisis”?

The human–ecological world crisis is best explained by the interaction between environmental degradation and reinforcing social tensions. Ecological damage such as climate change, biodiversity loss and resource depletion undermines food security, health and livelihoods, which in turn deepens poverty, inequality and political instability. These social stresses then increase pressure on natural systems, forming a self-reinforcing cycle.

4. What does “technological lock-in” refer to in the context of global environmental problems?

Technological lock-in refers to the long-term dependence of societies on polluting or resource-intensive technologies due to existing infrastructure, investments and institutional arrangements. Energy systems based on fossil fuels and transport systems centered on private cars are typical examples. Even when cleaner alternatives exist, lock-in makes transitions slow and costly, prolonging environmental harm.

5. Which human activity is identified as the dominant driver of recent atmospheric change?

The dominant driver of recent atmospheric change is the combustion of fossil fuels and related emissions from energy production, transport and industrial processes. These activities have significantly increased concentrations of greenhouse gases and air pollutants since the Industrial Revolution, altering atmospheric composition and driving climate change and air-quality degradation on a global scale.

6. Why are halogenated hydrocarbons considered especially problematic greenhouse gases?

Halogenated hydrocarbons are especially problematic because they have extremely high global warming potential per unit mass. Even small emissions can contribute disproportionately to radiative forcing, making them powerful drivers of climate change despite their relatively low concentrations compared to carbon dioxide. Many also have long atmospheric lifetimes.

7. Why is tropospheric ozone classified as an environmental problem?

Tropospheric ozone is classified as an environmental problem because it is a strong oxidant that damages human health, vegetation and ecosystems. Formed near the surface from precursor pollutants under sunlight, it contributes to respiratory diseases, reduces crop yields and harms natural vegetation, in contrast to stratospheric ozone, which provides essential UV protection.

8. Why is freshwater scarcity a structural global problem?

Freshwater scarcity is structural because only a very small fraction of Earth's total water is accessible freshwater suitable for human use. This limited resource is unevenly distributed and increasingly stressed by population growth, agriculture, industry and climate change. Over-abstraction and pollution further reduce availability, making water scarcity a persistent global challenge.

9. Which sector is globally the largest user of freshwater?

Agriculture is the largest user of freshwater globally, accounting for the majority of withdrawals. Irrigation-intensive farming places heavy pressure on rivers, lakes and groundwater, often exceeding natural recharge rates and contributing to water scarcity, ecosystem degradation and conflicts over water use.

10. What is a major cause of eutrophication in freshwater and marine ecosystems?

A major cause of eutrophication is nutrient runoff from agriculture, particularly nitrogen and phosphorus from fertilizers. These nutrients enter rivers, lakes and coastal waters, stimulating excessive algal growth that depletes oxygen, disrupts aquatic food webs and creates dead zones harmful to aquatic life.

11. Why is soil considered a critical but vulnerable resource?

Soil is critical because it supports food production, biodiversity and key ecosystem functions, yet it is vulnerable because it forms very slowly and can degrade rapidly. Erosion, contamination, compaction and loss of organic matter reduce soil fertility and resilience, often causing long-lasting or irreversible damage.

12. Which process contributes directly to soil sealing?

Soil sealing occurs primarily through urbanization and infrastructure development, where natural soil surfaces are covered by buildings, roads and pavements. This process prevents

water infiltration, disrupts soil functions and contributes to flooding, heat stress and loss of fertile land.

13. What is meant by desertification?

Desertification refers to land degradation in arid and semi-arid regions caused by the interaction of climatic variability and human activities. Unsustainable land use, deforestation, overgrazing and poor irrigation practices reduce soil productivity and vegetation cover, leading to desert-like conditions.

14. Which stage of demographic transition is associated with rapid population growth?

Rapid population growth occurs in the stage where death rates decline due to improved health and sanitation while birth rates remain high. This imbalance leads to fast population increase, particularly in many developing regions, intensifying pressure on resources, ecosystems and infrastructure.

15. Why does urbanization intensify environmental problems?

Urbanization intensifies environmental problems because cities concentrate population, consumption and infrastructure in limited spaces. This leads to high levels of pollution, sealed surfaces, altered water cycles, urban heat islands and increased energy and material demand, especially where urban growth is rapid and poorly planned.

16. Which driver is considered the most important cause of biodiversity loss?

Habitat loss and fragmentation are the most important drivers of biodiversity loss worldwide. Conversion of natural habitats for agriculture, forestry, infrastructure and urban development reduces living space, isolates populations and undermines ecosystem integrity.

17. Why is biodiversity loss considered a global problem rather than a local one?

Biodiversity loss is global because species extinction affects ecosystem functions and services at regional and global scales. The loss of pollinators, genetic diversity and ecosystem resilience has consequences for food security, climate regulation and human well-being worldwide.

18. Why are fossil fuels central to both the energy crisis and climate change?

Fossil fuels are central because they are finite resources and their combustion releases large amounts of greenhouse gases. Dependence on these fuels creates supply risks, environmental pollution and climate impacts, making their replacement essential for sustainable energy systems.

19. Which environmental factor is directly linked to respiratory and cardiovascular diseases?

Air pollution is directly linked to respiratory and cardiovascular diseases through exposure to particulate matter, ozone and toxic gases. These pollutants increase the risk of asthma, heart disease, stroke and premature death, especially in densely populated and industrialized areas.

20. Why is waste considered a global environmental problem?

Waste is a global problem because waste streams, pollution and trade often cross national borders. Improper handling of hazardous and plastic waste contaminates ecosystems worldwide, while transboundary waste movements shift environmental burdens between regions.

21. Which principle ranks highest in the waste-management hierarchy?

Prevention and reduction rank highest because avoiding waste generation minimizes environmental impacts most effectively. Designing durable products, reducing material use and changing consumption patterns are more sustainable than recycling, recovery or disposal.

3 Concept of Sustainable Development

3.1 From Global Environmental Problems to Sustainable Development

The idea of **sustainable development** did not appear suddenly in 2015 with the adoption of the Sustainable Development Goals (SDGs). It evolved over several decades as governments, scientists and civil society tried to make sense of a growing set of **global environmental problems** and their close links to poverty, inequality and patterns of economic growth.

By the late 1960s and early 1970s, several trends became impossible to ignore:

- rapid **population growth** and urbanization,
- accelerating **resource use** (fossil fuels, minerals, forests, fish stocks),
- visible **pollution crises** (smog episodes, oil spills, contaminated rivers and lakes),
- early warnings about **climate change** and loss of biodiversity.

These concerns led to the **1972 UN Conference on the Human Environment in Stockholm**, the first major global summit to put environmental issues onto the international political agenda. It created the **UN Environment Programme (UNEP)** and recognized that environmental protection and economic development are deeply interconnected.

At the same time, influential reports such as the **Club of Rome's "Limits to Growth" (1972)** argued that unlimited economic and population growth on a finite planet would eventually collide with ecological limits. This sparked a long-running debate: How can we reconcile development with the protection of the Earth's life-support systems?

3.2 The Brundtland Report and the Emergence of the Concept

A decisive step came with the work of the **World Commission on Environment and Development (WCED)**, often called the **Brundtland Commission** after its chair, Norwegian Prime Minister **Gro Harlem Brundtland**. The Commission was set up by the UN in 1983 to analyze the links between environment and development and to propose a new long-term strategy.

In 1987 it published the report **"Our Common Future"**, which introduced the now classic definition:

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

This definition highlights two key ideas:

1. **Needs** – especially the basic needs of the world’s poor, which should have overriding priority.
2. **Limitations** – environmental limits and the limits imposed by technology and social organization on the environment’s ability to meet present and future needs.

The Brundtland Report argued that:

- environmental problems and development problems are **two sides of the same coin**;
- poverty and underdevelopment in the Global South and unsustainable consumption and production in the Global North are **joint drivers** of the crisis;
- solutions must therefore integrate **economic, social and environmental** objectives instead of treating them separately.

Since then, sustainable development is often described as resting on **three mutually reinforcing dimensions**:

1. **Economic** – a productive economy that provides livelihoods and prosperity.
2. **Social** – social equity, inclusion, health, education and human rights.
3. **Environmental** – protection of ecosystems, climate and natural resources.

3.2.1 Strategic Imperatives of Sustainable Development in the Brundtland Report

The Brundtland Report did not only provide the famous definition of sustainable development; it also formulated **seven strategic imperatives** that societies must address simultaneously in order to achieve development that is socially just, environmentally viable and economically feasible. These imperatives identified the structural causes of unsustainability and formed the intellectual foundation for Agenda 21, the MDGs and eventually the SDGs.

1. Reviving Growth

The Commission acknowledged that **economic growth is necessary**, especially in low-income countries, to reduce poverty and improve living standards. However, this growth must be:

- **more evenly distributed** between and within nations,
- **environmentally sound**, avoiding resource depletion and pollution,
- **qualitatively different** from the resource-intensive, carbon-heavy growth models of the 20th century.

Growth is not rejected, but **redefined**: economies must grow in ways that expand opportunities without destroying the ecological systems that future development depends on.

2. Changing the Quality of Growth

The Brundtland Report emphasized that not all growth is beneficial. What matters is **the character, composition and efficiency** of economic activity.

Key elements include:

- reducing material and energy intensity of production,
- increasing resource efficiency and circularity,
- shifting growth towards knowledge, services, renewable resources and low-emission sectors,
- eliminating highly polluting or waste-intensive forms of production.

This imperative anticipates ideas now central to green growth, circular economy, and low-carbon transition.

3. Meeting Essential Human Needs

The Report placed human well-being at the center of sustainable development, arguing that **development cannot be sustainable if basic needs are unmet.**

Essential needs include:

- food security,
- clean water and sanitation,
- adequate housing and energy,
- primary health care,
- education,
- safety and social inclusion.

It stressed **equity within and between generations.** Ending poverty is not only a moral goal but an environmental necessity: societies facing deprivation cannot invest in conservation or long-term stewardship.

4. Ensuring a Sustainable Level of Population

Population dynamics were identified as a crucial driver of global environmental pressures. Sustainable development requires:

- reducing poverty and improving living standards, which naturally leads to lower fertility rates,
- expanding women's rights, access to education and reproductive health care,

- ensuring that population growth does not exceed the carrying capacity of ecosystems.

The Report emphasized **voluntary, rights-based approaches**, contrasting sharply with coercive population policies of the past.

5. Conserving and Enhancing the Resource Base

A core imperative is the **protection, restoration and sustainable use** of natural systems:

- forests, soils, freshwater, oceans, biodiversity, and the atmosphere.
- maintaining ecosystem services that underpin economic productivity and human health.
- reversing land degradation, deforestation, desertification and biodiversity loss.

This imperative connects directly with present-day climate and nature conservation policies and influenced later agreements such as the **Convention on Biological Diversity (1992)**.

6. Reorienting Technology and Managing Risk

Technological innovation must shift from focusing solely on productivity to also emphasizing:

- **resource efficiency,**
- **pollution prevention,**
- **renewable energy,**
- **risk-reducing technologies,**
- safety and resilience in face of industrial hazards.

The Report warned that many existing technologies created new risks—chemical pollution, nuclear waste, industrial accidents—and that societies must manage these risks transparently and responsibly.

This imperative foreshadows today’s discussions about clean technology, green innovation, and digital transitions.

7. Merging Environment and Economics in Decision Making

Perhaps the most transformative imperative is the call to **integrate environment and development in all levels of planning and policy-making**. This requires:

- including environmental impacts in economic accounts,
- using environmental cost–benefit analysis and social discounting,

- ensuring cross-sectoral coordination between environment, finance, agriculture, energy, and industry ministries,
- empowering institutions so they can enforce environmental standards.

The Brundtland Report argued that environmental policy cannot be an “add-on” — it must be **the organizing principle** of modern governance. This rationale later formed the backbone of Agenda 21 and the integrated structure of the SDGs.

3.3 From Concept to Global Agenda: Key Milestones

After 1987, sustainable development gradually became the organizing concept for international environmental and development policy. Important milestones include:

- **1992 – Earth Summit, Rio de Janeiro**
 - Adoption of **Agenda 21**, a comprehensive action plan for sustainable development at global, national and local levels.
 - Adoption of major conventions, including the **UN Framework Convention on Climate Change (UNFCCC)** and the **Convention on Biological Diversity (CBD)**.
- **2000 – Millennium Summit, New York**
 - Adoption of the **Millennium Declaration** and creation of **8 Millennium Development Goals (MDGs)**, focused mainly on reducing extreme poverty, hunger, disease and improving education by 2015.
- **2002 – World Summit on Sustainable Development, Johannesburg**
 - Adoption of the **Johannesburg Declaration and Plan of Implementation**, reaffirming commitments to poverty eradication and environmental protection, and emphasizing the role of partnerships.
- **2012 – Rio+20 Conference, Rio de Janeiro**
 - Outcome document “**The Future We Want**” launched a process to develop a new set of **Sustainable Development Goals**, building on the MDGs and integrating the three dimensions of sustainable development. It also established the **High-level Political Forum on Sustainable Development (HLPF)** to oversee follow-up and review.
- **2015 – A Landmark Year**
 - **Sendai Framework for Disaster Risk Reduction**,
 - **Addis Ababa Action Agenda** on financing for development,
 - **Paris Agreement on Climate Change**,

- and, crucially, the **2030 Agenda for Sustainable Development** with its 17 SDGs.

Together, these agreements form the backbone of the current global governance system for sustainable development.

3.4 The 2030 Agenda for Sustainable Development

Adopted unanimously by all UN Member States in **September 2015**, the **2030 Agenda for Sustainable Development** is a global plan for “peace and prosperity for people and the planet, now and into the future.” At its heart are the **17 Sustainable Development Goals (SDGs)** and 169 targets.

Key characteristics of the 2030 Agenda:

- **Universality** – the SDGs apply to all countries, not only developing ones.
- **Integration** – economic, social and environmental goals must be pursued together.
- **“Leave no one behind”** – priority to the poorest and most vulnerable groups.
- **Global partnership** – strong emphasis on cooperation between governments, business, civil society, science and citizens.
- **Follow-up and review** – the **High-level Political Forum** meets annually to review progress based on indicators and national reports.

The **Division for Sustainable Development Goals (DSDG)** within the UN Department of Economic and Social Affairs supports implementation, capacity-building and monitoring, and coordinates reporting such as the **annual SDG Progress Report** of the UN Secretary-General.

3.4.1 The 17 Sustainable Development Goals: Content and Meaning

The **17 SDGs** are often called the **Global Goals**. They are interdependent; progress on one goal usually supports progress on others, while failure in one area can undermine the whole agenda. Below is a concise overview.

1. **No Poverty**

End poverty in all its forms everywhere.

Focuses on eradicating extreme income poverty, expanding social protection, building resilience to shocks, and ensuring equal access to economic resources.

2. **Zero Hunger**

End hunger, achieve food security and improved nutrition, and promote sustainable agriculture.

Addresses undernourishment, sustainable food production systems, smallholder livelihoods, and resilience to climate-related shocks.

3. **Good Health and Well-Being**

Ensure healthy lives and promote well-being for all at all ages.

Targets maternal and child health, infectious and non-communicable diseases, mental health, road safety, universal health coverage and access to medicines.

4. **Quality Education**

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

Aims for universal primary and secondary education, early childhood development, affordable tertiary education and relevant skills for decent work.

5. **Gender Equality**

Achieve gender equality and empower all women and girls.

Seeks to end discrimination and violence, ensure equal participation and leadership, and secure access to sexual and reproductive health and rights.

6. **Clean Water and Sanitation**

Ensure availability and sustainable management of water and sanitation for all.

Includes safe and affordable drinking water, adequate sanitation, improving water quality, efficiency and integrated water resources management.

7. **Affordable and Clean Energy**

Ensure access to affordable, reliable, sustainable and modern energy for all.

Focuses on universal energy access, increasing the share of renewables and improving energy efficiency.

8. Decent Work and Economic Growth

Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.

Combines productivity and innovation with labour rights, safe working conditions, reduced youth unemployment, and the elimination of child labour, ensuring that economic growth is achieved through decent, fairly paid, and legally protected work that does not exploit children or undermine access to education.

9. Industry, Innovation and Infrastructure

Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Emphasises sustainable industrial development, research and development, and access to information and communications technology.

10. Reduced Inequalities

Reduce inequality within and among countries.

Addresses income inequality, social, economic and political inclusion, equal opportunities, and fairer global financial and trading systems.

11. Sustainable Cities and Communities

Make cities and human settlements inclusive, safe, resilient and sustainable.

Covers housing, transport, urban planning, cultural and natural heritage, disaster risk reduction, and urban environmental quality.

12. Responsible Consumption and Production

Ensure sustainable consumption and production patterns.

Promotes resource efficiency, waste reduction, circular economy approaches, sustainable business practices and consumer information.

13. Climate Action

Take urgent action to combat climate change and its impacts.

Supports mitigation and adaptation, climate resilience, integration of climate policies into national planning, and implementation of the Paris Agreement.

14. Life Below Water

Conserve and sustainably use the oceans, seas and marine resources for sustainable development.

Addresses marine pollution, overfishing, coastal and marine ecosystems, ocean acidification and support for small-scale fishers.

15. Life on Land

Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

Includes conservation, restoration, sustainable forest management, and protection of mountain ecosystems and threatened species.

16. Peace, Justice and Strong Institutions

Promote peaceful and inclusive societies, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.

Focuses on reducing violence, strengthening the rule of law, combating corruption, protecting fundamental freedoms and enhancing participation.

17. Partnerships for the Goals

Strengthen the means of implementation and revitalize the global partnership for sustainable development.

Deals with finance, technology, capacity-building, trade, systemic issues, and multi-stakeholder partnerships, recognising that no actor can achieve the goals alone.



Figure 5: The 17 Sustainable Development Goals (SDGs) of the United Nations' 2030 Agenda for Sustainable Development.
Source: <https://www.un.org/pt/teach/SDGs>

3.5 How Sustainable Development Responds to Global Problems

Sustainable development does not offer a single technical fix. Instead, it provides a **normative framework** and **strategic approach** to deal with the global crises described in Chapter 2:

- **Climate change** → decarbonizing energy systems, protecting forests and ecosystems, adapting to inevitable impacts (SDGs 7, 12, 13, 15).
- **Poverty, hunger and inequality** → inclusive growth, social protection, decent work, equitable access to resources and services (SDGs 1, 2, 3, 4, 5, 8, 10).
- **Biodiversity loss and ecosystem degradation** → conservation, sustainable use of land and seas, reduction of pollution and overexploitation (SDGs 14, 15).
- **Resource depletion and pollution** → more efficient, circular economies and responsible consumption and production (SDG 12).
- **Fragile institutions, conflict and weak governance** → strengthening rule of law, participation, and peaceful societies (SDG 16).

In other words, sustainable development seeks **structural change** in how societies produce, consume, govern and share the benefits of development — not just environmental protection added on to business as usual.

The concept of sustainable development emerged as a response to the intertwined crises of environment and development. From early environmental concerns in the 1970s, through the Brundtland Report in 1987, to the adoption of the 2030 Agenda and the SDGs in 2015, the international community has gradually built a **shared framework** for transforming our societies.

Sustainable development is both:

- a **vision** of a world where human needs are met within the planet’s ecological limits, and
- a **practical agenda** with concrete goals, targets and indicators.

In the following chapters, we will examine how this global framework is translated into **policies, instruments and actions** at international, national and local levels – including nature conservation policy, climate policy, and sectoral strategies in areas such as forestry, agriculture and urban development.

Core Concepts and Review Questions – Chapter 3

1. How is sustainable development defined in the Brundtland Report (Our Common Future, 1987)?

The Brundtland Report defines sustainable development as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. This definition introduces the principle of intergenerational equity and stresses that development must operate within ecological limits. It explicitly integrates social justice, economic development and environmental protection, rejecting both unchecked economic growth and purely conservationist approaches detached from human needs.

2. Which event first placed environmental issues firmly on the global political agenda?

The UN Conference on the Human Environment, held in Stockholm in 1972, was the first major international conference to place environmental issues firmly on the global political agenda. It recognized that environmental degradation and economic development are deeply interconnected and led to the establishment of the UN Environment Programme (UNEP). This conference marked the beginning of coordinated international environmental governance.

3. What was the main message of the Club of Rome's Limits to Growth (1972)?

The main message of Limits to Growth was that unlimited economic and population growth on a finite planet would inevitably collide with ecological limits. Using system dynamics modelling, the report showed that exponential growth in resource use and pollution could lead to economic and environmental collapse unless growth patterns were fundamentally altered. It played a key role in shaping early sustainability debates.

4. Which institution produced the Brundtland Report (Our Common Future, 1987)?

The Brundtland Report was produced by the World Commission on Environment and Development (WCED), an independent commission established by the United Nations in 1983. Chaired by Gro Harlem Brundtland, the Commission was mandated to examine the links between environment and development and to propose long-term strategies capable of reconciling economic progress with environmental protection.

5. What are the two core concepts emphasized in the Brundtland definition of sustainable development?

The Brundtland definition emphasizes two core concepts: needs and limitations. It gives overriding priority to the basic needs of the world's poor, while acknowledging environmental limits and the constraints imposed by technology and social organization. Together, these concepts frame sustainable development as both a moral and ecological imperative.

6. How does the Brundtland Report conceptualize the relationship between environment and development?

The Brundtland Report conceptualizes environment and development as inseparable and mutually dependent. Environmental degradation undermines development prospects, while poverty and underdevelopment intensify environmental pressures. Sustainable development therefore requires integrated policies that address economic, social and environmental challenges simultaneously rather than in isolation.

7. Which three dimensions are commonly used to describe sustainable development?

Sustainable development is commonly described as resting on three mutually reinforcing dimensions: economic, social and environmental. A productive economy, social equity and inclusion, and the protection of ecosystems must be pursued together. Long-term sustainability cannot be achieved if any one of these dimensions is neglected.

8. How does the Brundtland Report treat economic growth?

The Brundtland Report does not reject economic growth but argues that its nature must fundamentally change. Growth is seen as necessary, particularly in low-income countries, but it must be more equitable, less resource-intensive and environmentally sound. The Report calls for growth models that expand opportunities without degrading ecological systems.

9. What does “changing the quality of growth” primarily refer to?

Changing the quality of growth refers to reducing material and energy intensity while improving efficiency and sustainability. This includes shifting economic activity toward knowledge-based sectors, services, renewable energy and circular economy approaches, and away from highly polluting and waste-intensive forms of production.

10. Why does the Brundtland Report place strong emphasis on meeting essential human needs?

The Report emphasizes essential human needs because development cannot be sustainable if basic needs remain unmet. Poverty and deprivation force short-term survival strategies that often accelerate environmental degradation. Ensuring access to food, water, health care, housing and education is therefore both a social goal and a prerequisite for long-term environmental stewardship.

11. How does the Brundtland Report propose addressing population growth?

The Brundtland Report proposes addressing population growth through poverty reduction, education and the empowerment of women. Improved living standards, access to education and reproductive health services lead to voluntary declines in fertility rates. The Report explicitly rejects coercive population policies and emphasizes rights-based approaches.

12. What is meant by “conserving and enhancing the resource base” in the Brundtland Report?

Conserving and enhancing the resource base means protecting, restoring and sustainably managing natural systems such as forests, soils, freshwater, oceans, biodiversity and the atmosphere. These ecosystems provide essential services that underpin economic productivity,

human health and social well-being, making their protection central to sustainable development.

13. Why does the Brundtland Report stress reorienting technology and managing risk?

The Report stresses reorienting technology and managing risk because many existing technologies create pollution, environmental hazards and long-term risks. Sustainable development requires innovation that prioritizes resource efficiency, pollution prevention, renewable energy and safety, while managing industrial and technological risks transparently and responsibly.

14. What does “merging environment and economics in decision-making” imply in the Brundtland Report?

Merging environment and economics means integrating environmental impacts and costs into economic planning and policy decisions. This includes accounting for environmental externalities, using environmental cost–benefit analysis and ensuring cross-sectoral coordination. Environmental considerations should be an organizing principle of governance, not an afterthought.

15. Which outcome of the 1992 Earth Summit directly operationalized sustainable development?

Agenda 21, adopted at the 1992 Earth Summit in Rio de Janeiro, directly operationalized sustainable development. It provided a comprehensive action plan covering economic, social and environmental issues at global, national and local levels, translating sustainability principles into concrete policy guidance.

16. What was the main focus of the Millennium Development Goals (MDGs)?

The Millennium Development Goals focused primarily on poverty reduction and basic human development, addressing issues such as extreme poverty and hunger, health, education and gender equality. Adopted in 2000, the MDGs translated broader sustainable development ideas—earlier articulated in Agenda 21—into a limited set of concrete, time-bound goals to be achieved by 2015. However, the MDGs are not part of Agenda 21; they represent a later and more targeted political framework.

17. What was the key contribution of the Rio+20 Conference (2012)?

The Rio+20 Conference launched the process that led to the creation of the Sustainable Development Goals and established the High-level Political Forum on Sustainable Development. It reaffirmed the integration of economic, social and environmental dimensions and strengthened global mechanisms for follow-up and review.

18. What does the principle of “universality” mean in the 2030 Agenda?

Universality means that the Sustainable Development Goals apply to all countries, regardless of income level or development status. Unlike earlier frameworks focused mainly on

developing countries, the 2030 Agenda recognizes that sustainability challenges and responsibilities are shared globally.

19. What is meant by the principle “leave no one behind” in the 2030 Agenda?

The principle “leave no one behind” means prioritizing the poorest, most vulnerable and marginalized groups in development efforts. It emphasizes equity, inclusion and fairness, ensuring that progress benefits all segments of society and does not reinforce existing inequalities.

20. Why are the SDGs described as interdependent?

The SDGs are interdependent because progress in one goal often supports progress in others, while failure in one area can undermine the entire agenda. For example, improvements in education, health and gender equality reinforce economic development and environmental sustainability.

21. How does sustainable development respond to global environmental problems?

Sustainable development responds to global environmental problems by promoting structural changes in how societies produce, consume and govern. Rather than offering a single technical solution or adding environmental protection to business as usual, it provides an integrated framework for transforming economic systems, social structures and governance within planetary limits.

4 Sectoral Policies

4.1 What Are Sectoral Policies?

Sectoral policy can be understood as a **government-led framework of public intervention** that defines objectives, rules, and instruments for guiding activities within a specific domain of the economy or society, such as agriculture, forestry, energy, transport, or environmental protection. Institutionally, it emerges from governance arrangements in which designated public authorities—typically line ministries or specialized agencies—exercise regulatory, financial, and administrative competences over clearly delimited policy domains. In legal terms, sectoral policy is embodied in statutory laws, regulations, standards, and enforcement mechanisms, often complemented by sector-specific strategies, programs, and action plans.

Definition

Sectoral policy is a government-led framework of objectives, legal rules, and policy instruments through which public authorities regulate, support, and steer activities within a specific domain of the economy or society (e.g. agriculture, forestry, energy, transport, environmental protection). It is implemented by designated institutions using regulatory, economic, and administrative tools, involves multiple stakeholders, and operates as a dynamic process from policy formulation to implementation and evaluation.

From an economic perspective, sectoral policy represents a form of state intervention aimed at correcting market failures, managing externalities, and influencing production, consumption, and investment decisions through regulatory measures and economic instruments such as subsidies, taxes, and incentives. Within a governance framework, sectoral policy is shaped through interactions among public authorities, private-sector actors, civil society organizations, and expert institutions, operating across local, national, and supranational levels. Finally, from a policy analysis perspective, sectoral policy constitutes a dynamic process encompassing agenda-setting, policy formulation, implementation, monitoring, and evaluation, continuously adapting to evolving social, economic, and environmental conditions.

Typical policy sectors include agriculture, forestry, water management, energy, transport, industry, and environmental protection. Sectoral policies establish the rules under which actors operate, determine access to public resources and subsidies, and influence how public goods and services are produced, maintained, or protected.

These policies emerge within distinct institutional frameworks and professional communities that possess sector-specific mandates, expertise, and governance traditions. As a result, sectoral policies tend to prioritize objectives that are internally consistent within a given domain—such as productivity, efficiency, security of supply, or conservation—while giving less attention to interactions with other sectors. Although this specialization allows for technically refined and

targeted interventions, it can also lead to fragmented decision-making and competing policy objectives, particularly when multiple sectors depend on the same land, water, ecosystems, or climate-regulating processes.

In the field of environmental and nature protection policy, interactions among sectoral policies are especially pronounced and extend well beyond land management alone. Water management policies directly influence wetland conservation and floodplain ecosystems, agricultural policies shape land-use intensity, habitat structure, and nutrient cycles, while forestry policies affect not only forest ecosystems but also downstream industrial systems. Through their influence on harvest levels, species composition, rotation length, and forest management practices, forestry policies have a direct impact on the availability, quality, and cost of wood raw material. These effects propagate along the value chain, shaping the development of the wood-processing industry, construction sector, bioenergy production, and other material- and energy-intensive industries.

Forestry policies therefore also influence climate mitigation outcomes through ecosystem carbon sequestration and storage, as well as product substitution and energy substitution effects. The use of wood-based products in place of more emission-intensive materials such as steel, concrete, or plastics can substantially reduce life-cycle greenhouse gas emissions, while the use of woody biomass as a renewable energy source may substitute fossil fuels under appropriate sustainability conditions. Consequently, decisions taken within forestry policy frameworks affect not only forest carbon stocks and biodiversity, but also industrial emissions, energy systems, and broader decarbonization pathways. Because these interlinkages span multiple policy domains—including forestry, industry, energy, and climate policy—environmental challenges cannot be addressed effectively through isolated sectoral approaches. Instead, they require coordinated policy design and integrated analytical frameworks that account for cross-sectoral interactions and substitution effects.

4.2 The Logic of Policy Formulation

4.2.1 Stages of the Policy Cycle

The **policy cycle** is a widely used analytical framework that conceptualizes public policymaking as a sequence of interrelated stages, through which societal problems are translated into public action and subsequently reviewed. Although real-world policymaking rarely follows a strictly linear path, the policy cycle provides a useful heuristic for understanding the logic, structure, and internal dynamics of policy processes across sectors and governance levels.

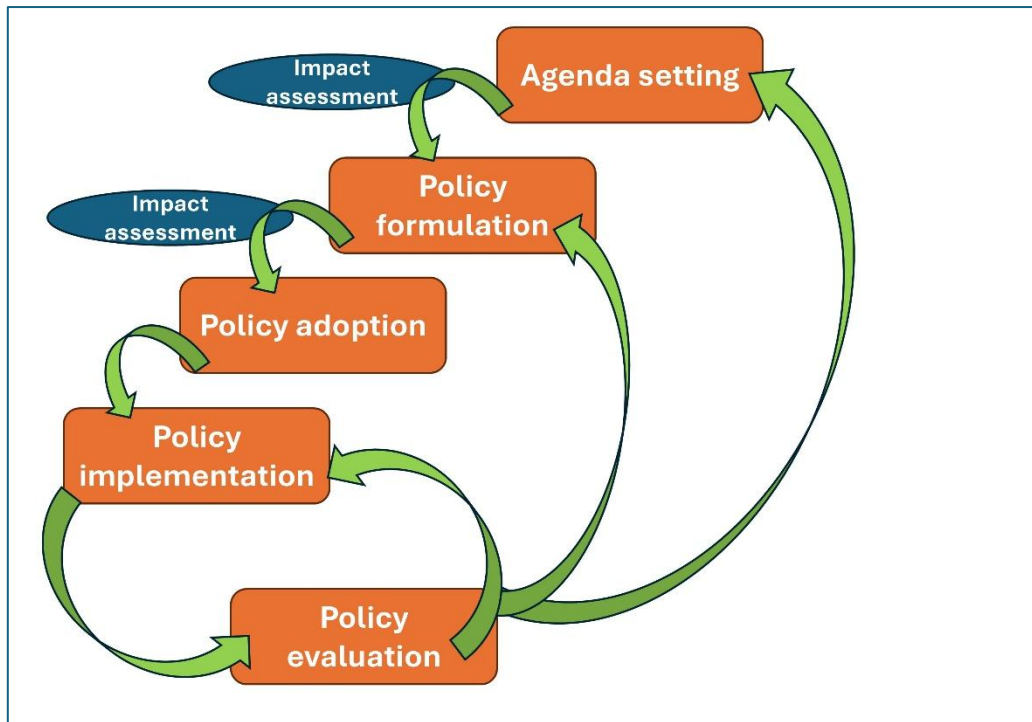


Figure 6: The Policy Cycle and Embedded Impact Assessment

The cycle typically begins with **agenda-setting**, the phase in which certain issues gain visibility and political relevance. Problems enter the policy agenda through multiple channels, including scientific evidence, media attention, advocacy by interest groups, crisis events, or international obligations. At this stage, not all societal problems receive equal attention; political priorities, institutional mandates, and power relations strongly influence which issues are recognized as requiring public intervention.

Agenda-setting is followed by **problem definition and policy formulation**, during which policymakers and stakeholders seek to define the nature, causes, and boundaries of the problem. Competing actors often frame the same issue differently—for example, as an economic challenge, an environmental risk, or a social equity concern—leading to divergent policy preferences. Policy formulation involves developing and comparing alternative solutions and selecting appropriate policy instruments, such as regulatory measures, economic incentives, or voluntary approaches. As illustrated in the figure, **impact assessment** plays a crucial role at this stage by systematically evaluating the expected economic, environmental, and social consequences of policy options before decisions are taken.

The **policy adoption** stage represents the formal decision-making phase, in which political authorities—such as parliaments, governments, or regulatory bodies—negotiate, amend, and approve policy proposals. Adoption often reflects compromises among competing interests and may differ significantly from initial technical recommendations. Once adopted, policies move into the **implementation** phase, where abstract objectives are translated into concrete actions through administrative procedures, enforcement mechanisms, funding schemes, and stakeholder engagement. Implementation outcomes depend heavily on institutional capacity, clarity of rules, and the cooperation of implementing actors at different governance levels.

Policies are subsequently subject to **monitoring and evaluation**, which assess whether objectives are being met, how efficiently resources are used, and whether unintended effects arise. As shown in the figure, evaluation does not mark the end of the process; rather, it feeds back into agenda-setting and policy reform. Through **policy learning and feedback loops**, policymakers may adjust instruments, revise objectives, or redesign policies entirely. While simplified, the policy cycle highlights the iterative and adaptive nature of public policymaking and underscores the importance of learning over time.

4.2.1 Evidence-Based Policymaking

Evidence-based policymaking has become a central principle of modern public administration, reflecting the expectation that public decisions should be informed by systematic knowledge rather than solely by political negotiation or administrative tradition. In this approach, **scientific, economic, and social evidence** is used to support problem identification, policy design, and evaluation, thereby improving the effectiveness, efficiency, and legitimacy of public policies.

Evidence may originate from multiple sources, including peer-reviewed academic research, expert assessments, monitoring systems, statistical databases, and local or experiential knowledge contributed by stakeholders. In many jurisdictions—particularly within the European Union—**impact assessments (IAs)** are a mandatory component of policy formulation. These assessments examine the anticipated effects of proposed policies across multiple dimensions, such as economic competitiveness, environmental sustainability, social equity, and administrative burden. By comparing alternative policy options, impact assessments help decision-makers understand trade-offs and avoid unintended consequences.

Economic tools such as **cost-benefit analysis (CBA)** and **cost-effectiveness analysis** are commonly used to evaluate whether the expected benefits of a policy justify its costs or whether objectives can be achieved at lower expense through alternative instruments. In addition, **ex ante evaluations** assess likely policy impacts before implementation, while **ex post evaluations** examine actual outcomes once policies are in place. Together, these tools support the feedback mechanisms depicted in the policy cycle figure, linking evaluation results back to agenda-setting and policy revision.

Despite its normative appeal, evidence-based policymaking faces important limitations. Political considerations, value conflicts, time constraints, data gaps, and institutional capacity can all restrict the effective use of evidence. Moreover, evidence does not speak for itself; it must be interpreted within specific political and societal contexts. Consequently, evidence-based policymaking should be understood not as a technocratic replacement for political decision-making, but as a framework that enhances transparency, accountability, and learning within the inherently political process of public policy development.

4.3 Stakeholders in Sectoral Policy Processes

4.3.1 The Role of Stakeholders in Public Policymaking

Sectoral public policies are not produced by governments acting in isolation, but rather emerge from **complex interactions among multiple stakeholder groups** that differ in interests, resources, knowledge, and institutional roles. Policymaking is therefore best understood as a governance process in which public authorities, economic actors, civil society, scientific institutions, and international organizations collectively shape policy objectives, instruments, and outcomes. The composition and influence of these stakeholder constellations vary across sectors, policy domains, and governance levels, but stakeholder interaction is a defining feature of modern public administration.

At the core of sectoral policymaking are **governmental actors**, including line ministries (such as agriculture, forestry, energy, transport, or environment), regulatory agencies, and public authorities at national, regional, and local levels. These actors hold formal decision-making power, legal authority, and administrative responsibility for policy formulation and implementation. Municipalities and regional governments play particularly important roles in land-use planning, infrastructure development, and the delivery of public services, translating national and supranational policies into local practice. Specialized public institutions—such as environmental inspectorates, national park authorities, or state-owned enterprises—often combine regulatory and operational functions within specific sectors.

Alongside public authorities, **economic stakeholders** exert substantial influence on sectoral policy processes. These include individual firms, state-owned enterprises, small and medium-sized enterprises, and sectoral associations representing agriculture, forestry, industry, energy, transport, or construction. Umbrella organizations such as chambers of commerce and trade federations aggregate interests, provide technical expertise, and engage in organized advocacy. Economic actors often play a dual role: they are both subjects of regulation and key implementers of policy measures. Their involvement is therefore indispensable, yet their strong economic interests can also shape policy agendas in ways that prioritize competitiveness, growth, or cost minimization over environmental or social objectives.

Civil society organizations (CSOs) and non-governmental organizations (NGOs) constitute a third major stakeholder group. Environmental NGOs, social justice organizations, community groups, and landowner associations articulate public interests that may not be fully represented by governmental or economic actors. International umbrella organizations such as the **International Union for Conservation of Nature (IUCN)**, and NGOs such as the **World Wide Fund for Nature (WWF)**, and **BirdLife International** play a particularly important role in environmental and nature conservation policy by providing scientific assessments, global policy frameworks, and advocacy platforms. At the national and local levels, NGOs contribute to public consultations, raise awareness, mobilize citizens, and often act as watchdogs monitoring policy implementation and compliance.

Scientific and academic institutions form another essential pillar of sectoral policy processes. Universities, research institutes, expert panels, and advisory councils supply empirical

evidence, modelling results, and policy-relevant knowledge that support evidence-based decision-making. Their role is especially prominent in technically complex policy fields such as climate change mitigation, biodiversity conservation, energy transitions, or public health. However, the influence of scientific actors depends on institutional arrangements, access to decision-makers, and the degree to which political systems value independent expertise. Scientific knowledge competes with other forms of authority, including economic interests and political considerations.

At the **international and supranational level**, political forums and intergovernmental organizations increasingly shape sectoral policies. Within the United Nations system, bodies such as the **United Nations Environment Programme (UNEP)**, the **Food and Agriculture Organization (FAO)**, and the **UN Framework Convention on Climate Change (UNFCCC)** provide normative guidance, technical standards, and platforms for global coordination. In the European context, the **European Union** plays a decisive role through its legal framework, funding mechanisms, and policy strategies. EU institutions—including the European Commission, the European Parliament, and the Council—interact with national ministries, regional authorities, and stakeholder organizations, creating multi-level policy networks that strongly influence national sectoral policies.

4.3.2 Stakeholder Interests, Power, and Policy Outcomes

While all stakeholders participate in sectoral policy processes, they do so with **unequal levels of influence and power**. Stakeholder interests may be economic, environmental, social, or political in nature, and often overlap or conflict. Power resources vary widely and include financial capacity, legal authority, access to information, expertise, organizational strength, and political legitimacy. Actors such as dominant ministries, large corporations, or well-organized sectoral associations often enjoy privileged access to decision-making arenas, enabling them to shape policy agendas and preferred solutions.

Other stakeholders rely on alternative forms of influence. NGOs and civil society organizations often draw power from **public mobilization, moral authority, and scientific credibility**, while academic institutions exert influence through expert knowledge and advisory roles. International organizations and political forums derive authority from treaty obligations, normative standards, and funding conditionalities. These different power bases interact within policy networks, producing negotiation processes characterized by cooperation, conflict, and compromise.

Historical policy trajectories frequently reinforce existing power structures. In many countries, agricultural policies continue to reflect the strong influence of farming lobbies, while transport policies prioritize infrastructure expansion and mobility over environmental concerns. Similarly, energy and industrial policies have often favored established technologies and incumbent actors, creating path dependencies that complicate sustainability transitions. Such imbalances can marginalize environmental or social considerations unless countervailing forces—such as strong environmental NGOs, independent scientific bodies, or supranational regulations—are present.

Understanding stakeholder interests and power relations is therefore essential for analyzing policy outcomes and designing more effective and equitable policies. Transparent decision-making, inclusive participation, and institutionalized consultation mechanisms can help balance competing interests and improve policy legitimacy. In the context of sustainable development, effective sectoral policymaking depends not only on technical solutions, but also on the ability of governance systems to manage stakeholder diversity, address power asymmetries, and integrate long-term environmental and social objectives into policy decisions.

4.4 Sectoral Policymaking Processes

4.4.1 Formal Processes in Sectoral Policymaking

Formal policy processes are embedded in established legal and administrative frameworks that define who is authorized to make decisions, how policies are adopted, and how they are implemented. At the national level, **legislative bodies**—such as parliaments or assemblies—adopt laws that establish policy objectives, regulatory requirements, and institutional responsibilities. These framework laws are typically complemented by **secondary legislation**, strategic plans, and technical regulations developed by line ministries and specialized agencies.

Formal procedures increasingly incorporate **public consultation and stakeholder participation** requirements. Draft laws, strategies, and regulations are often subject to open consultations, expert hearings, and impact assessments, allowing stakeholders to submit comments and evidence. These mechanisms aim to improve transparency, policy quality, and societal acceptance. In the context of carbon pricing, for instance, consultations with industry, labor unions, and civil society have influenced the design of carbon taxes and emissions trading schemes, particularly with respect to revenue recycling and social safeguards.

Another important formal mechanism is **inter-ministerial coordination**, designed to address cross-sectoral interactions and conflicts. Climate and biodiversity policies, for example, cut across energy, transport, agriculture, forestry, and industrial sectors. Governments therefore establish coordination bodies, working groups, or policy committees to align objectives and resolve inconsistencies. While such mechanisms are essential for policy coherence, their effectiveness depends on political leadership, institutional mandates, and the relative power of participating ministries.

4.4.2 Informal Processes and Political Dynamics

Alongside formal procedures, sectoral policies are profoundly shaped by **informal processes** that operate outside codified rules. Political negotiation, personal relationships, trust-based networks, and informal exchanges between policymakers and stakeholders often determine which policy options advance and which are sidelined. These processes are particularly influential during early stages of agenda-setting and policy formulation, when problems and solutions are still being defined.

The role of **policy entrepreneurs** is central in this context. Policy entrepreneurs are individuals or organizations—such as senior civil servants, politicians, NGO leaders, or industry representatives—who invest time, resources, and political capital to promote specific policy ideas. In climate policy, policy entrepreneurs have been instrumental in advancing carbon pricing instruments, framing them as cost-effective tools for emission reduction rather than as purely environmental regulations. Similarly, in nature conservation, NGOs and scientific leaders have acted as policy entrepreneurs by highlighting biodiversity loss and advocating for protected areas, ecological restoration, and nature-based solutions.

Kingdon’s **multiple streams framework** provides a useful lens for understanding informal dynamics. According to this approach, policy change occurs when three streams converge: a recognized problem (e.g. rising greenhouse gas emissions), viable policy solutions (e.g. carbon markets or conservation incentives), and favorable political conditions (e.g. electoral mandates, international pressure, or crisis events). Such convergence creates a **window of opportunity**, during which rapid policy change becomes possible. The introduction and expansion of voluntary carbon markets (VCMs) illustrate this process, as growing climate awareness, methodological advances in carbon accounting, and corporate net-zero commitments have combined to elevate VCMs on policy agendas.

Informal processes also influence **access to decision-makers** and the framing of policy debates. Well-organized stakeholders with strong networks may gain privileged access, while less resourced groups struggle to be heard. As a result, informal dynamics can reinforce existing power asymmetries unless balanced by transparent procedures and inclusive participation mechanisms.

4.4.2 Instruments of Sectoral Policy

Once policy objectives are defined, policymakers select from a broad range of **policy instruments** to influence behavior within a sector. These instruments differ in their degree of coercion, flexibility, and reliance on market mechanisms, and they are often combined to address complex challenges.

Regulatory instruments establish legally binding rules, standards, and restrictions. In environmental policy, these include emission limits, land-use restrictions, and conservation obligations. Nature conservation policies frequently rely on regulatory instruments such as protected area designation, habitat protection requirements, and species conservation rules. While regulations provide clarity and enforceability, they can be inflexible and may face resistance from affected stakeholders.

Economic instruments use financial incentives to steer behavior. These include subsidies, taxes, fees, and pricing mechanisms. **Carbon pricing**—through carbon taxes or emissions trading systems—is a prominent example in climate policy, internalizing the cost of greenhouse gas emissions and encouraging low-carbon investment. In the EU ETS, firms face a carbon price signal that influences production decisions and technology choices. In the conservation domain, payment schemes such as agri-environmental measures or payments for ecosystem services compensate land managers for biodiversity-friendly practices.

Informational instruments aim to influence behavior by providing knowledge and raising awareness. Guidelines, best-practice manuals, labeling schemes, and advisory services fall into this category. For example, sustainability reporting requirements and eco-labels inform consumers and investors about environmental performance, indirectly shaping market demand and corporate behavior.

Finally, **voluntary and market-based instruments** rely on flexible frameworks and stakeholder participation rather than direct regulation. Certification schemes, eco-labels, and **voluntary carbon markets (VCMs)** exemplify this approach. In VCMs, emission reductions or carbon removals—such as those achieved through forest conservation or restoration projects—are monetized and traded voluntarily, often to meet corporate climate commitments. While such instruments can mobilize private finance and innovation, their credibility depends on robust standards, transparency, and safeguards to ensure environmental integrity and social co-benefits.

Effective sectoral policymaking rarely relies on a single instrument. Instead, policymakers typically design **instrument mixes** that combine regulatory, economic, informational, and voluntary tools. In climate and nature policy, such integrated approaches are increasingly recognized as essential for addressing complex, cross-sectoral challenges and for aligning short-term incentives with long-term sustainability objectives.

4.5 Policy Analysis and Impact Assessment: Concepts, Frameworks, and Methods

Policy analysis provides the analytical foundation for understanding, designing, and evaluating public policies. In the context of sectoral policymaking, it supports decision-makers, administrators, and stakeholders in assessing whether policies address clearly defined societal problems, whether they achieve their stated objectives, and how their impacts are distributed across actors, sectors, and time horizons. Closely linked to policy analysis is **impact assessment**, which institutionalizes analytical insights within formal decision-making processes, particularly during policy formulation.

This chapter introduces the core analytical questions of policy analysis, the main conceptual frameworks used to structure analysis, and the most important analytical tools. It also explains how impact assessment builds on these elements to support evidence-based, transparent, and accountable policymaking, with particular relevance for environmental, climate, and natural resource policies.

4.5.1 Core Analytical Questions

At its core, policy analysis seeks to explain **why a policy exists, how it functions, and what consequences it produces**. A fundamental starting point is **problem definition**. Analysts ask what problem the policy is intended to address and how that problem is framed. Problem framing is not neutral: the same issue can be interpreted in multiple ways, each implying different policy responses. Climate change, for example, may be framed as an environmental

degradation problem, a market failure, a security risk, or a development challenge. Policy analysis therefore pays close attention to who defines the problem, whose perspectives are prioritized, and what assumptions underlie the chosen framing.

A second central question concerns the **distribution of costs and benefits**. Public policies rarely affect all actors equally. Policy analysis examines who benefits from a policy—such as particular industries, regions, or social groups—and who bears its costs, whether in financial terms, reduced opportunities, or environmental burdens. Distributional effects are especially significant in environmental and climate policy, where measures such as carbon pricing, land-use regulation, or conservation restrictions may impose uneven impacts across society. These distributional considerations are a core component of both policy analysis and impact assessment.

Effectiveness represents another key analytical dimension. A policy is considered effective if it achieves its stated objectives, such as reducing greenhouse gas emissions, conserving biodiversity, or improving public health outcomes. Effectiveness analysis requires clearly defined policy goals, measurable indicators, and reliable monitoring data. Closely related is **efficiency**, which evaluates whether objectives are achieved at reasonable cost and whether alternative policy options could deliver similar outcomes with fewer resources. Efficiency considerations are particularly relevant when public budgets are constrained or when policies impose significant compliance costs on private actors.

Beyond effectiveness and efficiency, policy analysis also addresses **equity and fairness**. Equitable policies distribute costs and benefits in a manner perceived as just, taking into account social vulnerability, historical responsibility, and differential capacity to adapt. Equity concerns are central to debates on environmental justice and just transitions, where disadvantaged groups may be disproportionately affected by environmental policies. Finally, policy analysis examines **political and administrative feasibility**. Even analytically sound policies may fail if they lack political support, institutional capacity, or public acceptance. Assessing feasibility helps distinguish theoretically optimal solutions from those that can realistically be implemented and sustained.

These core questions form the analytical backbone of **impact assessment**, which operationalizes them within formal policy formulation processes.

4.5.2 Analytical Frameworks

To address these questions in a structured manner, policy analysts rely on a range of **conceptual frameworks** that support systematic inquiry and comparative assessment. One widely used approach is **PESTEL analysis**, which examines the political, economic, social, technological, environmental, and legal context in which a policy operates. PESTEL analysis provides a broad situational overview, helping analysts identify external drivers, constraints, and risks that may influence policy outcomes and feasibility. It is often used as a preparatory step in impact assessment.

Another common framework is **SWOT analysis**, which focuses on internal strengths and weaknesses of a policy or institution, alongside external opportunities and threats. SWOT

analysis is particularly useful in strategic policy design and reform processes, as it highlights areas where policies can build on existing capacities or where vulnerabilities and resistance may emerge.

More theory-driven approaches include **Theory of Change models**, which explicitly map the causal pathways linking policy inputs and instruments to outputs, outcomes, and long-term impacts. These models make assumptions transparent and help identify critical conditions for success. Theory of Change frameworks are increasingly used in impact assessment to clarify how proposed interventions are expected to produce change and where uncertainties or risks may arise.

Institutional frameworks provide another important analytical lens. **Ostrom’s Institutional Analysis and Development (IAD) framework** examines how formal rules, informal norms, actor incentives, and decision-making arenas shape policy processes and outcomes. This approach is particularly valuable for analyzing environmental governance, common-pool resource management, and multi-level policy systems, where coordination and collective action problems are prominent.

Finally, **policy coherence assessment** has become a central element of sustainability-oriented policy analysis and impact assessment. Policy coherence analysis examines whether policies across different sectors and governance levels reinforce or undermine each other. For example, climate mitigation objectives may conflict with agricultural, transport, or energy policies unless explicitly aligned. Assessing coherence helps identify trade-offs, synergies, and gaps in policy mixes and supports more integrated and consistent policy design.

4.5.3 Analytical Tools

In addition to conceptual frameworks, policy analysis and impact assessment rely on a set of **quantitative and qualitative tools** that support evidence-based evaluation. One of the most widely used tools is **cost–benefit analysis (CBA)**, which seeks to monetize all relevant costs and benefits of a policy to assess its net contribution to social welfare. While CBA provides a clear decision rule, it faces methodological challenges when valuing non-market impacts such as biodiversity, ecosystem services, or human health—issues that are central to environmental policy.

Cost-effectiveness analysis offers an alternative when policy objectives are fixed, such as achieving a specific emission reduction target. Rather than monetizing benefits, this approach compares the costs of different policy options and identifies the least-cost pathway. Cost-effectiveness analysis is commonly applied in climate, energy, and air quality policy and is frequently used within ex ante impact assessments.

For policies involving diverse and non-commensurable objectives, **multi-criteria analysis (MCA)** is particularly valuable. MCA allows analysts to compare policy options across multiple criteria—economic, environmental, social, and institutional—without reducing all impacts to a single monetary metric. This makes MCA especially suitable for environmental, land-use, and nature conservation policies, where trade-offs between competing objectives are unavoidable.

Risk and uncertainty analysis addresses the fact that policy outcomes are often uncertain, particularly in long-term and complex systems such as climate, ecosystems, or technological transitions. Risk analysis examines the likelihood and consequences of adverse outcomes, while uncertainty analysis explores sensitivity to assumptions, data limitations, and future variability. These approaches enhance the robustness of both policy analysis and impact assessment.

Finally, **stakeholder analysis** and **scenario modelling** play a critical role. Stakeholder analysis maps actors, interests, power relations, and potential conflicts, supporting inclusive policy design and anticipating implementation challenges. Scenario modelling explores alternative future pathways under different assumptions, allowing policymakers to assess long-term implications and resilience of policy choices. Together, these tools support learning, transparency, and adaptive capacity across the policy cycle.

4.5.4 Impact Assessment as an Application of Policy Analysis

Impact assessment represents the **formalized application of policy analysis within policy formulation and evaluation**. It integrates core analytical questions, frameworks, and tools into a structured procedure that supports decision-making before and after policy adoption. Ex ante impact assessment evaluates alternative policy options and their expected economic, environmental, and social impacts, while ex post impact assessment examines actual outcomes and feeds lessons back into future policy design.

By institutionalizing policy analysis, impact assessment enhances transparency, clarifies trade-offs, and strengthens accountability. At the same time, it does not replace political decision-making; rather, it informs it by providing a common evidence base. When effectively applied, impact assessment helps ensure that sectoral policies are not only technically sound, but also coherent, equitable, and aligned with long-term sustainability objectives.

4.6 Sectoral Conflicts and Policy Coherence

Modern public governance is characterized by the coexistence of multiple sectoral policies that operate simultaneously within the same social, economic, and ecological systems. While sectoral specialization enables targeted intervention and administrative efficiency, it also creates a structural risk of **policy conflict**, as different sectors pursue distinct objectives under separate institutional mandates. These conflicts are particularly visible in policy domains that interact with natural resources, land use, and environmental systems. This chapter examines the nature of sectoral policy conflicts, introduces the concept of policy coherence, and discusses institutional and analytical mechanisms designed to manage and reduce cross-sectoral tensions.

4.6.1 The Nature of Sectoral Policy Conflicts

Sectoral policy conflicts arise when policies developed within different administrative domains generate **inconsistent, competing, or mutually undermining objectives or outcomes**. Such conflicts are not accidental but are rooted in the historical development of sectoral governance structures, professional traditions, and political priorities. Each sector—such as agriculture,

transport, energy, forestry, or environmental protection—tends to define problems and solutions according to its own mandate, performance indicators, and stakeholder base.

In practice, this leads to recurring tensions. Agricultural support policies may encourage intensive production systems that increase nutrient runoff and pesticide use, while water and environmental policies seek to improve water quality and protect aquatic ecosystems. Transport policies often prioritize accessibility, mobility, and infrastructure expansion, which can conflict with climate mitigation objectives aimed at reducing greenhouse gas emissions. In forestry, policies promoting increased timber mobilization and bioenergy use may clash with biodiversity conservation strategies that emphasize the protection of old-growth forests, habitat continuity, and ecosystem integrity.

These conflicts are particularly pronounced in the context of sustainability challenges, where environmental systems are shared across sectors and governance levels. Climate change, biodiversity loss, soil degradation, and water scarcity cannot be effectively addressed through isolated sectoral interventions. Instead, they expose the limitations of fragmented policymaking and underscore the need for more integrated approaches.

4.6.2 Concept and Dimensions of Policy Coherence

Policy coherence refers to the degree to which policies across different sectors and governance levels are **mutually supportive, consistent, and aligned with overarching objectives**, rather than working at cross-purposes. Coherence does not imply the absence of trade-offs or conflicts; rather, it requires that such trade-offs are explicitly recognized, managed, and justified within a broader strategic framework.

Policy coherence can be examined along several dimensions. **Horizontal coherence** concerns alignment between policies at the same governance level, such as coordination between agriculture, energy, transport, and environmental policies at the national level. **Vertical coherence** refers to consistency across governance levels, for example between local, national, and supranational policies. A third dimension, sometimes described as **temporal coherence**, addresses consistency over time, ensuring that short-term policy measures do not undermine long-term objectives.

In sustainability-oriented policymaking, coherence is closely linked to the integration of environmental and climate objectives into sectoral decision-making. Without coherence, gains achieved in one policy area may be offset by losses in another, resulting in inefficient use of public resources and limited overall progress.

4.6.3 Typical Areas of Sectoral Conflict

Sectoral conflicts manifest differently across policy domains but follow recurring patterns. **Land-use conflicts** are among the most prominent, involving competing claims between agriculture, forestry, urban development, infrastructure, and nature conservation. Policies promoting agricultural expansion or intensification may reduce habitat availability, while conservation measures may constrain economic activities and generate local resistance.

Climate and energy policies often intersect with transport, industry, and housing policies. Measures to reduce emissions—such as carbon pricing or energy efficiency standards—may conflict with sectoral objectives related to affordability, competitiveness, or mobility. Similarly, the promotion of renewable energy infrastructure can generate conflicts with landscape protection and biodiversity conservation goals.

In **natural resource governance**, sectoral conflicts frequently arise between extraction-oriented policies and conservation objectives. Forestry, fisheries, and mining policies may prioritize resource use and economic output, while environmental policies emphasize ecological limits and long-term sustainability. These tensions are intensified by uncertainty, long time horizons, and unequal distribution of costs and benefits.

4.6.4 Institutional and Procedural Mechanisms to Improve Coherence

To address sectoral conflicts, governments employ a range of **institutional and procedural mechanisms** aimed at improving coordination and integration. One common approach is **integrated planning**, which seeks to align objectives across sectors through comprehensive strategies or spatial plans. Integrated planning frameworks encourage joint problem definition and the consideration of cumulative impacts rather than sector-specific outcomes.

Cross-sectoral coordination bodies, such as inter-ministerial committees or task forces, provide institutional platforms for negotiation and information exchange. These bodies can help reconcile competing priorities, although their effectiveness depends on political authority, mandate clarity, and leadership. Without strong coordination mechanisms, dominant sectors may continue to shape outcomes in line with their own interests.

A key strategic instrument for enhancing coherence is **Strategic Environmental Assessment (SEA)**. SEA evaluates the environmental implications of plans and programs before they are adopted, allowing potential conflicts to be identified at an early stage. Unlike project-level assessment, SEA operates at a strategic level and explicitly considers alternatives, cumulative impacts, and long-term effects. As such, it plays a critical role in integrating environmental considerations into sectoral policies and improving horizontal coherence.

4.6.5 Policy Coherence in Sustainability Governance

In the context of sustainability governance, policy coherence has become a central normative objective. Climate mitigation, biodiversity conservation, and sustainable resource management require consistent signals across policy domains to influence behavior and investment decisions. Fragmented or contradictory policies weaken incentives, increase uncertainty, and undermine public trust.

Overarching policy frameworks can support coherence by providing **shared long-term goals and reference points** for sectoral policies. International agreements, national sustainability strategies, and integrated climate and biodiversity frameworks help align sectoral objectives and create a common direction of travel. However, translating high-level goals into coherent sectoral action remains challenging, particularly where short-term economic interests conflict with long-term environmental objectives.

Policy coherence is therefore not a static condition but a continuous process that requires monitoring, evaluation, and adjustment. Analytical tools such as policy coherence assessments, impact assessments, and scenario analysis play a crucial role in identifying inconsistencies and exploring alternative policy mixes.

4.6.6 Challenges and Trade-offs in Achieving Coherence

Despite its importance, achieving policy coherence faces significant obstacles. Institutional fragmentation, competing mandates, and power asymmetries between sectors can limit effective coordination. Political cycles and short-term priorities may discourage investments in long-term coherence. Moreover, rather than eliminating trade-offs, coherence helps to identify them explicitly.

In some cases, pursuing coherence may require difficult political choices, such as reforming subsidies, reallocating resources, or redefining sectoral objectives. Resistance from vested interests can slow or block such reforms. As a result, coherence should be understood not as a purely technical goal, but as a **political and governance challenge** that involves negotiation, compromise, and societal debate.

4.7 Policy Formulation, Stakeholders, Impact Assessment, and Evaluation in the European Union

The European Union (EU) has developed one of the most advanced and institutionalized systems of public policymaking in the world. EU policy formulation is characterized by a strong emphasis on **evidence-based decision-making**, extensive stakeholder involvement, and continuous evaluation of existing legislation. Impact assessment and evaluation are not peripheral technical exercises, but core elements of EU governance, supporting transparency, accountability, and policy learning across the entire policy cycle.

This chapter introduces the EU decision-making framework, the main actors and stakeholders involved, the role of impact assessment in policy formulation, and the system of evaluation and fitness checks used to ensure that EU policies remain effective, coherent, and fit for purpose over time.

4.7.1 Institutional Framework of EU Policymaking

EU decision-making rests on an institutional balance between three main bodies:

- **The European Commission**, which represents the general interest of the Union and holds the primary responsibility for initiating legislation.
- **The European Parliament**, which represents EU citizens and acts as a co-legislator.
- **The Council of the European Union**, which represents the governments of the Member States and shares legislative authority with the Parliament.

These institutions operate within a system designed to balance supranational objectives with national interests, democratic legitimacy, and respect for the principle of subsidiarity. While

additional actors—such as EU agencies, advisory committees, and the European Council—play important roles, the Commission, Parliament, and Council form the core of EU legislative policymaking.

4.7.2 Policy Formulation and the Ordinary Legislative Procedure

Most EU legislation is adopted through the **ordinary legislative procedure**, which places the European Parliament and the Council on an equal footing as co-legislators. The process begins with the **European Commission**, which identifies policy needs based on treaty obligations, political priorities, international commitments, or emerging societal challenges.

Agenda-Setting and Preparatory Work

Before proposing new initiatives or revising existing legislation, the Commission undertakes extensive preparatory activities. These include reviewing existing laws and policies, analysing implementation experience, and assessing whether EU action is justified in light of subsidiarity and proportionality principles. National parliaments are formally involved at this stage and may issue reasoned opinions if they consider that an issue would be better addressed at national rather than EU level.

Preparatory work also involves structured dialogue with stakeholders, including industry, small and medium-sized enterprises (SMEs), social partners, regional and local authorities, and civil society organizations. This phase ensures that policy initiatives are grounded in practical experience and aligned with broader strategic priorities.

4.7.3 Impact Assessment in EU Policy Formulation

A defining feature of EU policymaking is the systematic use of **impact assessment (IA)** during policy formulation. Before submitting a legislative proposal, the Commission prepares an impact assessment report that evaluates the likely **economic, social, and environmental impacts** of alternative policy options.

Purpose and Scope of Impact Assessment

EU impact assessments aim to:

- clearly define the policy problem and its underlying drivers,
- set objectives consistent with EU treaties and long-term strategies,
- identify and compare alternative policy options,
- assess their impacts, trade-offs, and distributional effects, and
- support informed political decision-making.

Impact assessments draw on analytical tools such as cost–benefit analysis, cost-effectiveness analysis, multi-criteria analysis, modelling, and scenario analysis. They also examine policy coherence, ensuring consistency with existing EU legislation and international commitments.

Stakeholder Participation in Impact Assessment

Stakeholder involvement is an integral part of EU impact assessment. The Commission collects input from non-governmental organisations, industry associations, national authorities, expert groups, and the general public. Individuals, businesses, and organisations can contribute through **public consultations and calls for evidence** published on the Have Your Say – Public Consultations and Feedback portal. This participatory approach enhances transparency, improves the evidence base, and strengthens the legitimacy of policy proposals.

4.7.4 Stakeholders in EU Policymaking

EU policy formulation involves a wide range of stakeholders operating across multiple governance levels:

- **Institutional actors:** Commission directorates-general, Parliament committees, Council working parties, EU agencies.
- **Member State actors:** national ministries, permanent representations, national parliaments.
- **Economic actors:** industry associations, chambers of commerce, SMEs, sectoral federations.
- **Civil society and NGOs:** environmental and social NGOs, umbrella organisations such as IUCN.
- **Knowledge providers:** universities, research institutes, expert panels, think tanks.

These actors form complex policy networks that influence agenda-setting, policy design, and implementation. While power asymmetries exist, EU procedures aim to mitigate them through transparency rules, consultation requirements, and institutional checks and balances.

4.7.5 Reviewing, Amending, and Adopting EU Law

Once the Commission submits a legislative proposal, it is examined by both the European Parliament and the Council. Each institution may propose amendments, often following detailed committee and working-group deliberations. Interinstitutional negotiations seek to reach agreement on a common text.

If agreement is not reached at first reading, a second reading takes place, followed—if necessary—by a conciliation procedure. Both the Parliament and the Council retain the right to block a proposal. Legislation is adopted only when both co-legislators agree on a joint text, which is then published in the **Official Journal of the European Union**.

4.7.6 Evaluation and Fitness Checks in EU Policymaking

Evaluation is a central pillar of EU governance. The European Commission evaluates existing laws, policies, and spending programmes to determine whether they are **fit for purpose** and whether they have delivered the intended results for European businesses and citizens **at minimum cost**. Evaluation supports political priority setting, strategic planning, and decisions on whether policies should be maintained, revised, or repealed.

Evaluations and fitness checks are **ex post assessments**, focusing on implemented policies. Their primary objective is to generate evidence for **future policy revision**, rather than to judge past decisions. Together, they contribute to the structured screening—or “stress-testing”—of the EU acquis, ensuring that EU legislation remains relevant, proportionate, coherent, and cost-efficient.

Evaluation Criteria

EU evaluations assess whether a law, policy, or funding programme is:

- **Effective** – achieving its stated objectives,
- **Efficient** – delivering results in a cost-effective and proportionate manner,
- **Relevant** – responding to current and emerging needs,
- **Coherent** – internally consistent and aligned with other EU policies and international commitments,
- **Providing EU added value** – delivering outcomes that Member States could not achieve acting alone.

Fitness Checks

A **fitness check** is a specific type of evaluation that examines several related laws, policies, or programmes together. Its purpose is to assess how different interventions interact and what their **combined impacts** are. Fitness checks focus on identifying overlaps, inconsistencies, administrative burdens, and cumulative effects across policy areas.

Planning and Participation

The Commission Work Programme includes an annual plan of evaluations and fitness checks, initiating a systematic review of EU legislation. Over time, the entire EU acquis is subject to review. The Commission informs the public about planned, ongoing, and completed evaluations through the Have Your Say portal, inviting citizens and stakeholders to contribute through calls for evidence and public consultations.

4.7.7 Ensuring Quality and Transparency

To ensure methodological rigor and consistency, all evaluations follow the **Better Regulation Guidelines and Toolbox**, which set common standards for evidence collection, analysis, and reporting. The **Regulatory Scrutiny Board** plays a key quality-control role by reviewing and issuing opinions on the quality of all fitness checks and selected evaluations.

Evaluation and fitness check results are documented in evaluation reports, published as **Commission staff working documents**. These are made publicly available through the Have Your Say portal, the Commission document register, and EUR-Lex, reinforcing transparency and accountability.

EU policymaking integrates policy formulation, impact assessment, stakeholder participation, evaluation, and fitness checks into a continuous and iterative governance process. Impact

assessment supports informed decision-making before legislation is adopted, while evaluation and fitness checks ensure that existing policies remain effective, coherent, and fit for purpose. Together, these instruments form the analytical backbone of evidence-based EU governance, enabling learning, adaptation, and long-term policy coherence in a complex multi-level political system.

Core Concepts and Review Questions – Chapter 4

1. Which description best captures the concept of sectoral policy in public governance?

Sectoral policy refers to a structured and formalized form of government intervention that guides activities within a clearly defined sector of the economy or society, such as agriculture, energy, transport, forestry, or environmental protection. It is implemented through laws, regulations, standards, financial instruments, and administrative procedures, and is typically managed by designated public authorities. Sectoral policies establish binding rules and incentives that shape how actors behave, how public resources are allocated, and how collective objectives—such as sustainability, efficiency, or security—are pursued, distinguishing them from informal agreements or non-binding awareness initiatives.

2. Which institutional actors typically lead sectoral policies?

Sectoral policies are primarily led by line ministries and specialized public agencies that possess formal mandates, legal authority, and administrative capacity within a given policy domain. These institutions are responsible for setting objectives, designing instruments, implementing measures, and monitoring outcomes. While other actors—such as NGOs, private firms, or international organizations—may influence policy through advocacy, expertise, or funding. Leadership and accountability for sectoral policy decisions generally rest with governmental bodies operating at national, regional, or local levels.

3. From an economic perspective, what is the primary function of sectoral policy?

From an economic perspective, sectoral policy functions as a form of state intervention designed to correct market failures and manage externalities that markets alone cannot efficiently address. Examples include environmental pollution, public goods provision, and information asymmetries. Governments use regulatory tools and economic instruments such as taxes, subsidies, and pricing mechanisms to influence behavior, steer investment, and align private decision-making with broader societal objectives.

4. Why can sectoral specialization create policy conflicts?

Sectoral specialization can create policy conflicts because individual sectors tend to focus on optimizing their own objectives—such as productivity, competitiveness, or security of supply—while paying insufficient attention to impacts on other sectors. Since many sectors depend on shared resources like land, water, ecosystems, and climate regulation, isolated decision-making can lead to contradictory or mutually undermining outcomes. These conflicts expose the limitations of fragmented governance and highlight the need for coordination and integrated policy approaches.

5. Which example illustrates cross-sectoral effects of forestry policy?

Forestry policy influences decisions about harvest intensity, rotation length, species composition, and forest management practices, which directly affect the quantity, quality, and price of wood raw material. These effects extend beyond forests to downstream sectors such as

wood processing, construction, pulp and paper production, and bioenergy. As a result, forestry policy has implications for industrial development, energy systems, employment, and climate mitigation, demonstrating its cross-sectoral relevance.

6. What is meant by “product substitution” in the forestry context?

Product substitution refers to the replacement of emission-intensive materials such as steel, concrete, or plastics with wood-based products. Because wood typically requires less fossil energy to produce and can store carbon over its lifetime, this substitution can reduce overall greenhouse gas emissions across the product life cycle. The concept links forestry, industry, and climate policy by emphasizing the role of material choices in achieving mitigation objectives.

7. What is “energy substitution”?

Energy substitution refers to replacing fossil fuels with renewable energy sources, such as woody biomass derived from sustainably managed forests. When sustainability criteria are respected, this substitution can reduce net greenhouse gas emissions and contribute to energy security and diversification. Energy substitution highlights the intersection of forestry, energy, and climate policy, as decisions about forest management affect biomass availability and long-term decarbonization pathways.

8. During which stage of the policy cycle are problems recognized and selected for political attention?

Problems are recognized and selected for political attention during the agenda-setting stage of the policy cycle. At this stage, issues gain visibility through scientific evidence, media coverage, advocacy by interest groups, crisis events, or international commitments. Political priorities, institutional mandates, and power relations strongly influence which problems enter the agenda, making agenda-setting a critical phase in shaping future policy outcomes.

9. Why is the policy cycle described as a heuristic tool?

The policy cycle is described as a heuristic tool because it offers a simplified analytical framework for understanding complex and often non-linear policymaking processes. Although real-world policymaking rarely follows the stages in a strict sequence, the model helps organize analysis by distinguishing key phases such as formulation, implementation, and evaluation. It serves as a conceptual guide rather than a literal description of how policy is always made.

10. Where does impact assessment mainly fit in the policy cycle?

Impact assessment mainly takes place during the policy formulation stage, when alternative policy options are developed and compared before adoption. It evaluates the likely economic, environmental, and social impacts of different choices, helping policymakers understand trade-offs and avoid unintended consequences. By informing decisions before implementation, impact assessment strengthens evidence-based policymaking.

11. What is the main difference between ex ante and ex post evaluation?

Ex ante evaluation focuses on assessing the expected impacts of a policy before it is implemented, supporting informed decision-making and option selection. Ex post evaluation, by contrast, examines actual outcomes after implementation, assessing whether objectives have been achieved and identifying unintended effects. Together, these approaches support learning, accountability, and continuous policy improvement.

12. What is the primary purpose of evidence-based policymaking?

Evidence-based policymaking aims to improve the effectiveness, efficiency, and legitimacy of public decisions by grounding them in systematic knowledge, such as scientific research, data analysis, and evaluation results. Evidence informs problem definition, policy design, and review, enhancing transparency and accountability. It complements political judgment rather than replacing it.

13. Which factor can limit the effective use of evidence in policymaking?

The effective use of evidence can be constrained by political values, time pressures, data gaps, and limited institutional capacity. Policymakers often face uncertainty, competing interests, and urgent decision timelines, which shape how evidence is interpreted and applied. As a result, evidence-based policymaking operates within political and practical constraints.

14. Which statement best describes how public policies are formed?

Public policies are formed through interaction among public authorities, economic actors, civil society organizations, and experts. Policymaking is therefore a governance process involving negotiation, cooperation, and conflict among multiple stakeholders with different interests and resources. This multi-actor dynamic shapes policy agendas, instruments, and outcomes.

15. Which type of power resources are most important in shaping stakeholder influence in policymaking?

Stakeholder influence depends on a combination of power resources, including financial capacity, legal authority, expertise, access to decision-makers, and perceived legitimacy. Actors who command several of these resources are often better positioned to shape policy debates and outcomes. Influence is therefore unevenly distributed across stakeholders.

16. Which statement best describes power asymmetries in public policymaking?

Power asymmetries arise because dominant ministries, large firms, or well-organized associations often enjoy privileged access to decision-making arenas compared to less resourced actors. These imbalances can shape policy agendas and outcomes unless counterbalanced by transparency, inclusive participation, or strong regulatory frameworks.

17. Which is an example of a formal process in sectoral policymaking?

Formal processes in sectoral policymaking include the parliamentary adoption of laws, complemented by secondary legislation and detailed regulations developed by ministries or agencies. These procedures are embedded in legal frameworks that define authority, responsibilities, and enforcement mechanisms, ensuring accountability and legal certainty.

19. What is the role of inter-ministerial coordination?

Inter-ministerial coordination aims to align objectives across sectors and manage cross-sectoral interactions and conflicts. It is particularly important for complex issues such as climate change, biodiversity loss, and land use, which span multiple policy domains. Effective coordination supports policy coherence and reduces contradictions.

20. Who are “policy entrepreneurs”?

Policy entrepreneurs are actors who invest time, resources, and political capital to promote specific policy ideas or solutions. They play a key role in framing problems, building coalitions, and exploiting windows of opportunity for policy change. Policy entrepreneurs can be politicians, civil servants, NGO leaders, or experts.

21. Which instrument type is described as legally binding rules and standards?

Regulatory instruments consist of legally binding rules, standards, and obligations that prescribe or restrict behavior. Examples include emission limits, land-use regulations, and conservation requirements enforced by public authorities. They provide clarity and enforceability but may be less flexible than other instruments.

22. Which example illustrates an economic instrument?

Carbon pricing through taxes or emissions trading systems uses price signals to internalize environmental costs and influence behavior. By making pollution more expensive, such instruments incentivize emission reductions and low-carbon investment while allowing flexibility in how actors respond.

23. What is the core function of informational instruments?

Informational instruments aim to influence behavior by providing knowledge, transparency, and guidance through tools such as labels, reporting requirements, guidelines, and advisory services. They shape preferences and decision-making without imposing binding obligations and often complement regulatory and economic instruments.

24. Why is problem framing important in policy analysis?

Problem framing is important because different interpretations of the same issue imply different policy objectives and solutions. Framing reflects underlying assumptions, values, and power relations, influencing which instruments are considered appropriate and which actors' interests are prioritized.

25. What is policy coherence?

Policy coherence refers to the degree to which policies across sectors and governance levels are consistent and mutually supportive rather than contradictory. It does not eliminate trade-offs but requires that they are explicitly recognized and managed within a broader strategic framework.

26. What does “horizontal coherence” refer to?

Horizontal coherence refers to alignment between policies operating at the same governance level, such as coordination among national ministries. It helps ensure that sectoral policies reinforce rather than undermine each other, particularly in sustainability governance.

27. Why is Strategic Environmental Assessment (SEA) important for coherence?

Strategic Environmental Assessment evaluates environmental implications of plans and programmes before adoption and considers alternatives and cumulative impacts. By operating at a strategic level, SEA supports early integration of environmental objectives and improves cross-sectoral coherence.

28. Which EU institution has primary responsibility for initiating legislation?

The European Commission initiates EU legislation by identifying policy needs, preparing proposals, and conducting impact assessments. It acts in the general interest of the Union before submitting proposals to the European Parliament and the Council.

29. What characterizes the ordinary legislative procedure?

The ordinary legislative procedure is characterized by the European Parliament and the Council acting as co-legislators on an equal footing. Both institutions must agree on the final text, ensuring democratic legitimacy and balance between supranational and national interests.

30. What is a “fitness check” in EU policymaking?

A fitness check evaluates several related laws or programmes together to identify overlaps, inconsistencies, administrative burdens, and cumulative impacts. It supports simplification, coherence, and effectiveness of EU legislation over time.

31. Which evaluation criterion is explicitly included in EU evaluations?

EU evaluations apply a core set of criteria to assess the performance and justification of EU interventions, including effectiveness (whether objectives are achieved), efficiency (the relationship between costs and results), relevance (the continued appropriateness of objectives), coherence (consistency within the intervention and with other EU and Member State policies), and EU added value (whether action at EU level delivers benefits that could not be achieved as effectively by Member States acting alone, in line with subsidiarity and proportionality).

32. What is the role of the Regulatory Scrutiny Board in EU governance?

The Regulatory Scrutiny Board ensures quality control of impact assessments and selected evaluations and fitness checks. By reviewing methodological rigor and evidence use, it strengthens transparency, credibility, and evidence-based EU policymaking.

5 Actors and Institutional Frameworks in International Environmental Governance and Policy Formulation

5.1 Intergovernmental Organizations (IGOs): Formal Authority, Coordination, and Treaty-Based Governance

International environmental policy has developed in response to the transboundary and global nature of environmental problems such as climate change, biodiversity loss, desertification, air pollution, and marine degradation. Since these challenges exceed the jurisdictional capacity of individual states, **intergovernmental organizations (IGOs)** have become central actors in coordinating collective responses. IGOs provide institutional frameworks for negotiation, scientific assessment, norm-setting, implementation support, and monitoring of international environmental commitments.

This chapter focuses on the role of key IGOs that shape international environmental policy through **formal coordination mechanisms and treaty-based processes**, with particular attention to the United Nations system and the European Union.

5.1.2 The United Nations System

The **United Nations (UN)** constitutes the core institutional architecture of global environmental governance. Although the UN Charter does not explicitly address environmental protection, environmental policy has gradually emerged as a cross-cutting domain within the UN system, integrating development, health, food security, and climate considerations.

The UN provides:

- **Legitimacy and universality**, with near-global membership,
- **Diplomatic platforms** for multilateral negotiation,
- **Secretariats and technical bodies** supporting treaty implementation, and
- **Links between science, policy, and development assistance.**

Environmental governance within the UN operates through both specialized agencies and treaty-specific institutions.

5.1.3 United Nations Environment Programme (UNEP)

The **United Nations Environment Programme (UNEP)** serves as the leading global authority on environmental issues within the UN system. Established in 1972 following the Stockholm Conference on the Human Environment, UNEP's mandate is primarily **normative and coordinating**, rather than regulatory.

Key functions of UNEP include:

- Setting the **global environmental agenda**,
- Producing authoritative assessments (e.g. Global Environment Outlook),
- Supporting the development and coherence of international environmental law,
- Hosting or supporting the secretariats of several multilateral environmental agreements (MEAs),
- Facilitating capacity-building and technical assistance, especially in developing countries.

UNEP does not adopt binding rules itself but plays a crucial role in shaping policy discourse and aligning environmental objectives across UN institutions.

5.1.4 Multilateral Environmental Agreements

Multilateral Environmental Agreements (MEAs) constitute the legally binding core of international environmental governance. They operationalize general environmental principles—such as precaution, sustainability, and common but differentiated responsibilities—through specific objectives, commitments, and institutional arrangements. Each MEA functions through a dedicated secretariat and governing bodies, most notably the Conference of the Parties (COP), ensuring continuity, coordination, and implementation support.

The Role of MEA Secretariats

Across all MEAs, secretariats play a crucial coordinating role. They:

- Organize meetings of governing bodies,
- Support implementation and reporting,
- Facilitate scientific and technical cooperation,
- Promote coherence among related treaties.

While secretariats do not possess enforcement authority, they ensure institutional continuity and enable the functioning of complex multilateral regimes.

5.1.4.1 United Nations Framework Convention on Climate Change (UNFCCC)

The **United Nations Framework Convention on Climate Change (UNFCCC)** is the central institutional framework for international climate policy. Adopted in 1992 at the Rio Earth Summit, the Convention recognizes climate change as a global problem caused primarily by anthropogenic greenhouse gas emissions and establishes a cooperative process to address it.

The UNFCCC introduced key principles that continue to shape climate governance, including **equity, precaution, and common but differentiated responsibilities and respective capabilities (CBDR–RC)**. Rather than imposing immediate binding emission limits, the Convention created a flexible framework for progressive commitments.

Its core institutional functions include:

- **Regular Conference of the Parties (COP) meetings**, serving as the supreme decision-making body,
- **Negotiation and adoption of subsequent instruments**, including the Kyoto Protocol and the Paris Agreement,
- **Reporting, review, and transparency mechanisms**, based on national greenhouse gas inventories and progress reports,
- **Financial, technological, and capacity-building support**, notably through mechanisms such as the Green Climate Fund.

Through this evolving architecture, the UNFCCC has become a dynamic regime that combines legal obligations, political commitments, and scientific assessment.

5.1.4.2 Convention on Biological Diversity (CBD)

The **Convention on Biological Diversity (CBD)**, adopted in 1992, provides the principal global framework for biodiversity governance. Unlike earlier conservation-focused treaties, the CBD adopts a comprehensive approach that links conservation objectives with development and equity concerns.

The Convention pursues three mutually reinforcing objectives:

1. **Conservation of biological diversity**,
2. **Sustainable use of its components**,
3. **Fair and equitable sharing of benefits** arising from the utilization of genetic resources.

The CBD addresses biodiversity at multiple levels, including ecosystems, species, and genetic diversity. It requires Parties to develop national biodiversity strategies and action plans (NBSAPs) and to integrate biodiversity considerations into sectoral policies such as agriculture, forestry, and fisheries.

Institutionally, the CBD operates through:

- **A Conference of the Parties**, setting strategic priorities and targets,
- Subsidiary scientific bodies providing assessments and guidance,
- Supplementary protocols, such as the Nagoya Protocol on access and benefit-sharing.

The CBD thus represents a bridge between conservation policy, resource governance, and socio-economic development.

5.1.4.3 United Nations Convention to Combat Desertification (UNCCD)

The **United Nations Convention to Combat Desertification (UNCCD)** addresses land degradation, desertification, and drought, particularly in dryland regions. Adopted in 1994, it is unique among MEAs in its strong emphasis on **local participation and socio-economic dimensions**.

The Convention recognizes land degradation as both an environmental and developmental challenge, closely linked to poverty, food security, and climate vulnerability. Its primary objective is to improve the living conditions of affected populations while restoring and maintaining land productivity.

Key features of the UNCCD include:

- National Action Programmes (NAPs) tailored to country-specific conditions,
- A strong focus on **sustainable land management**,
- Integration with climate adaptation and biodiversity strategies,
- Increasing alignment with global targets such as **land degradation neutrality**.

The UNCCD illustrates how environmental treaties can explicitly integrate human development, livelihoods, and resilience considerations.

5.1.4.4 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

The **Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)** regulates international trade in wildlife to ensure that such trade does not threaten species survival. Adopted in 1973, CITES is one of the most enforcement-oriented MEAs.

Rather than focusing on habitat protection, CITES targets **trade flows** through a permit and licensing system based on species listings. Species are categorized into different appendices according to their conservation status and the level of trade control required.

CITES governance is characterized by:

- Legally binding trade restrictions,
- National management and scientific authorities,
- Compliance mechanisms linked to customs and border control.

Species are classified into **three Appendices**, which reflect different levels of conservation concern and corresponding degrees of trade control. **Appendix I**, comprising roughly **3% of listed species**, includes species threatened with extinction, for which international commercial

trade is generally prohibited; these listings are dominated by plant species. **Appendix II**, accounting for approximately **97% of all listed species**, covers species that are not necessarily threatened with extinction but may become so unless trade is regulated, as well as look-alike species; international trade is permitted but strictly controlled, with a higher proportion of animal species. **Appendix III**, representing about **1% of listings**, includes species protected in at least one country that has requested international cooperation to control their trade, and is overwhelmingly composed of animal species. Overall, CITES regulates international trade in around **36,000 animal and plant species**.

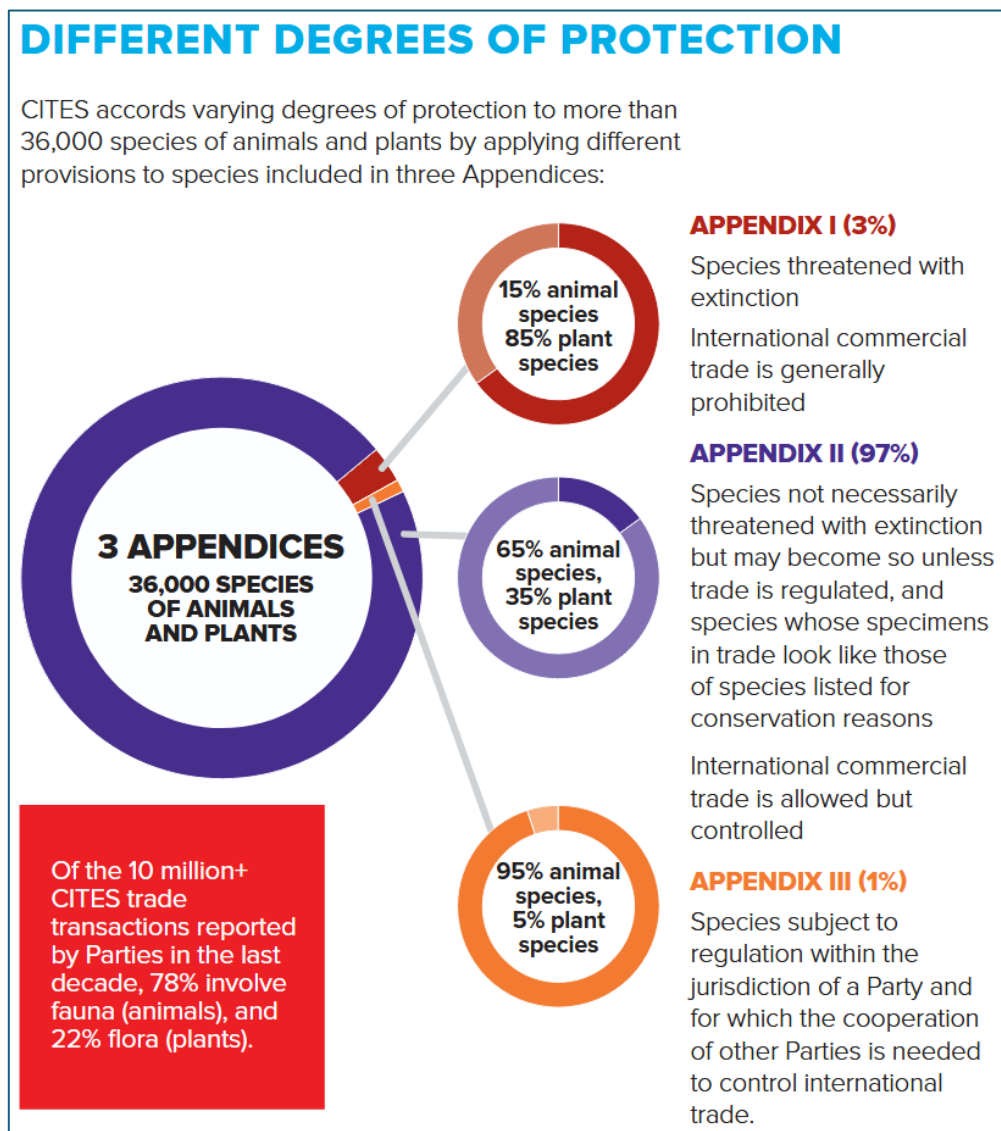


Figure 7: Degrees of protection under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). (Source: https://cites.org/sites/default/files/1/Brochure_UNEP_CITES_eng.pdf)

In operational terms, CITES implementation is built around **three cumulative conditions** that must be satisfied for any international trade in listed species. First, **legality** requires that specimens are acquired in full compliance with national conservation and wildlife laws, confirmed through a formal legal acquisition finding. Second, **sustainability** is ensured through a **non-detriment finding**, a science-based assessment demonstrating that trade will

not negatively affect the survival of the species or its ecological role. Third, **traceability** is achieved via standardized CITES permits and certificates, supported by national reporting obligations and centralized compilation in the CITES Trade Database. Together, these principles translate conservation objectives into enforceable administrative procedures, linking biodiversity protection with customs control, scientific assessment, and international transparency.

By linking biodiversity conservation objectives directly to the regulation of international trade—most strikingly reflected in **more than 10 million reported** CITES trade transactions over the past decade, of which 78% involved fauna and 22% flora—CITES demonstrates how environmental policy can be effectively embedded within global economic and trade governance.

5.1.4.5 Ramsar Convention on Wetlands

The **Ramsar Convention**, adopted in 1971, is the oldest global environmental treaty. It focuses on the conservation and wise use of wetlands. It recognizes wetlands as critical ecosystems providing services such as water regulation, biodiversity support, and climate mitigation.

Unlike more prescriptive treaties, the Ramsar Convention emphasizes:

- **Designation of Wetlands of International Importance,**
- The principle of **wise use**, rather than strict protection,
- Integration of wetland conservation into national land-use planning.

The Convention relies heavily on cooperation, monitoring, and knowledge exchange, reflecting a flexible governance approach suited to diverse ecological and institutional contexts.

5.1.5 Specialized UN Agencies

Specialized UN agencies play a central role in integrating environmental objectives into sector-specific governance frameworks. Unlike multilateral environmental agreements (MEAs), which are primarily treaty-based, specialized agencies operate through **technical expertise, data provision, policy guidance, and capacity-building**. Their mandates are sectoral, yet environmental considerations have become increasingly central to their activities. This chapter focuses on three key agencies: the Food and Agriculture Organization (FAO), the World Meteorological Organization (WMO), and the World Health Organization (WHO).

5.1.5.1 Food and Agriculture Organization of the United Nations (FAO)

Mandate and Scope

The **Food and Agriculture Organization of the United Nations (FAO)** is the leading international organization addressing global challenges related to **food security, agriculture,**

forestry, fisheries, and land use. Established in 1945, FAO's overarching objective is to eradicate hunger and malnutrition while promoting the sustainable use of natural resources.

Because food and agricultural production systems are fundamentally dependent on ecosystems and biological resources, FAO occupies a pivotal position at the interface between **environmental sustainability and socio-economic development.** Within its mandate, FAO explicitly recognizes the central importance of **biodiversity for food and agriculture,** defined as the diversity of plants, animals, micro-organisms, and ecosystems that support agricultural, forest, and aquatic production systems.

This biodiversity underpins key ecosystem services such as pollination, pest and disease regulation, soil formation, water regulation, carbon sequestration, and resilience to climatic and environmental shocks. FAO assessments demonstrate that the degradation of these biological foundations directly undermines food security, rural livelihoods, and adaptive capacity.

Environmental issues within FAO's scope therefore include:

- Sustainable management of forests, agricultural land, rangelands, and aquatic ecosystems,
- Conservation and sustainable use of biodiversity within production landscapes,
- Soil protection and prevention of land degradation,
- Maintenance of ecosystem services essential for food security and livelihoods,
- Climate change mitigation and adaptation in food and agricultural systems.

FAO's mandate emphasizes **integration rather than separation:** environmental protection is addressed as an intrinsic component of productive land and resource use.

Role in Climate and Environmental Policy

FAO plays a key role in translating global environmental and climate objectives into **sector-specific policies and practices.** One of its flagship approaches is the promotion of **climate-smart agriculture,** which aims to:

- Sustainably increase productivity and incomes,
- Enhance resilience and adaptive capacity to climate change,
- Reduce greenhouse gas emissions and enhance carbon sinks where feasible.

In forestry, FAO promotes **sustainable forest management,** supports global forest monitoring through instruments such as the **Global Forest Resources Assessment,** and contributes to internationally applied methodologies for carbon accounting in land use and land-use change. In fisheries and aquaculture, FAO advances ecosystem-based management approaches to address overexploitation, habitat degradation, and climate impacts on aquatic systems.

Across all sectors, FAO emphasizes that biodiversity loss within production systems weakens ecosystem resilience and increases vulnerability to climate change, land degradation, and

environmental shocks. FAO therefore provides technical and scientific input to international frameworks on climate change, biodiversity, desertification, and sustainable development, linking global policy goals with on-the-ground production realities.

Role in Nature Protection

FAO plays a **distinctive role in nature protection** that differs from that of conservation-focused organizations. Rather than emphasizing strict protection or exclusionary conservation, FAO approaches nature protection through **sustainable use, management, and restoration of production landscapes**.

FAO's concept of nature protection is grounded in the recognition that:

- Food production and biodiversity conservation are interdependent,
- Agricultural, forest, and aquatic systems can contribute to biodiversity protection if managed sustainably,
- Long-term food security depends on healthy ecosystems and ecosystem services.

FAO promotes management practices that maintain or enhance ecosystem services such as pollination, soil fertility, water regulation, biological pest control, and carbon sequestration. In forestry and land-use policy, it supports sustainable forest management, integrated landscape planning, agroforestry, and ecosystem restoration, aligning conservation objectives with livelihood and development needs.

FAO complements global biodiversity conventions and conservation organizations by **translating biodiversity goals into sectoral land-use and resource-management policies**, thereby embedding nature protection within everyday decisions on food production and resource use

Institutional Operation and Governance

FAO operates as an **intergovernmental organization within the United Nations system**, combining political decision-making by its members with scientific, technical, and policy expertise provided by its Secretariat.

Its governance structure includes:

- The **FAO Conference**, the supreme governing body in which all members participate; it meets biennially to set overall policy directions and approve the programme of work and budget,
- The **FAO Council**, acting as the executive body between Conference sessions,
- Specialized **technical committees** (notably on agriculture, forestry, fisheries, and commodities), which provide sector-specific policy guidance,
- The **FAO Secretariat**, led by the Director-General, responsible for day-to-day operations and programme implementation.

A distinctive institutional feature of FAO is the **Commission on Genetic Resources for Food and Agriculture**, which coordinates global policy processes related to genetic resources and biodiversity in food and agricultural systems and oversees major global assessments through country-driven reporting processes.

FAO relies primarily on **voluntary guidelines, technical standards, data provision, and capacity-building**, rather than binding regulatory instruments.

Membership

FAO is a **member-based organization** with near-universal membership. It includes **almost all sovereign states worldwide**, as well as the **European Union** as a member organization. Member States define FAO's strategic priorities, contribute to its budget, and participate in its governing bodies, technical committees, and assessment processes.

This broad membership gives FAO high international legitimacy and enables it to function as a global forum for integrating environmental, agricultural, and development perspectives across diverse ecological and socio-economic contexts.

Headquarters and Regional Structure

FAO is **headquartered in Rome, Italy**, where its central Secretariat, Director-General, and governing bodies are located. From its headquarters, FAO coordinates global policy processes, assessments, and normative work.

To ensure regional relevance and effective implementation, FAO operates through a decentralized system of **regional, subregional, and country offices**. The five **Regional Offices** are located in:

- **Africa** – Accra, Ghana
- **Asia and the Pacific** – Bangkok, Thailand
- **Europe and Central Asia** – Budapest, Hungary
- **Latin America and the Caribbean** – Santiago, Chile
- **Near East and North Africa** – Cairo, Egypt

Regional offices adapt global FAO strategies to regional ecological and institutional conditions, coordinate regional programmes, support Member States in policy development and implementation, and facilitate knowledge exchange. This structure enables FAO to operationalize global sustainability and environmental objectives in region-specific ways.

5.1.5.2 World Meteorological Organization (WMO)

Mandate and Scientific Authority

The **World Meteorological Organization (WMO)** is the central UN agency responsible for weather, climate, and hydrological sciences. Its mandate is fundamentally scientific, yet its outputs form the **epistemic foundation of international climate and environmental policy**.

WMO coordinates:

- Global meteorological and climate observation networks,
- Standardization of data collection and exchange,
- Climate monitoring and forecasting services.

Role in Climate Governance

WMO's most significant contribution to environmental policy lies in its support for **evidence-based decision-making**. Reliable climate data, long-term observation records, and standardized methodologies are essential for identifying trends, assessing risks, and evaluating policy outcomes.

The organization plays a central role in underpinning the work of global assessment bodies, most notably the **Intergovernmental Panel on Climate Change (IPCC)**, by ensuring the scientific credibility of climate data and observation systems.

Adaptation, Risk Management, and Early Warning

Beyond mitigation-focused climate policy, WMO contributes directly to:

- Climate adaptation planning,
- Disaster risk reduction,
- Early warning systems for extreme weather events.

These functions link environmental policy to human safety, economic stability, and resilience, illustrating the growing importance of climate services in governance.

5.1.5.3 World Health Organization (WHO)

Mandate and Environmental Health

The **World Health Organization (WHO)** addresses the connections between environment and human health. Environmental factors are recognized as major determinants of global disease burdens, particularly in relation to pollution, chemical exposure, and climate change.

WHO's environmental focus includes:

- Air and water quality,
- Chemical and waste management,

- Climate-related health risks,
- Urban environmental health.

Environmental Policy Through a Health Lens

WHO reframes environmental degradation as a **public health issue**, strengthening the political relevance of environmental policy. By quantifying health impacts and mortality risks, WHO provides compelling evidence that environmental protection delivers immediate social benefits.

Key areas of engagement include:

- Health impacts of air pollution,
- Climate-sensitive diseases,
- Heat stress and extreme weather events,
- Environmental justice and vulnerability.

This approach helps bridge environmental policy with social and health policy agendas.

Normative and Advisory Role

WHO does not regulate environmental policy directly but exerts influence through:

- Health-based guidelines and standards,
- Risk assessments,
- Policy recommendations,
- Support for national public health strategies.

By integrating environmental considerations into health governance, WHO contributes to a broader understanding of sustainability that places human well-being at its center.

5.1.6 The European Union as a Supranational Actor

The EU represents a unique case in international environmental governance, as it combines **supranational regulatory authority** with active participation in global environmental negotiations. Environmental protection is an explicit EU competence, and EU law is legally binding on its Member States.

Key characteristics of EU environmental governance include:

- Comprehensive environmental legislation and standards,
- Integration of environmental objectives into sectoral policies (e.g. agriculture, energy, transport),
- Strong implementation and enforcement mechanisms,

- Leadership in international negotiations, particularly on climate policy.

The EU has played a prominent role in advancing global frameworks such as climate neutrality, emissions trading, and land-use accounting, and increasingly positions itself as a normative power in global environmental policy.

5.2 Science–Policy Assessment Bodies: Evidence, Credibility, and Global Environmental Assessments

Effective international environmental policy depends fundamentally on **credible scientific knowledge**. Unlike intergovernmental organizations that negotiate rules or implement programmes, **science–policy assessment bodies** operate at the interface between science and decision-making. Their primary function is not regulation, but the **synthesis, assessment, and communication of scientific evidence** relevant to global environmental challenges.

These bodies enhance the legitimacy of environmental policy by:

- Providing authoritative assessments of the state of the environment,
- Identifying risks, trends, and uncertainties,
- Evaluating response options and their implications,
- Establishing shared scientific baselines for international negotiations.

Credibility, Legitimacy, and Policy Impact

Science–policy assessment bodies and scientific networks derive their influence from:

- Scientific rigor,
- Transparency and inclusiveness,
- Policy relevance without prescriptive mandates.

Their authority lies not in enforcement, but in shaping **shared understandings of environmental problems and solution spaces**. As such, they play a decisive role in framing international environmental policy agendas.

This chapter examines the two most influential intergovernmental science–policy assessment bodies—the **Intergovernmental Panel on Climate Change (IPCC)** and the **Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)**—as well as the role of **international scientific networks**, with particular attention to **IUFRO** and **CGIAR**.

5.2.1 Intergovernmental Panel on Climate Change (IPCC)

Mandate and Role

The **Intergovernmental Panel on Climate Change (IPCC)** was established in **1988** by the **World Meteorological Organization (WMO)** and the **United Nations Environment Programme (UNEP)** to provide comprehensive, policy-relevant assessments of the **scientific, technical, and socio-economic knowledge** related to climate change. The IPCC does **not conduct original research**; instead, it **synthesizes and evaluates peer-reviewed scientific literature** to produce authoritative assessment reports that inform international climate policy and negotiations.

Assessment Structure and Outputs

The IPCC's assessment work is organized into **three Working Groups**:

- **Working Group I** assesses the **physical science basis** of climate change;
- **Working Group II** examines **impacts, adaptation, and vulnerability**;
- **Working Group III** focuses on **mitigation of climate change**.

In addition, the IPCC produces **Synthesis Reports** and **Special Reports** addressing cross-cutting or emerging issues. The assessment cycles provide a **standardized scientific foundation** for global climate governance, particularly for processes under the **UNFCCC**.

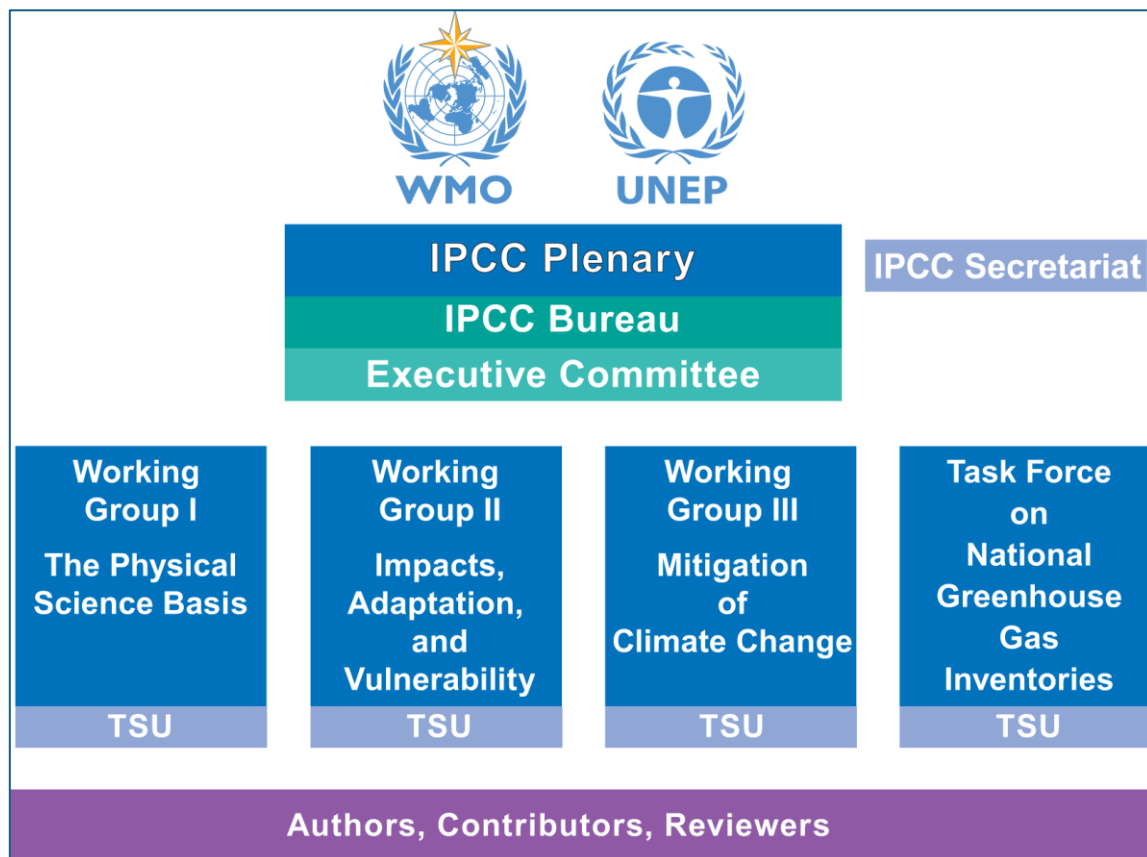


Figure 8: Organizational structure of the Intergovernmental Panel on Climate Change (IPCC) (Source: <https://www.ipcc.ch/languages-2/english/>)

Alongside the Working Groups, the IPCC includes a **permanent Task Force on National Greenhouse Gas Inventories (TFI)**, which plays a distinct and operationally critical role in climate governance.

IPCC Guidelines for Greenhouse Gas Inventories

A defining contribution of the IPCC is the development of the **IPCC Guidelines for National Greenhouse Gas Inventories**, coordinated through the **Task Force on National GHG Inventories (TFI)**. These guidelines establish **standardized methodologies** for estimating and reporting greenhouse gas emissions and removals across all major sectors, including energy, industry, agriculture, land use, land-use change and forestry (LULUCF), and waste.

The guidelines are **periodically updated** to reflect scientific and methodological advances, most notably through the **2006 IPCC Guidelines** and the **2019 Refinement to the 2006 Guidelines**. By defining common accounting rules, transparency principles, and approaches to uncertainty, the IPCC Guidelines ensure **comparability, consistency, and credibility** of national greenhouse gas inventories.

These methodologies form the **technical backbone of the Enhanced Transparency Framework of the Paris Agreement**, underpinning national reporting, technical expert review, and global stocktake processes. Through this function, the IPCC directly links scientific assessment with the operational mechanisms of international climate governance.

Science–Policy Interface

A defining feature of the IPCC is its carefully balanced **science–policy interface**. While assessment reports are authored by scientists, governments are formally involved in the **scoping of assessments**, the **multi-stage review process**, and the **approval of Summaries for Policymakers**. This structure preserves scientific integrity while enhancing political relevance and acceptance.

Beyond assessments and inventories, the IPCC also standardizes key analytical tools used in climate policy, including **emissions scenarios** (such as the Shared Socioeconomic Pathways) and **climate metrics** (e.g. Global Warming Potentials). In parallel, it supports **capacity-building efforts**, particularly in developing countries, to strengthen participation in assessments and the application of inventory methodologies.

Through these combined functions, the IPCC has become the **primary epistemic authority on climate change**, shaping international negotiations, national climate policies, and long-term mitigation and adaptation strategies worldwide.

5.2.2 Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)

Mandate and Scope

The **Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)** was established in 2012 to strengthen the science–policy interface on biodiversity, ecosystems, and human well-being. Its creation responded to the recognized need for a

permanent, authoritative assessment mechanism for biodiversity, comparable to the role played by the IPCC in climate policy.

IPBES builds directly on the experience of the **Millennium Ecosystem Assessment (MEA)**, a landmark global assessment conducted between 2001 and 2005. The MEA was **initiated by the United Nations Secretary-General** and carried out by an international network of more than **1,300 scientists**, coordinated under the auspices of the UN system with the involvement of organizations such as UNEP, FAO, WHO, UNESCO, and the World Bank. Unlike the IPCC, the MEA was not an intergovernmental panel but an independent, large-scale scientific assessment. Its ecosystem services framework and its linkage of ecosystem change to human well-being provided the conceptual foundation for IPBES.

Assessment Functions and Outputs

IPBES produces global, regional, and thematic assessments that evaluate:

- The status and trends of biodiversity and ecosystem services,
- The direct and indirect drivers of biodiversity loss,
- Impacts on human well-being and sustainable development,
- Policy response options and governance pathways.

In contrast to the one-off nature of the MEA, IPBES was designed as a **permanent, intergovernmental platform**, ensuring continuity, regular assessments, and structured interaction with policymakers.

Knowledge Systems and Conceptual Innovation

A defining feature of IPBES is its **pluralistic knowledge approach**. While grounded in peer-reviewed science, IPBES explicitly incorporates **indigenous and local knowledge systems**, recognizing their relevance for biodiversity governance. This inclusive approach expands upon the MEA's ecosystem services concept by introducing the notion of **nature's contributions to people**, which encompasses ecological, cultural, and relational values.

Role in Global Biodiversity Governance

IPBES functions as the principal global science–policy body supporting biodiversity-related international processes, particularly the **Convention on Biological Diversity (CBD)**. Its assessments inform global biodiversity targets, national strategies, and policy coherence across sectors such as agriculture, forestry, fisheries, and land use.

By institutionalizing and expanding the legacy of the Millennium Ecosystem Assessment, IPBES has become the central epistemic authority on biodiversity and ecosystem services in international environmental governance.

5.2.3 International Union of Forest Research Organizations (IUFRO)

In addition to intergovernmental assessment bodies, **international scientific networks** play a crucial role in generating knowledge, advancing methodologies, and supporting policy-relevant research. Unlike IPCC and IPBES, these networks are not intergovernmental decision-making bodies, but **research-driven platforms** that contribute to the scientific foundations of environmental governance.

Role and Significance

The **International Union of Forest Research Organizations (IUFRO)** is a global network of forest science institutions and researchers. It facilitates international collaboration on forest-related research, including ecology, management, climate mitigation, biodiversity, and socio-economic aspects of forestry.

IUFRO's contributions are particularly important in:

- Forest-based climate mitigation and adaptation,
- Sustainable forest management,
- Biodiversity conservation in forest ecosystems,
- Science-based forest policy development.

Science–Policy Contribution

IUFRO does not produce binding assessments, but it contributes to the science–policy interface by:

- Synthesizing forest research for policymakers,
- Supporting international assessment processes,
- Providing scientific input to climate, biodiversity, and land-use policy debates.

Through its expert networks, IUFRO strengthens the scientific basis of forest-related policy at global and regional levels.

5.2.4 Consultative Group on International Agricultural Research (CGIAR)

Mandate and Research Focus

CGIAR is a global partnership of research centers focused on agriculture, food systems, and natural resource management. Its research addresses food security, climate change, land degradation, water management, and biodiversity within agricultural landscapes.

CGIAR plays a key role in:

- Climate-resilient agriculture,
- Sustainable land and water use,

- Agroecology and biodiversity-friendly production systems,
- Mitigation of environmental impacts of agriculture.

Policy Relevance

CGIAR’s work supports environmental policy by:

- Generating applied research for sustainable development,
- Informing FAO, IPBES, and climate-related assessments,
- Translating scientific innovation into scalable solutions.

By linking agricultural productivity with environmental sustainability, CGIAR contributes to the integration of environmental objectives into development-oriented policy frameworks.

5.3 International Non-Governmental and Advocacy Organizations: Agenda-Setting and Norm Diffusion in Global Environmental Governance

International environmental governance is shaped not only by states, intergovernmental organizations, and scientific assessment bodies, but also by a diverse range of **non-governmental and advocacy organizations**. These actors lack formal regulatory authority, yet they exert significant influence through **agenda-setting, norm diffusion, public mobilization, and knowledge production**.

Non-governmental organizations (NGOs) operate across multiple scales—from local communities to global forums—and engage with policymakers, international institutions, private actors, and the public. Their influence stems from their ability to frame environmental problems, introduce new concepts and standards, hold decision-makers accountable, and legitimize or contest policy outcomes.

Influence Pathways and Governance Impact

International non-governmental and advocacy organizations influence environmental governance through multiple pathways:

- **Agenda-setting**, by defining problems and priorities,
- **Norm diffusion**, by promoting new standards and concepts,
- **Accountability**, by monitoring and criticizing policy implementation,
- **Coalition-building**, by linking actors across scales and sectors.

Although these organizations lack formal authority, their ability to shape discourse, legitimacy, and public expectations gives them substantial indirect power.

This chapter distinguishes between three major categories of international non-governmental actors:

1. **Environmental advocacy NGOs,**
2. **Policy-oriented NGOs and think tanks, and**
3. **International indigenous and civil-society networks.**

5.3.1 Environmental Advocacy NGOs

Role and Characteristics

Environmental advocacy NGOs are among the most visible non-state actors in global environmental politics. Their primary functions include:

- Raising public awareness of environmental issues,
- Framing problems in moral, ecological, or justice-based terms,
- Mobilizing public pressure and political action,
- Influencing international negotiations and national policy debates.

These organizations often combine scientific evidence with normative claims, emphasizing urgency, responsibility, and ethical considerations.

World Wide Fund for Nature (WWF)

The **World Wide Fund for Nature (WWF)** is one of the largest and most influential environmental NGOs globally. Its work focuses on biodiversity conservation, sustainable resource use, and the reduction of human pressures on ecosystems.

WWF operates through:

- Conservation projects and partnerships,
- Policy advocacy at national and international levels,
- Engagement with the private sector to promote sustainability standards,
- Support for global frameworks on biodiversity, climate, and nature-based solutions.

WWF's strategy emphasizes cooperation with governments and businesses, positioning itself as both an advocacy organization and a pragmatic policy partner.

Greenpeace

Greenpeace represents a more confrontational model of environmental advocacy. It is known for direct action, high-visibility campaigns, and strong public messaging.

Key features of Greenpeace’s approach include:

- Non-violent direct action to expose environmental harm,
- Public campaigns targeting governments and corporations,
- Strong emphasis on climate change, fossil fuels, pollution, and biodiversity loss.

Greenpeace plays a crucial role in **agenda-setting** by bringing environmental issues into public debate and applying pressure that can shift political priorities.

Friends of the Earth

Friends of the Earth is a global network of grassroots environmental organizations. Its work emphasizes:

- Environmental justice,
- Community rights,
- Democratic control over natural resources.

Unlike more centralized NGOs, Friends of the Earth operates as a federation of national groups, allowing it to connect global environmental debates with local social and ecological struggles.

5.3.2 Policy-Oriented NGOs and Think Tanks

Role in Evidence-Based Advocacy

Policy-oriented NGOs and think tanks occupy a distinct position at the science–policy interface. They combine analytical capacity with advocacy, producing policy-relevant research that informs decision-making while promoting specific normative objectives.

Their influence is often less visible than that of campaigning NGOs but is critical in shaping policy design and implementation.

World Resources Institute (WRI)

The **World Resources Institute (WRI)** is a leading global think tank focusing on environment, development, and sustainability. It is particularly influential in climate policy, land-use governance, and resource management.

WRI’s contributions include:

- Development of global data platforms and indicators,
- Analytical tools for climate mitigation and adaptation,
- Policy guidance on land use, forests, and carbon accounting.

WRI often works closely with governments, international organizations, and the private sector, providing technical expertise that supports evidence-based policymaking.

International Institute for Environment and Development (IIED)

The **International Institute for Environment and Development** focuses on the links between environmental sustainability, poverty reduction, and development. Its work highlights:

- Equity and social justice,
- Local and indigenous knowledge,
- Inclusive governance of natural resources.

IIED plays a key role in amplifying voices from the Global South and ensuring that environmental policies reflect development realities and social dimensions.

5.3.3 International Indigenous and Civil-Society Networks

Representation and Rights-Based Governance

International indigenous and civil-society networks represent communities that are often directly affected by environmental policies and resource-use decisions. These networks:

- Advocate for land rights, tenure security, and self-determination,
- Promote recognition of indigenous and local knowledge systems,
- Engage in international forums to influence environmental governance.

Their participation has become increasingly institutionalized in global processes related to biodiversity, climate change, and land use.

Role in Norm Diffusion

These networks contribute to norm diffusion by introducing concepts such as:

- Free, prior, and informed consent (FPIC),
- Rights-based approaches to conservation,
- Co-management and community-based resource governance.

By challenging purely technocratic or market-based approaches, indigenous and civil-society networks broaden the ethical and social foundations of international environmental policy.

5.4 Multi-Stakeholder Governance at the International Level: Soft Law, Technical Norms, and Coordination Roles in Environmental Policy

In addition to intergovernmental treaties and non-governmental advocacy, international environmental governance increasingly relies on **multi-stakeholder platforms** that coordinate action across public authorities, private actors, civil society, and scientific communities. These

platforms operate primarily through **soft law**, voluntary standards, and shared technical norms rather than legally binding obligations.

Multi-stakeholder governance platforms function as **bridge actors**. They translate scientific knowledge and global policy objectives into operational guidance, implementation standards, and decision-making tools that shape real-world practices. This chapter distinguishes between two analytically distinct but interconnected categories:

1. **Normative multi-stakeholder platforms and knowledge authorities**, and
2. **Market-based certification and integrity platforms**.

5.4.1 Normative Multi-Stakeholder Platforms and Knowledge Authorities

Role and Governance Logic

Normative multi-stakeholder platforms influence environmental governance by defining **concepts, classifications, best-practice frameworks, and shared understandings** of sustainability. They do not certify compliance or enforce rules. Instead, their authority derives from **scientific credibility, inclusiveness, and epistemic legitimacy**.

These platforms play a foundational role in:

- Shaping how environmental problems are defined,
- Establishing common languages and metrics,
- Providing legitimacy for policies, standards, and investments,
- Informing both public regulation and private governance systems.

5.4.1.1 International Union for Conservation of Nature (IUCN)

Institutional Character and Governance Role

The **International Union for Conservation of Nature (IUCN)** is a unique global **multi-stakeholder organization** bringing together:

- **States and government agencies**
- **Non-governmental organizations (NGOs)**
- **Scientific and research institutions**

Unlike certification schemes or market regulators, IUCN does **not** enforce compliance or regulate behavior. Its influence derives from its role as a **norm-setting and knowledge-authoritative body**, grounded in scientific credibility, expert consensus, and institutional legitimacy.

Core Normative and Knowledge Instruments

IUCN exercises global influence through a set of widely recognized reference frameworks and standards, including:

- **The IUCN Red List of Threatened Species**, the global benchmark for extinction risk
- **Standardized protected area categories and management guidelines**, providing a common language for conservation planning
- **Scientific and policy guidance on biodiversity conservation**, supporting evidence-based decision-making
- **Global standards for nature-based solutions**, ensuring environmental integrity and social safeguards

Through these instruments, IUCN shapes conservation priorities and legitimizes policy choices at **international, national, and local levels**, despite lacking formal regulatory authority.

The IUCN Red List of Threatened Species

The **IUCN Red List** is a central pillar of global biodiversity governance. Far more than a catalogue of species, it functions as a **comprehensive decision-support system** for conservation policy and action.

For each assessed species, the Red List provides standardized information on:

- **Geographic range and distribution**
- **Population size and trends**
- **Habitat and ecological requirements**
- **Use and trade**
- **Threats** and recommended **conservation actions**

The Red List is widely used by:

- Government agencies and wildlife authorities
- Conservation NGOs and land-use planners
- Researchers and educational institutions
- The **business and finance sectors**, increasingly in risk assessment and sustainability strategies

Its credibility rests on a large collaborative process involving the **IUCN Biodiversity Assessment and Knowledge Team**, partner organizations, and thousands of experts within the **IUCN Species Survival Commission** and associated scientific networks.

To date, many major taxonomic groups—including **mammals, amphibians, birds, freshwater fishes, reef-building corals, and trees**—have been comprehensively assessed.

What are The IUCN Red List Categories and Criteria?

The IUCN Red List Categories indicate how close a species is to becoming extinct. The nine Red List Categories are shown below:

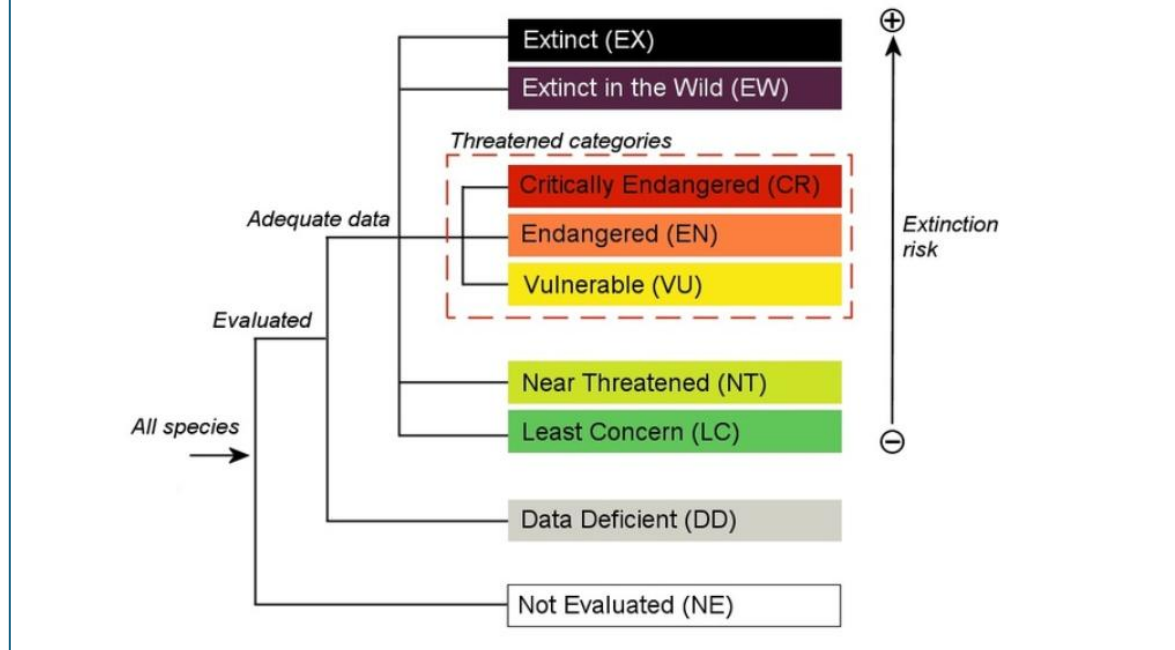


Figure 9: IUCN Red List Categories and extinction risk. (Source: <https://www.iucnredlist.org/about/faqs>)

The Red List is a **dynamic instrument**, regularly updated to incorporate newly described species and reassess existing ones.

- **Positive outcomes** are occasionally documented, including the **downlisting** of species following successful conservation interventions.
- However, the overall trend is one of **accelerating biodiversity loss**.

Currently:

- Over **172,600 species** have been assessed
- More than **48,600 species** are threatened with extinction, including:
 - 44% of reef-building corals
 - 41% of amphibians
 - 38% of trees
 - 38% of sharks and rays
 - 34% of conifers
 - 26% of mammals

- 26% of freshwater fishes
- 11.5% of birds

Figure 9 illustrates the **nine IUCN Red List Categories**, which indicate the relative risk of extinction for assessed species. Species progress from **Least Concern (LC)** and **Near Threatened (NT)** through the **threatened categories—Vulnerable (VU), Endangered (EN), and Critically Endangered (CR)**—which represent increasing extinction risk. **Extinct in the Wild (EW)** and **Extinct (EX)** denote the highest risk levels, where species no longer survive in natural habitats or at all. Species classified as **Data Deficient (DD)** lack sufficient information for assessment, while **Not Evaluated (NE)** species have not yet been assessed. The diagram emphasizes that extinction risk increases upward and highlights the subset of categories considered “threatened” under IUCN criteria.

To strengthen its role as a global monitoring tool, IUCN aims to develop the Red List into a comprehensive “**Barometer of Life**” by:

- Expanding assessments to at least **260,000 species**
- Reassessing approximately **142,000 species** to track trends over time
- Improving taxonomic and geographic coverage

This expanded evidence base enhances:

- Conservation priority-setting
- Policy formulation
- Funding and investment decisions

Protected Areas, Conservation Guidance, and Nature-Based Solutions

Beyond species assessments, IUCN plays a key normative role through its **protected area categories and management guidelines**, which:

- Classify protected areas by **management objectives**
- Support national and international reporting (e.g. under the **CBD**)
- Improve **comparability, transparency, and policy coherence**

IUCN also produces **scientific and policy guidance** on biodiversity conservation, covering areas such as:

- Ecosystem management and restoration
- Species recovery planning
- Invasive alien species

- Conservation governance

More recently, IUCN has led the development of **global standards for nature-based solutions**, providing criteria to ensure that such interventions:

- Deliver real **biodiversity benefits**
- Contribute to **climate mitigation and adaptation**
- Support **human well-being and social safeguards**

5.4.1.2 Natural Capital Coalition

The **Natural Capital Coalition** represents a different form of normative governance, focusing on the integration of nature into **economic and decision-making systems**. It brings together businesses, financial institutions, NGOs, and researchers to develop shared frameworks for understanding nature's value.

Its central output, the **Natural Capital Protocol**, provides guidance for:

- Identifying dependencies and impacts on natural capital,
- Measuring and valuing ecosystem services,
- Integrating environmental considerations into corporate and public decisions.

The Coalition does not impose standards or certification requirements. Instead, it supports **norm diffusion** by aligning environmental sustainability with economic rationality, thereby influencing investment, accounting, and strategic planning.

5.4.2 Market-Based Certification and Integrity Platforms

Role and Governance Logic

Market-based multi-stakeholder platforms govern environmental performance through **voluntary but enforceable standards**. While participation is optional, compliance often determines access to markets, finance, and reputational legitimacy. These platforms thus translate soft law into **practical constraints and incentives**.

Their authority rests on:

- Multi-stakeholder governance structures,
- Technical credibility and third-party verification,
- Market recognition and supply-chain requirements.

4.4.2.1 Forest Stewardship Council (FSC)

The **Forest Stewardship Council (FSC)** is a global forest certification system promoting environmentally sound, socially responsible, and economically viable forest management. It operates through a **balanced multi-chamber governance model** representing environmental, social, and economic interests.

FSC establishes:

- Global principles and criteria for forest management,
- Nationally adapted standards,
- Independent third-party certification and auditing.

Through supply-chain requirements and consumer trust, FSC exerts significant influence on forestry practices worldwide.

5.4.2.2 Programme for the Endorsement of Forest Certification (PEFC)

The **Programme for the Endorsement of Forest Certification (PEFC)** endorses national forest certification schemes rather than imposing a single global standard. Its model emphasizes:

- National ownership and contextual adaptation,
- Mutual recognition of certification systems,
- Broad participation by forest owners and industry actors.

PEFC complements FSC by offering a more decentralized approach to voluntary forest governance.

5.4.2.3 Integrity Council for the Voluntary Carbon Market (ICVCM)

The **Integrity Council for the Voluntary Carbon Market (ICVCM)** addresses governance and credibility challenges in voluntary carbon markets. It functions as a **meta-governance platform**, setting quality benchmarks rather than issuing credits itself.

ICVCM develops:

- **Core Carbon Market Principles** defining high-integrity credits,
- Eligibility criteria for carbon standards and methodologies,
- Guidance on transparency and quality assurance.

By shaping market rules and expectations, ICVCM strengthens trust and coherence in voluntary carbon markets.

5.4.2.4 Other Global Certification and Partnership Platforms

Numerous additional multi-stakeholder platforms operate in areas such as:

- Sustainable fisheries and seafood,
- Agricultural and commodity supply chains,
- Corporate sustainability disclosure and reporting.

Together, these initiatives expand the reach of environmental governance into global value chains where formal regulation is often limited.

5.4.3 Soft Law, Legitimacy, and Implementation

Despite their voluntary nature, multi-stakeholder governance platforms often exert **strong de facto regulatory influence**. Their standards and frameworks:

- Inform public regulation and international negotiations,
- Shape private-sector behavior and investment decisions,
- Translate global environmental goals into operational practices.

By bridging science, policy, and markets, these platforms play a critical role in implementing international environmental objectives.

International multi-stakeholder governance platforms represent a central pillar of contemporary environmental governance. Normative knowledge authorities such as IUCN and the Natural Capital Coalition shape the conceptual foundations and legitimacy of environmental action, while market-based platforms such as FSC, PEFC, and ICVCM translate these norms into practical standards and incentives. Together, they illustrate how soft-law mechanisms and voluntary coordination can significantly influence environmental outcomes in a multi-actor global governance system.

5.5 International Financial and Market Institutions: Funding, Incentives, and Implementation Leverage in Environmental Governance

While international agreements, scientific assessments, and normative frameworks define environmental goals, their implementation depends heavily on **financial resources and economic incentives**. International financial and market institutions play a decisive role in translating environmental commitments into action by mobilizing capital, shaping investment priorities, and creating incentive structures that influence public and private actors.

Unlike advocacy organizations or science–policy bodies, these institutions exert influence through **funding decisions, conditionality, and market mechanisms**. By allocating financial resources and setting eligibility criteria, they can steer development pathways toward—or away

from—environmental sustainability. This chapter examines the role of key international financial institutions in global environmental governance.

Implementation Leverage and Policy Coherence

International financial and market institutions exert influence not through regulation but through **financial leverage**. By conditioning finance on environmental performance and policy reforms, they shape incentives and priorities across sectors and countries.

Their role is essential for:

- Scaling up environmental investment,
- Aligning development finance with climate and biodiversity goals,
- Translating international commitments into measurable outcomes.

5.5.1 World Bank Group

Mandate and Structure

The **World Bank Group** is a central actor in international development finance and increasingly in environmental and climate governance. It comprises several institutions, most notably:

- The **International Bank for Reconstruction and Development (IBRD)**,
- The **International Development Association (IDA)**,
- The **International Finance Corporation (IFC)**.

Together, these institutions finance projects and policy reforms in low- and middle-income countries, influencing infrastructure development, land use, energy systems, and natural resource management.

Environmental and Climate Role

The World Bank integrates environmental objectives through:

- Environmental and social safeguard policies,
- Climate-related lending and investment frameworks,
- Support for climate mitigation and adaptation projects,
- Analytical work on environmental economics and climate risks.

By linking finance to policy reform and institutional capacity-building, the World Bank exercises significant **implementation leverage**, shaping how environmental objectives are operationalized in development contexts.

5.5.2 Multilateral Development Banks (MDBs)

Collective Role and Influence

Multilateral Development Banks (MDBs) include regional and sectoral institutions such as:

- The Asian Development Bank,
- The African Development Bank,
- The Inter-American Development Bank,
- The European Bank for Reconstruction and Development.

Together with the World Bank, MDBs are major providers of development finance and play a growing role in climate and environmental investment.

Environmental Mainstreaming

MDBs increasingly mainstream environmental objectives by:

- Integrating climate and environmental criteria into project appraisal,
- Scaling up renewable energy and low-carbon infrastructure finance,
- Supporting sustainable land-use and ecosystem-based projects,
- Aligning lending portfolios with international climate goals.

Through co-financing, policy dialogue, and technical assistance, MDBs amplify environmental objectives across regions and sectors.

5.5.3 Global Environment Facility (GEF)

Mandate and Governance

The **Global Environment Facility (GEF)** is a dedicated international financing mechanism for global environmental benefits. It operates as a financial mechanism for several multilateral environmental agreements, including those related to biodiversity, climate change, land degradation, and chemicals.

GEF funding focuses on:

- Biodiversity conservation,
- Climate change mitigation and adaptation,
- Land degradation and sustainable land management,
- International waters and chemical pollution.

Role in Environmental Governance

GEF provides grants and concessional finance to support projects that generate global environmental benefits, often in countries with limited financial capacity. It plays a crucial role in:

- Supporting implementation of Multilateral Environmental Agreements,
- Enabling capacity-building and institutional development,
- Leveraging co-financing from other sources.

GEF thus acts as a **bridge between international environmental agreements and on-the-ground implementation.**

5.5.4 Green Climate Fund (GCF)

Purpose and Institutional Design

The **Green Climate Fund (GCF)** was established under the UNFCCC to support climate mitigation and adaptation in developing countries. It represents a cornerstone of the international climate finance architecture.

GCF aims to:

- Promote paradigm-shifting investments,
- Balance support between mitigation and adaptation,
- Prioritize vulnerable countries and communities.

Financing and Impact

GCF provides grants, concessional loans, guarantees, and equity investments. Its funding supports:

- Renewable energy and energy efficiency,
- Climate-resilient infrastructure and ecosystems,
- Adaptation planning and implementation.

Through its governance structure and funding criteria, GCF reflects negotiated political priorities while operating as a financial institution.

Core Concepts and Review Questions – Chapter 5

1. Why do intergovernmental organizations (IGOs) matter for environmental policy?

Intergovernmental organizations are essential because many environmental problems—such as climate change, biodiversity loss, air pollution, and marine degradation—cross national borders and cannot be effectively addressed by individual states acting alone. IGOs provide platforms for coordination, negotiation, information-sharing, and collective decision-making, enabling countries to agree on common goals, principles, and rules. Through treaties, monitoring mechanisms, and technical support, IGOs help align national actions with shared international environmental objectives.

2. Which role is most typical of the United Nations system in environmental governance?

The United Nations system provides near-universal legitimacy and serves as a central forum for multilateral negotiation on environmental issues. With almost all countries as members, the UN enables inclusive diplomatic processes, supports treaty development, and hosts secretariats and scientific bodies that connect global knowledge with policy. Rather than directly enforcing laws, its strength lies in coordination, norm-setting, and fostering collective commitment.

3. Which statement best describes UNEP?

The United Nations Environment Programme primarily acts as a global agenda-setter, coordinator, and knowledge authority rather than an enforcement body. It produces authoritative environmental assessments, supports the development and coherence of international environmental law, and facilitates capacity-building, especially in developing countries. UNEP shapes policy discourse and aligns environmental objectives across the UN system without adopting binding rules itself.

4. What are Multilateral Environmental Agreements (MEAs) best described as?

Multilateral Environmental Agreements are legally binding international treaties through which states commit to specific environmental objectives, obligations, and institutional arrangements. They operationalize broad environmental principles—such as precaution or sustainability—into concrete rules, reporting requirements, and governance structures, typically overseen by Conferences of the Parties and supported by permanent secretariats.

5. What is the main function of a Conference of the Parties (COP) under an MEA?

The Conference of the Parties serves as the supreme decision-making body of a multilateral environmental agreement. It brings together all Parties to review implementation, adopt new decisions or protocols, update commitments, and guide the future direction of the treaty. While it does not function as a court, it plays a central role in steering and evolving the regime.

6. What is the UNFCCC primarily?

The United Nations Framework Convention on Climate Change is the central treaty-based framework for international climate policy. It establishes principles, objectives, and

institutional processes for addressing climate change and provides the foundation for subsequent instruments such as the Kyoto Protocol and the Paris Agreement, which progressively specify commitments and implementation mechanisms.

7. Which principle is most closely associated with fairness under the UNFCCC?

The principle of common but differentiated responsibilities and respective capabilities reflects fairness in the UNFCCC by recognizing that countries have contributed differently to climate change and possess unequal capacities to address it. This principle underpins differentiated obligations, balancing shared responsibility with equity between developed and developing countries.

8. Which mechanism is central to transparency under the UNFCCC?

National greenhouse gas inventories and reporting systems are central to transparency under the UNFCCC. They require countries to regularly report emissions and removals using standardized methodologies, enabling comparability, technical review, and trust among Parties. These mechanisms form the backbone of accountability under the climate regime.

9. What are the three core objectives of the Convention on Biological Diversity (CBD)?

The CBD pursues the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of benefits arising from the utilization of genetic resources. Together, these objectives integrate conservation goals with development and equity concerns, distinguishing the CBD from earlier, more narrowly focused conservation treaties.

10. What planning instrument are Parties to the CBD required to develop?

Parties to the CBD are required to develop National Biodiversity Strategies and Action Plans (NBSAPs), which translate global biodiversity objectives into national policies, targets, and measures. NBSAPs serve as the main implementation tool of the Convention at the national level and promote integration of biodiversity considerations across sectors.

11. What is the main focus of the UN Convention to Combat Desertification (UNCCD)?

The UNCCD focuses on addressing land degradation, desertification, and drought, particularly in dryland regions. It recognizes these challenges as both environmental and socio-economic problems, closely linked to poverty, food security, and climate vulnerability.

12. What distinguishes the UNCCD from many other environmental treaties?

A distinctive feature of the UNCCD is its strong emphasis on local participation and socio-economic dimensions. The Convention promotes bottom-up approaches, community involvement, and sustainable land management practices that simultaneously address environmental degradation and human livelihoods.

13. What does CITES regulate?

CITES regulates international trade in wild animals and plants to ensure that such trade does not threaten species survival. By controlling cross-border trade, the Convention directly addresses one of the major drivers of species decline linked to global markets.

14. How does CITES primarily operate?

CITES operates through a permit and licensing system based on species listings in different appendices. These appendices determine the level of trade control required, linking scientific assessments with customs enforcement and administrative procedures at national borders.

15. What is the Ramsar Convention mainly concerned with?

The Ramsar Convention focuses on the conservation and wise use of wetlands. It recognizes wetlands as ecosystems of international importance and promotes their sustainable management rather than strict protection alone, integrating conservation into broader land-use planning.

16. Which statement best describes specialized UN agencies such as FAO, WMO, and WHO?

Specialized UN agencies integrate environmental objectives into sectoral governance through technical expertise, data provision, standards, and policy guidance. Rather than enforcing treaties, they embed environmental considerations within areas such as agriculture, climate science, and public health.

17. What is FAO's key role in environmental governance?

FAO plays a central role in linking food security with the sustainable management of land, forests, fisheries, and other natural resources. It promotes approaches that integrate biodiversity conservation, climate resilience, and productive land use within agricultural and rural development policies.

18. What is WMO's most important contribution to climate governance?

WMO's most important contribution lies in coordinating global climate and meteorological observation and data systems. These standardized data underpin climate assessments, early warning systems, and evidence-based policymaking at national and international levels.

19. How does WHO mainly influence environmental policy?

WHO influences environmental policy by framing environmental degradation—such as air pollution or climate change—as a public health issue. By quantifying health impacts and risks, it strengthens the social and political relevance of environmental protection.

20. What best characterizes the European Union's role in environmental governance?

The European Union acts as a supranational actor with binding environmental law that is directly applicable to its Member States. It combines internal regulatory authority with an

active role in international environmental negotiations, giving it significant influence in global governance.

21. What is the primary function of science–policy assessment bodies like IPCC and IPBES?

Science–policy assessment bodies synthesize and assess scientific evidence to inform policymaking. They do not regulate or enforce rules but provide authoritative knowledge on environmental trends, risks, and response options, shaping policy agendas and negotiations.

22. What best describes the IPCC?

The IPCC is an intergovernmental body that assesses the scientific, technical, and socio-economic knowledge related to climate change. It produces comprehensive assessment reports that serve as the scientific foundation for international climate policy.

23. What is a key operational contribution of the IPCC to climate governance?

A key operational contribution of the IPCC is the development of greenhouse gas inventory methodologies. These standardized guidelines enable countries to estimate and report emissions consistently, forming the technical backbone of international climate transparency systems.

24. What best describes IPBES?

IPBES is a permanent intergovernmental platform focused on biodiversity and ecosystem services. It assesses the state of nature, drivers of biodiversity loss, and policy options, providing scientific support for global biodiversity governance.

25. What best describes IUFRO?

IUFRO is a global network of forest research institutions and scientists that facilitates international collaboration and knowledge exchange. It contributes scientific input to forest-related policy debates without exercising regulatory authority.

26. What is CGIAR primarily?

CGIAR is a global research partnership focused on agriculture, food systems, and natural resource management. Its work links food security with environmental sustainability, climate resilience, and biodiversity within agricultural landscapes.

27. How do international environmental NGOs typically exert influence?

International environmental NGOs exert influence through agenda-setting, norm diffusion, advocacy, and public mobilization. By framing issues, raising awareness, and holding decision-makers accountable, they shape policy priorities despite lacking formal authority.

28. What best characterizes multi-stakeholder governance platforms?

Multi-stakeholder governance platforms rely on voluntary, soft-law coordination among public authorities, private actors, civil society, and experts. They develop shared standards, norms, and practices that influence behavior without legally binding enforcement.

29. What distinguishes IUCN from certification schemes?

IUCN provides norms, standards, and authoritative knowledge—such as the Red List and protected area categories—without certifying compliance. Its influence rests on scientific credibility and legitimacy rather than market-based enforcement.

30. What is the core contribution of the Natural Capital Coalition?

The Natural Capital Coalition develops tools and frameworks for measuring and valuing natural capital in decision-making. Its work integrates environmental considerations into economic and business strategies by making nature’s value visible and comparable.

31. What is the Forest Stewardship Council (FSC)?

The Forest Stewardship Council is a voluntary forest certification system that promotes environmentally sound, socially responsible, and economically viable forest management. Its standards are implemented through independent third-party certification.

32. What is the Integrity Council for the Voluntary Carbon Market (ICVCM)?

The ICVCM is a governance platform that sets quality benchmarks for voluntary carbon credits. By defining integrity principles and eligibility criteria, it strengthens trust and coherence in voluntary carbon markets without issuing credits itself.

33. How do international financial institutions shape environmental outcomes?

International financial institutions shape environmental outcomes by steering investment through funding decisions, safeguards, and conditionality. By linking finance to environmental performance and policy reforms, they exert strong leverage over development pathways.

6. The EU Nature Protection Governance Framework: Layers, Instruments, and the Green Deal Paradigm Shift

6.1 Introduction: From Sectoral Conservation to Integrated Nature Governance

Nature protection within the European Union has developed from a relatively narrow system focused on species and habitat conservation into a **multi-layered governance framework** that extends across land use, water management, climate policy, finance, corporate governance, and product regulation. This evolution reflects a growing recognition that biodiversity loss is not merely a conservation issue but the cumulative outcome of **economic structures, sectoral policies, and production–consumption systems**.

For several decades, EU nature policy rested primarily on a small number of **core conservation instruments**, most notably the Birds and Habitats Directives. While these remain legally and ecologically fundamental, experience has shown that **strict protection alone cannot counteract the indirect and diffuse pressures** driving ecosystem degradation. Agricultural intensification, infrastructure development, climate change, global supply chains, and financial incentives increasingly shape ecological outcomes far beyond protected areas.

The **European Green Deal** represents a qualitative shift in EU governance by embedding nature protection across a broad spectrum of binding and non-binding policy domains. Under this paradigm, biodiversity is no longer governed exclusively through nature conservation law but is increasingly addressed through **climate legislation, sustainable finance rules, corporate reporting obligations, and product-level regulation**.

To make sense of this complexity, this textbook conceptualizes EU nature protection as a system of **seven interacting governance layers**. These layers are not hierarchical in a legal sense; rather, each performs a distinct governance function, and together they form an integrated framework shaping how ecosystems are protected, managed, restored, and impacted across the Union.

6.1.1 Conceptualizing Nature Protection as Interacting Governance Layers

The **EU Nature Protection Governance Framework** can be understood as a set of **functional governance layers**, each addressing biodiversity loss through different mechanisms and policy logics. These layers range from **direct legal protection** to **indirect, systemic interventions** targeting markets, corporate behaviour, and product life cycles.

The seven layers are designed to capture how the EU governs nature through:

- legally binding conservation obligations,
- management of environmental pressures,

- procedural safeguards and liability regimes,
- strategic policy direction and coherence,
- integration with climate and energy policy,
- market-based accountability mechanisms,
- and long-term product-related environmental controls.

This layered approach reflects the EU’s broader shift toward **systems-based environmental governance**, where ecological outcomes emerge from the interaction of multiple policy domains rather than from isolated conservation measures.

6.1.2 Overview of the EU Nature Protection Governance Framework

Table 1 provides an overview of the **seven governance layers**, their primary functions, and the main EU legal and policy instruments associated with each layer.

Table 1: EU Nature Protection Governance Framework

Layer	Title & governance function	EU instrument (type and number)
Layer 1	Core Biodiversity Protection & Conservation Law Direct, binding protection of species, habitats, and ecosystems	<ul style="list-style-type: none"> ➤ Birds Directive — Directive 2009/147/EC ➤ Habitats Directive — Council Directive 92/43/EEC ➤ Natura 2000 Network — established under Directives 2009/147/EC and 92/43/EEC ➤ Nature Restoration Regulation — Regulation (EU) 2024/1991 ➤ Invasive Alien Species (IAS) Regulation — Regulation (EU) 1143/2014
Layer 2	Ecosystem-Based Management & Pressure-Reduction Instruments Control of land use, water, pollution, and biological pressures	<p>Water, marine & floodplain systems</p> <ul style="list-style-type: none"> ➤ Water Framework Directive — Directive 2000/60/EC ➤ Marine Strategy Framework Directive — Directive 2008/56/EC ➤ Floods Directive — Directive 2007/60/EC <p>Agriculture, land use & pollution</p> <ul style="list-style-type: none"> ➤ Nitrates Directive — Directive 91/676/EEC ➤ Industrial Emissions Directive (IED) — Directive 2010/75/EU ➤ Ambient Air Quality Directive — Directive 2008/50/EC <p>Trade- and sourcing-based pressure control</p> <ul style="list-style-type: none"> ➤ EU Deforestation Regulation (EUDR) — Regulation (EU) 2023/1115

Layer 3	Procedural Environmental Safeguards & Liability Planning, assessment, and accountability mechanisms	<ul style="list-style-type: none"> ➤ Environmental Impact Assessment (EIA) Directive — Directive 2011/92/EU, amended by 2014/52/EU ➤ Strategic Environmental Assessment (SEA) Directive — Directive 2001/42/EC ➤ Environmental Liability Directive — Directive 2004/35/EC
Layer 4	Strategic Policy Frameworks (Soft Law) Agenda-setting, coherence, and long-term direction	<ul style="list-style-type: none"> ➤ European Green Deal — Communication COM(2019) 640 final ➤ EU Biodiversity Strategy for 2030 — Communication COM(2020) 380 final ➤ EU Forest Strategy for 2030 — Communication COM(2021) 572 final ➤ EU Soil Strategy for 2030 — Communication COM(2021) 699 final ➤ EU Bioeconomy Strategy — Communication (2018 update: COM(2018) 673 final) ➤ A new Circular Economy Action Plan (CEAP) — Communication COM(2020) 98 final
Layer 5	Climate–Nature–Energy Integration Instruments Binding climate and energy governance shaping ecosystem use	<ul style="list-style-type: none"> ➤ European Climate Law — Regulation (EU) 2021/1119 ➤ LULUCF Regulation — Regulation (EU) 2018/841 (as revised) ➤ Carbon Removal Certification Framework (CRCF) — Regulation (EU) 2024/3012 ➤ Renewable Energy Directive — Directive (EU) 2018/2001 (RED II) and recast Directive (EU) 2023/2413 (RED III), including sustainability and GHG criteria for biomass
Layer 6	Sustainable Finance & Corporate Governance Market-based and corporate accountability instruments	<p>Corporate reporting & standards</p> <ul style="list-style-type: none"> ➤ Corporate Sustainability Reporting Directive (CSRD) — Directive (EU) 2022/2464 ➤ European Sustainability Reporting Standards (ESRS) — Delegated Act under CSRD (EU) 2023/2772, incl. ESRS E4 – Biodiversity & Ecosystems disclosure ➤ EU Taxonomy Regulation — Regulation (EU) 2020/852 ➤ Sustainable Finance Disclosure Regulation (SFDR) — Regulation (EU) 2019/2088 ➤ Green Claims Directive — Proposal COM(2023) 166 final (pending adoption)

Layer 7	Product-Related Ecosystem Protection Prevention of diffuse, long-term ecological damage	Chemicals & substances control <ul style="list-style-type: none"> ➤ REACH Regulation — Regulation (EC) 1907/2006 ➤ Plant Protection Products Regulation — Regulation (EC) 1107/2009 Green building & construction product regulation <ul style="list-style-type: none"> ➤ Energy Performance of Buildings Directive (EPBD) — Directive 2010/31/EU, recast as Directive (EU) 2024/1275 ➤ Energy Efficiency Directive (EED) — Directive (EU) 2023/1791 ➤ Construction Products Regulation (CPR) — Regulation (EU) No 305/2011, revised 2024 ➤ Ecodesign for Sustainable Products Regulation (ESPR) — Regulation (EU) 2024/1781 ➤ Waste Framework Directive — Directive 2008/98/EC
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6.1.3 How the Governance Layers Interact?

The seven governance layers should be understood as **complementary rather than hierarchical**. Each layer addresses biodiversity loss from a different angle, and their combined effect shapes real-world ecological outcomes.

- **Layer 1** defines ecological limits through strict legal protection and restoration obligations.
- **Layer 2** manages the environmental pressures that undermine biodiversity across landscapes and seascapes.
- **Layer 3** ensures that decisions affecting nature are assessed, justified, and subject to liability.
- **Layer 4** provides strategic orientation and policy coherence across sectors.
- **Layer 5** integrates nature protection into climate neutrality and energy transition objectives.
- **Layer 6** mobilizes financial markets and corporate actors to account for biodiversity impacts.
- **Layer 7** addresses long-term, cumulative ecosystem damage embedded in products and materials.

This layered structure allows the EU to intervene both **directly and indirectly**, combining regulatory, procedural, strategic, and market-based tools.

6.1.4 The European Green Deal as a Transformative Governance Shift

The European Green Deal fundamentally reshapes EU nature protection governance in three key ways.

First, it introduces **horizontal integration**, embedding biodiversity objectives across climate, energy, finance, trade, and industrial policy rather than confining them to environmental legislation.

Second, it shifts the focus from mere damage avoidance toward **active restoration and net-positive outcomes**, most clearly reflected in the Nature Restoration Regulation and the Carbon Removal Certification Framework.

Third, it expands responsibility for biodiversity impacts to **economic actors and value chains**, through instruments such as the EU Deforestation Regulation, the CSRD, the ESRS, and the EU Taxonomy.

Together, these changes signal a move away from protecting nature at the margins toward **governing nature as a core public interest embedded in economic systems**.

Structure of the Following Chapters

Following this introductory overview, the textbook will examine **each governance layer in a dedicated chapter** (Layers 1–7). Each chapter will:

- explain the legal and policy logic of the layer,
- analyse key instruments and implementation mechanisms,
- explore interactions with other layers,
- and discuss sector-specific implications for areas such as forestry, agriculture, urban development, and energy.

This layered structure enables students to understand both **individual policy instruments** and the **integrated architecture of EU nature protection governance** under the European Green Deal.

6.2 Layer 1 – Core Biodiversity Protection and Conservation Law

6.2.1 The Role of Layer 1 in EU Nature Protection Governance

Layer 1 constitutes the **legal core of biodiversity protection** within the European Union. It is the only layer in the EU Nature Protection Governance Framework that provides **direct, binding, and enforceable protection** for species, habitats, and ecosystems as conservation objectives in their own right. While other governance layers influence biodiversity indirectly—through land-use planning, climate policy, finance, or product regulation—Layer 1 establishes **non-negotiable ecological limits** grounded in EU primary law and interpreted by the Court of Justice of the European Union (CJEU).

The instruments in this layer define what must be protected, where protection applies, and which activities are legally constrained in the interest of biodiversity conservation. As such, Layer 1 functions as the **normative foundation** of EU nature policy. All other layers either support, operationalize, or must comply with the obligations arising from this core conservation law.

Historically, Layer 1 developed in response to accelerating biodiversity loss in Europe during the late twentieth century. More recently, it has been significantly strengthened under the European Green Deal through the introduction of **legally binding restoration obligations**, marking a shift from defensive conservation toward proactive ecological recovery.

6.2.2 Legal Characteristics of Core Conservation Law

Layer 1 instruments share several defining legal characteristics:

- **Direct conservation objectives:** Protection is aimed explicitly at species, habitats, and ecosystems, not merely at managing environmental pressures.
- **Binding obligations for Member States:** These instruments impose concrete duties of designation, protection, avoidance of deterioration, and, increasingly, restoration.
- **Strong justiciability:** Obligations are enforceable before national courts and the CJEU, often with limited scope for balancing against economic interests.
- **Precautionary and preventive logic:** Uncertainty regarding ecological impacts is resolved in favour of protection, particularly within designated sites.

These features distinguish Layer 1 sharply from strategic, procedural, or market-based governance layers discussed in later chapters.

6.2.3 The Birds Directive: Species Protection as a Legal Obligation

The Birds Directive (Directive 2009/147/EC) is the EU's oldest nature conservation instrument and, together with the Habitats Directive, forms the cornerstone of EU biodiversity law. Originally adopted in 1979 (Directive 79/409/EEC) and later codified in 2009, it establishes

that the conservation of wild birds is a matter of **binding Union-wide obligation**, not discretionary national policy.

Scope and regulatory logic

The Directive applies to **all species of naturally occurring birds in the wild state** in the European territory of the Member States to which the Treaties apply. It explicitly covers **birds, their eggs, nests, and habitats**, and it regulates not only protection but also **management, control, and rules for exploitation** (notably hunting and certain forms of use). In legal design terms, the Directive combines: (i) a general protective baseline; (ii) spatial habitat obligations; and (iii) narrowly framed and accountable exceptions.

Conservation objective and population-level duty

A central but often under-emphasised feature is Article 2, which sets the Directive's overarching objective in population terms. Member States must take the requisite measures to **maintain or adapt bird populations** to a level that corresponds in particular to **ecological, scientific, and cultural requirements**, while taking account of **economic and recreational requirements**.

This balancing clause does **not** downgrade conservation into a mere interest among others. Rather, it provides the Directive's policy frame: conservation is the default goal, while socio-economic considerations are recognised within the limits of maintaining populations at an ecologically appropriate level. In practice, this objective anchors the interpretation of hunting rules, derogations, and habitat measures.

General system of species protection

The Directive establishes a **general system of protection** for all wild bird species, applicable inside and outside protected areas. Member States must prohibit, in particular:

- deliberate killing or capture by any method,
- deliberate destruction of or damage to nests and eggs, or removal of nests,
- taking eggs in the wild and keeping eggs (even if empty),
- deliberate disturbance during breeding and rearing where significant for the Directive's objectives,
- keeping birds of species whose hunting/capture is prohibited.

In addition, the Directive contains a dedicated regime on **sale and marketing**. As a general rule, Member States must prohibit the sale, transport for sale, keeping for sale, and offering for sale of live or dead birds (and readily recognisable parts/derivatives). Limited exceptions exist only for specific species listed in **Annex III**, and even then only under conditions of legal acquisition. For Annex III Part B species, a Member State authorisation is subject to Commission consultation and scrutiny to avoid EU-wide conservation harm, with the possibility of a Commission recommendation opposing marketing.

This trade regime is an important governance complement to the field prohibitions: it targets demand-side incentives that can drive capture, illegal killing, or cross-border trafficking.

Habitat protection duties and the Natura 2000 framework

Habitat protection is not ancillary but structurally integrated. Under Article 3, Member States must preserve, maintain, or re-establish a **sufficient diversity and area of habitats** for all bird species. The Directive even lists the principal policy instruments that should be used, including:

- creation of protected areas,
- upkeep and management of habitats inside and outside protected zones in line with ecological needs,
- re-establishment of destroyed biotopes,
- creation of biotopes.

For Annex I species (those requiring special conservation measures), and for regularly occurring migratory species, Article 4 requires the designation of **Special Protection Areas (SPAs)** in the most suitable territories (number and size). Particular attention is required for wetlands, especially those of international importance.

A further legally relevant element is the coordination function in Article 4(3): Member States must provide the Commission with relevant information so that it can take initiatives to ensure that SPAs form a **coherent whole** meeting species' protection requirements across their range. This embeds SPAs in an EU-level network logic, not a purely national site-by-site approach.

Within SPAs, Member States must take steps to avoid **pollution, habitat deterioration, and significant disturbances** affecting birds. Outside SPAs, they must also strive to avoid pollution and deterioration—an important signal that conservation duties radiate beyond strictly protected sites.

Hunting and regulated exploitation

The Birds Directive recognises hunting as a possible form of sustainable use, but strictly confines it. Only species listed in **Annex II** may be hunted under national legislation, and Member States must ensure that hunting does **not jeopardise conservation efforts** in the species' distribution area.

Two refinements from the authentic text are especially important:

1. **Geographic differentiation (Annex II Parts A and B):** Some huntable species may be hunted across the EU (Part A), while others may be hunted **only in specified Member States** (Part B), reflecting differing ecological contexts and population pressures.
2. **Wise use and timing constraints (Art. 7(4)):** Hunting (including falconry) must comply with principles of **wise use** and **ecologically balanced control**, and Member States must ensure that huntable species are **not hunted during rearing and**

reproduction. For migratory species, hunting must also avoid periods of reproduction and return migration to breeding grounds. Member States must send the Commission relevant information on practical hunting regulation.

Prohibited methods and transport modes

Beyond which species may be hunted, the Directive imposes hard constraints on how birds may be taken. Under Article 8, Member States must prohibit methods that are large-scale or non-selective, or capable of causing local disappearance of a species—explicitly linked to Annex IV. This includes bans on tools such as snares, limes (with narrow exceptions), certain decoys and electronic devices, explosives, poisoned/anaesthetic bait, and certain high-capacity semi-automatic/automatic weapons, as well as restrictions on hunting from aircraft, motor vehicles, and fast-moving boats (subject to limited safety-related exceptions at sea, with Commission notification).

This is a key integrity element: even legal hunting can become incompatible with conservation objectives if methods are non-selective, high-intensity, or poorly controllable.

Derogations and accountability architecture

Article 9 provides derogations from Articles 5–8 only where **no other satisfactory solution** exists, and only for defined purposes: public health/safety, air safety, prevention of serious damage (including to forests and fisheries), protection of flora and fauna, research/teaching/reintroduction, or strictly supervised selective use in small numbers.

Crucially, derogations must specify species, authorised methods, time/place, competent authority, and controls, and Member States must report annually. The Commission is tasked with ensuring derogations remain compatible with the Directive’s aims. This makes derogations not only narrow in substance but also **proceduralised and reviewable**.

Research, introductions, and adaptive capacity

The Directive includes forward-looking governance tools:

- **Research duty (Art. 10):** Member States must encourage research and work needed as a basis for protection, management, and use, with particular attention to topics listed in Annex V (including migratory route areas, ringing data, effects of taking methods, pollution indicators, and chemical pollution impacts). They must share information with the Commission to enable coordination.
- **Introductions (Art. 11):** Member States must ensure introductions of bird species not naturally occurring in the EU do not prejudice local flora and fauna, consulting the Commission. This functions as a biosecurity-oriented safeguard within a conservation directive.

Monitoring, reporting, transparency, and non-regression

Article 12 strengthens implementation governance in three notable ways:

- reporting every **six years** aligned with Habitats Directive reporting cycles,

- reports must be **made accessible to the public**,
- the Commission sets the reporting format by implementing acts, aligned to the Habitats Directive format, and the Commission—assisted by the **European Environment Agency**—prepares a composite EU report every six years.

Article 13 adds a non-regression principle: applying measures under the Directive **may not lead to deterioration** in the present situation of bird conservation. Article 14 confirms that Member States may introduce **stricter protective measures** than those required by the Directive (a minimum-harmonisation logic).

Updating annexes and committee governance

Finally, the Directive contains an institutional mechanism to update technical elements. Annexes (notably Annexes I and V) may be adapted to technical and scientific progress via EU procedures (Arts. 15–16a), supported by committee processes. Member States must also communicate to the Commission the main national provisions adopted in the field governed by the Directive (Art. 17), supporting compliance monitoring.

Legal significance

In sum, the Birds Directive establishes bird conservation as a **population-level duty** operationalised through: general prohibitions (including trade controls), habitat restoration and SPA designation, strict rules on hunting and methods, narrow derogations with reporting and Commission oversight, research coordination, controls on non-native introductions, and transparent six-year reporting supported at EU level. Its architecture exemplifies EU environmental law’s characteristic approach: **binding obligations + procedural safeguards + network coherence + adaptive reporting**, with exploitation permitted only within ecologically defensible limits.

6.2.4 The Habitats Directive: Habitat-Based Conservation and Ecological Coherence

The Habitats Directive (Council Directive 92/43/EEC) complements the Birds Directive by extending EU nature protection beyond avian species to a wide range of **habitats and non-avian species of Community interest**. Together, the two Directives form the cornerstone of EU biodiversity law and establish the legal foundation of the **Natura 2000 network**, the largest coordinated system of protected areas worldwide.

While the Birds Directive is primarily species-oriented, the Habitats Directive introduces a **habitat-based and system-level approach** to conservation. Its regulatory logic is built around the maintenance of ecological structures and processes necessary for the long-term persistence of species and habitat types across the European Union.

Legal objective and conservation logic

Article 2 sets out the Directive's core objective: to contribute to biodiversity conservation by maintaining or restoring natural habitats and species of Community interest at **favourable conservation status**. In implementing this objective, Member States must take account of economic, social, cultural, and regional characteristics. However, these considerations operate within, not above, the conservation objective.

A defining feature of the Directive is its reliance on **ecological coherence and scientific criteria**. At the designation stage, decisions concerning conservation priorities and site selection must be based on ecological value rather than socio-economic negotiation. This distinguishes the Habitats Directive from many earlier conservation regimes and gives it a strong legal and scientific foundation.

Favourable conservation status as a binding legal standard

The concept of **favourable conservation status (FCS)**, defined in Article 1, functions as the central benchmark of the Directive.

For habitat types, FCS requires that:

- their natural range and area are stable or increasing,
- their specific structure and ecological functions are maintained, and
- the conservation status of typical species is favourable.

For species, FCS requires:

- long-term population viability,
- a stable or expanding natural range, and
- sufficient habitat to sustain populations in the long term.

FCS is not a descriptive notion but a **normative legal standard**. It underpins site designation, conservation measures, impact assessment, derogation decisions, and reporting obligations. EU conservation law is therefore explicitly **status-based**, rather than limited to the protection of individual sites.

Natura 2000 and ecological coherence

Article 3 establishes Natura 2000 as a **coherent European ecological network** of Special Areas of Conservation (SACs). The network is composed of sites hosting:

- habitat types listed in **Annex I**, and
- habitats of species listed in **Annex II**.

It explicitly includes **Special Protection Areas (SPAs)** designated under the Birds Directive, reinforcing the integrated character of EU nature protection law.

Member States are required to contribute to the network in proportion to the presence of habitats and species of Community interest on their territory. Importantly, Article 10 extends the Directive’s logic beyond formally designated sites by encouraging the maintenance of **landscape features**—such as rivers, hedgerows, and small woodland patches—that support ecological connectivity, migration, and genetic exchange.

Ecological coherence thus functions as both a **spatial and functional principle**, guiding conservation at network and landscape scale.

Scientific site selection and Commission oversight

Articles 4 and 5 establish a two-stage, science-driven designation process.

First, each Member State proposes a national list of sites based on the ecological criteria set out in **Annex III**, including representativity, conservation status, area, and restoration potential. Second, the Commission, acting within biogeographical regions and supported by scientific expertise, adopts the list of **Sites of Community Importance (SCIs)**.

From the moment a site is adopted as an SCI, it is subject to the protection regime of Article 6(2)–(4), even prior to its formal national designation. A **Special Area of Conservation (SAC)** is subsequently designated by the Member State as a site whose purpose is to maintain or restore, at favourable conservation status, the natural habitat types listed in Annex I and the species listed in Annex II. Member States have up to six years to complete this designation and to put in place the necessary conservation measures.

In exceptional cases, Article 5 empowers the Commission to initiate corrective action where a Member State has failed to propose a site hosting priority habitats or species. This provision underlines the Directive’s **supranational ecological authority**.

Article 6: the core enforcement mechanism

Article 6 constitutes the Directive’s most powerful legal instrument and one of the strongest tools in EU environmental law.

- **Article 6(1)** requires the establishment of conservation measures, including management plans or statutory, administrative, or contractual instruments.
- **Article 6(2)** imposes a continuous obligation to avoid habitat deterioration and significant disturbance of species.
- **Article 6(3)** introduces the requirement for an appropriate assessment of any plan or project likely to have a significant effect on a Natura 2000 site, including cumulative impacts.
- **Article 6(4)** provides a narrowly defined derogation pathway, allowing projects with adverse effects only where no alternatives exist, imperative reasons of overriding public interest apply, and compensatory measures preserve the overall coherence of Natura 2000.

For **priority habitats and species**, derogations are subject to even stricter conditions, reflecting their heightened conservation value.

Through extensive and consistent CJEU case law, Article 6 has become a binding constraint on infrastructure development, land-use planning, forestry, water management, and extractive activities across the EU.

Species protection beyond protected sites

The Habitats Directive does not confine protection to Natura 2000 areas. Articles 12–16 establish a **strict species protection regime** applicable throughout the territory of Member States.

Species listed in **Annex IV** benefit from strict protection, including prohibitions on deliberate killing, disturbance, destruction of breeding or resting sites, and trade. Species listed in **Annex V** may be subject to use or exploitation, but only under management measures ensuring compatibility with favourable conservation status.

Derogations under **Article 16** are tightly constrained. They require the absence of satisfactory alternatives, must not undermine conservation objectives, and are subject to regular reporting and Commission scrutiny. This ensures accountability and consistency in the application of exceptions.

Surveillance, reporting, and adaptive governance

Article 11 requires Member States to conduct ongoing **surveillance** of the conservation status of habitats and species, with particular attention to priority features. Article 17 complements this obligation with a **six-year reporting cycle**, aligned with the Birds Directive.

Reports must be made publicly accessible and form the basis of EU-wide assessments published by the Commission. These assessments, most visibly through the State of Nature in the European Union reports, provide a mechanism for policy learning, adjustment, and enforcement.

Financing, research, and adaptive capacity

The Directive also contains enabling provisions that support long-term implementation. These include:

- co-financing mechanisms for priority habitats and species,
- encouragement of scientific research and coordination,
- procedures for adapting annexes to technical and scientific progress, and
- obligations concerning species reintroduction, control of non-native introductions, and public awareness.

These elements reinforce the Directive’s adaptive capacity without weakening its binding conservation core.

Legal significance

The Habitats Directive establishes a **science-based, status-oriented, and enforceable conservation regime**. Its strength lies not in symbolic protection, but in legally binding decision rules that structure planning, permitting, and land-use governance. By integrating ecological coherence, strict species protection, landscape connectivity, and judicially enforceable obligations, the Directive represents one of the most advanced models of biodiversity governance in contemporary environmental law.

6.2.5 The Natura 2000 Network: Translating Conservation Obligations into Spatial Protection

Together, the Birds Directive and the Habitats Directive establish the **Natura 2000 network**, the world's largest coordinated network of protected areas. Natura 2000 represents the EU's primary spatial instrument for biodiversity conservation, transforming abstract species- and habitat-level obligations into **geographically defined legal regimes** that operate across land and sea.

Crucially, Natura 2000 is not conceived as a system of strict nature reserves isolated from human activity. Instead, it is designed as a **functional conservation network**, within which economic activities may continue, provided they remain compatible with the long-term maintenance or restoration of favourable conservation status.

Composition and legal structure of the network

Natura 2000 integrates two distinct but complementary site categories:

- **Special Protection Areas (SPAs)** designated under the Birds Directive, targeting habitats essential for threatened and migratory bird species;
- **Special Areas of Conservation (SACs)** designated under the Habitats Directive, protecting habitat types listed in Annex I and habitats of species listed in Annex II.

Together, these sites form a single, legally coherent network governed primarily by **Article 6 of the Habitats Directive**, which applies equally to SPAs and SACs. This integration ensures that bird conservation and broader habitat and species protection operate under a **shared enforcement framework**, avoiding fragmentation between legal regimes.

Natura 2000 as a management-oriented protection model

A defining characteristic of Natura 2000 is its emphasis on **management and compatibility**, rather than absolute exclusion of human use. Conservation objectives are pursued through:

- site-specific conservation objectives,
- tailored management plans or equivalent statutory, administrative, or contractual measures,
- regulation of activities that may cause deterioration or significant disturbance.

This approach reflects the ecological reality of Europe’s landscapes, which are largely shaped by long-term human use. Natura 2000 therefore embodies a model of **working landscapes for conservation**, where agriculture, forestry, fisheries, tourism, and infrastructure may coexist with biodiversity protection under clearly defined legal conditions.

Article 6 as the spatial enforcement mechanism

The operational core of Natura 2000 lies in the application of **Article 6 of the Habitats Directive**, which translates conservation duties into concrete spatial constraints:

- **Article 6(2)** establishes a permanent obligation to avoid deterioration of habitats and significant disturbance of species within Natura 2000 sites. This functions as a baseline “do no harm” rule.
- **Article 6(3)** requires an appropriate assessment for any plan or project likely to have a significant effect on a site, either individually or in combination with other plans or projects. This embeds biodiversity considerations directly into spatial planning and permitting processes.
- **Article 6(4)** provides a narrowly circumscribed derogation pathway, allowing projects with adverse effects only where no alternatives exist, imperative reasons of overriding public interest apply, and compensatory measures preserve the coherence of the network.

Through consistent case law of the Court of Justice of the European Union (CJEU), the obligations laid down in Article 6 of the Habitats Directive have been interpreted as **directly binding decision rules for national authorities**. As a result, permitting bodies must apply these provisions directly when authorising plans and projects, and national courts must enforce them. This has made Natura 2000 one of the **most judicially enforceable conservation frameworks** worldwide.

Network logic and ecological coherence

Natura 2000 is explicitly conceived as a **network**, not a collection of isolated sites. Ecological coherence is pursued through:

- biogeographical site selection ensuring representativity of habitat types and species across the EU,
- protection of migratory routes and functional ecological connections,
- complementary obligations under Article 10 of the Habitats Directive encouraging the maintenance of landscape features that support connectivity beyond designated sites.

This network logic distinguishes Natura 2000 from traditional protected-area models by recognising that species survival depends on **connectivity, landscape context, and cumulative effects**, not only on isolated core areas.

Governance interfaces across policy layers

From a governance perspective, Natura 2000 plays a pivotal role in **operationalising Layer 1 (core biodiversity protection law)** by giving spatial expression to conservation obligations. At the same time, it functions as a key interface with other governance layers:

- **Layer 2 – Pressure management:** Natura 2000 sites act as focal points for regulating land use, water abstraction, pollution, fisheries, and forestry practices that generate ecological pressures.
- **Layer 3 – Procedural safeguards:** The appropriate assessment requirement links Natura 2000 directly to environmental impact assessment, strategic planning, and permitting procedures.
- **Layer 4 and beyond:** Funding instruments (e.g. LIFE, CAP), strategic policy frameworks, and reporting obligations are often aligned around Natura 2000 priorities.

In this way, Natura 2000 serves as a **structural bridge** between conservation law and sectoral policies.

Reporting, monitoring, and adaptive management

The effectiveness of Natura 2000 is reinforced by the EU's reporting architecture. Conservation outcomes within Natura 2000 sites are assessed through the **Article 17 reporting cycle** under the Habitats Directive and **Article 12 reporting** under the Birds Directive. These feed into EU-wide State of Nature assessments, enabling evaluation of whether the network is delivering favourable conservation status at species and habitat level.

This reporting framework supports **adaptive management:** conservation objectives, management measures, and regulatory approaches can be revised in response to observed trends and emerging pressures, including climate change.

Legal and policy significance

Natura 2000 represents a distinctive EU model of spatial conservation governance. It combines:

- binding legal protection,
- scientific site selection,
- management-oriented flexibility,
- procedural safeguards,
- and continuous monitoring and judicial oversight.

Rather than separating nature from human activity, the network embeds conservation objectives into the everyday governance of land and sea use. In doing so, Natura 2000 translates the normative commitments of EU biodiversity law into **spatially explicit, enforceable, and adaptable protection on the ground.**

6.2.6 The Nature Restoration Regulation: From Protection to Recovery

The Nature Restoration Regulation (Regulation (EU) 2024/1991) constitutes a decisive evolution within Layer 1 of EU nature protection law. For the first time, EU conservation legislation establishes binding, outcome-oriented restoration obligations, moving beyond the traditional focus on preventing further deterioration and maintaining residual conservation value.

Whereas the Birds and Habitats Directives are primarily defensive in nature—seeking to halt decline and safeguard remaining assets—the Nature Restoration Regulation addresses the accumulated degradation of ecosystems across the Union. It reflects the recognition that, in extensively modified landscapes, passive protection and non-deterioration obligations alone are insufficient to reverse biodiversity loss, restore ecosystem functioning, or rebuild resilience to climate and environmental risks.

Objectives, legal basis, and scope

Adopted under **Article 192(1) TFEU**, the Regulation establishes a **Union-wide obligation to put in place restoration measures for ecosystems in need of restoration**, in accordance with binding targets, indicators, and timelines, across the EU’s land and sea areas. Its overarching objective is to achieve the **long-term recovery of biodiverse, resilient, and functional ecosystems by 2050**, while simultaneously contributing to climate change mitigation and adaptation, disaster-risk reduction, food and water security, and the sustained provision of ecosystem services.

Importantly, restoration is framed not as a sector-specific conservation task, but as a **systemic public obligation** integrated into wider environmental, climate, agricultural, water, urban, and land-use governance.

Restoration obligations and the non-deterioration principle

A central legal innovation of the Regulation is the combination of binding restoration duties with a **non-deterioration obligation**. Once restoration measures have been implemented, Member States must ensure that the ecological condition achieved is not subsequently degraded, **subject to the Regulation’s narrowly defined flexibility clauses and exceptions**, including force majeure events and overriding public interest considerations. This establishes a dynamic legal standard of continuous ecological improvement, extending beyond the static favourable conservation status logic of earlier instruments.

Restoration obligations apply **both inside and outside Natura 2000 sites**, ensuring that Layer 1 conservation logic is no longer spatially confined to designated protected areas but extends to the wider landscape and seascape.

Quantified restoration targets: from ambition to enforceability

For terrestrial, freshwater, coastal, and marine habitat types covered by EU nature legislation—**notably habitat types defined under the Habitats Directive and corresponding marine**

habitat groupings under the Regulation—the Regulation introduces staged, percentage-based restoration targets for areas that are not in good condition:

- at least **30%** restored by 2030,
- at least **60%** by 2040,
- at least **90%** by 2050.

Where habitat types have been lost, Member States must also undertake **re-establishment measures** to reach favourable reference areas. Until 2030, restoration measures must, where appropriate, be **prioritised within Natura 2000 sites**, reinforcing coherence with existing conservation obligations.

Scientifically, these percentage-based targets reflect the understanding that ecological recovery requires **sufficient spatial extent and connectivity** to overcome fragmentation and non-linear recovery thresholds. Legally, they function as **minimum compliance thresholds**, limiting discretion in overall ambition while allowing flexibility in spatial allocation.

Indicators and trajectories: restoring function, not only area

A defining feature of the Regulation is that restoration is assessed not only through spatial coverage, but through **ecological condition indicators and trend-based obligations**. This dual design addresses a long-standing weakness of conservation law, where formal compliance with protected-area coverage often failed to deliver functional ecological improvement.

Area-based targets ensure political accountability and minimum spatial ambition, while indicator-based targets ensure that restoration delivers **measurable ecological outcomes**, such as improved ecosystem structure, function, and resilience.

Several obligations are expressed as required trends—such as “increasing”, “no net loss”, or “continuous improvement”—rather than fixed end-states. This trajectory-based approach reflects scientific realities: baseline conditions differ across Member States, recovery is often non-linear, and short-term fluctuations may occur due to climate variability or disturbance.

Legally, this shifts compliance assessment toward **direction and consistency of change over time**, placing strong emphasis on monitoring quality, policy continuity, and adaptive management.

Ecosystem-specific targets and indicators

Beyond habitat-type restoration, the Regulation introduces **stand-alone ecosystem obligations** that broaden Layer 1 beyond the classical Birds- and Habitats-Directive model:

- **Pollinating insects:** Member States must halt and reverse pollinator decline by 2030 and achieve a sustained increasing trend thereafter. Monitoring methodologies are to be established through delegated acts, embedding scientific updating directly into the legal framework.

- **Forest ecosystems:** Restoration is assessed through biodiversity-relevant indicators, including common forest bird abundance, standing and lying deadwood, uneven-aged structure, connectivity, and organic carbon stocks. The requirement to achieve positive trends across a subset of indicators allows ecological and silvicultural diversity while preventing single-objective optimisation.
- **Agricultural ecosystems:** Targets address farmland biodiversity, soil organic carbon, landscape heterogeneity, and the restoration of drained peatlands, linking restoration obligations directly to land-use systems.
- **Urban ecosystems:** A novel obligation of **no net loss of urban green space and tree canopy cover by 2030**, followed by continuous increase, integrates biodiversity recovery into urban planning and development.
- **River connectivity:** Member States must identify and remove barriers to restore at least **25,000 km of rivers to free-flowing condition by 2030**, focusing on hydromorphological function rather than symbolic restoration.
- **Marine ecosystems:** Restoration targets prioritise habitats with high ecological and climate relevance, such as seagrass beds and sedimentary systems, alongside species recovery.

Taken together, these provisions shift the legal focus from isolated site protection toward **system-level ecological recovery**, assessed through functional indicators and spatial coherence.

Implementation through National Restoration Plans

The Regulation relies on a **binding planning architecture**. Member States must submit **National Restoration Plans by September 2026**, setting out:

- priority ecosystems and areas,
- restoration measures and timelines,
- financing mechanisms,
- coherence with climate, agricultural, water, energy, and land-use policies,
- and measures to avoid significant trade-offs.

The Commission assesses draft plans, issues observations, and monitors implementation. Plans must be **reviewed and updated by 2032 and 2042**, ensuring adaptive implementation in light of new scientific knowledge, climate impacts, and socio-economic developments. The **European Environment Agency** supports monitoring, data harmonisation, and progress assessment.

Flexibility, derogations, and scientific uncertainty

While the Regulation allows for **limited flexibility**, deviations from restoration trajectories are tightly constrained. Temporary shortfalls may be justified under specific conditions, such as

overriding public interest or force majeure events, but do not remove the obligation to pursue overall restoration objectives.

This design acknowledges ecological uncertainty—such as climate-driven disturbances—while maintaining legal enforceability. Restoration combines **obligations of means with performance-oriented outcome requirements**, rather than remaining a purely programmatic or aspirational commitment.

From conservation restraint to ecological recovery

Conceptually, the Nature Restoration Regulation completes the evolution of Layer 1 from **defensive conservation**, centred on limiting harm, toward **active ecological recovery as a public legal duty**. Nature is no longer treated solely as an object to be shielded from damage, but as a system requiring deliberate repair and long-term stewardship.

By combining binding targets, indicator-based assessment, non-deterioration safeguards, and adaptive planning, the Regulation elevates ecosystem restoration to a **core pillar of EU environmental law**, comparable in structural importance to the Birds and Habitats Directives and closely aligned with the Union’s climate-neutrality and resilience objectives.

6.2.7 The Invasive Alien Species Regulation: Preventing Biological Pressure

The Invasive Alien Species (IAS) Regulation (Regulation (EU) 1143/2014) addresses one of the most significant **direct drivers of biodiversity loss**: the introduction, establishment, and spread of non-native species that threaten ecosystems, habitats, native species, and ecosystem services. Alongside habitat loss, climate change, pollution, and overexploitation, invasive alien species are recognised as one of the **five major global causes of biodiversity decline**.

IAS exert pressure not only on biodiversity, but also on **economic systems and human health**. Their estimated economic cost within the EU amounts to approximately **EUR 12 billion per year**, while impacts include damage to agriculture and forestry, disruption of water and infrastructure systems, and health risks such as allergies, burns, and disease vectors. These multi-dimensional impacts justify a **preventive, binding regulatory approach** rather than reliance on voluntary management.

Objectives and regulatory logic

The overarching objective of the IAS Regulation is to **prevent, minimise, and mitigate** the adverse impacts of invasive alien species on biodiversity and ecosystem services, while also limiting associated social and economic damage. In line with the EU Biodiversity Strategy for 2030, the Regulation contributes to the commitment to **manage established invasive alien species and reduce by 50 % the number of Red List species threatened by IAS by 2030**.

Unlike instruments that address environmental pressures indirectly (e.g. through land-use or pollution control), the IAS Regulation operates through **direct prohibitions and obligations**, targeting biological pressure at its source. For this reason, it is situated within **Layer 1** of EU nature protection governance.

The Union list and core prohibitions

At the heart of the Regulation lies the **list of invasive alien species of Union concern** (the Union List). Species included on this list are subject to a harmonised set of **EU-wide restrictions**, regardless of whether they are already present in a given Member State.

As of the most recent update, **114 species** are strictly regulated, including **65 animal species** and **49 plant species**, with the list being **periodically updated through implementing acts** to reflect new scientific evidence and risk assessments.

For listed species, the Regulation establishes prohibitions on:

- import into the Union,
- keeping, breeding, or growing,
- transport and sale,
- use and exchange,
- and intentional release into the environment.

These prohibitions are legally binding and directly applicable, creating a **uniform baseline of protection** across the internal market and preventing regulatory fragmentation between Member States.

Prevention, early detection, and management: a tiered obligation structure

The IAS Regulation adopts a **three-pillar approach**, reflecting the ecological principle that prevention is significantly more effective and less costly than long-term control.

Prevention and pathway management

Member States are required to identify and address **pathways of unintentional introduction and spread**, such as trade, transport, soil movement, and ornamental or pet markets. Action on pathways is a core preventive obligation and is supported by guidance on pathway categorisation and prioritisation.

Early detection and rapid eradication

Where a listed species is detected at an early stage, Member States must implement **rapid eradication measures**, unless eradication is demonstrably unfeasible. Surveillance systems, identification tools, and reporting obligations are essential components of this phase, reflecting a precautionary and time-critical governance logic.

Management of widely spread species

For species that are already widely established, the Regulation requires Member States to adopt **long-term management measures** aimed at minimising impacts on biodiversity, ecosystem services, and, where relevant, human health and the economy. Management may include physical, chemical, biological, or—under strict conditions—lethal measures, subject to proportionality and animal-welfare considerations.

Scientific basis and secondary legislation

The inclusion of species on the Union List is grounded in **scientific risk assessments**, regulated through delegated and implementing acts. The Regulation is supported by an evolving body of **secondary legislation**, including:

- implementing regulations updating the Union List,
- delegated acts on risk-assessment methodologies,
- and implementing acts specifying reporting formats and permitting procedures.

This architecture ensures that the IAS framework remains **adaptive to scientific progress**, while preserving legal certainty through formalised EU procedures.

Governance structure and implementation support

Implementation of the IAS Regulation is supported by a **multi-level governance framework**, involving:

- the **Committee on Invasive Alien Species**, assisting the Commission in adopting implementing acts,
- the **Invasive Alien Species Expert Group**, facilitating coordination among Member States,
- the **Scientific Forum on IAS**, providing independent scientific advice,
- and a **Working Group on IAS**, involving stakeholders and national authorities.

In 2021, the Commission published the first report on the application of the Regulation, concluding that it has **improved prevention, coordination, and awareness**, while also identifying persistent challenges related to capacity, costs, and cross-border coordination.

Relationship to other nature protection instruments

The IAS Regulation complements the Birds and Habitats Directives and the Natura 2000 framework. While those instruments focus on **protecting species and habitats of conservation interest**, the IAS Regulation addresses a **horizontal pressure factor** capable of undermining conservation outcomes even within protected areas.

In governance terms, the Regulation strengthens Layer 1 by **closing a structural gap**: without effective control of invasive alien species, habitat protection, restoration, and species conservation measures risk being neutralised by biological pressure beyond the scope of site-based instruments.

Preventive protection as a core conservation function

Conceptually, the IAS Regulation embodies a **preventive dimension of nature protection law**. Instead of reacting to biodiversity loss after it occurs, it seeks to **anticipate and block irreversible ecological damage** at an early stage. This aligns with the precautionary principle and reinforces the EU's shift toward **risk-based, science-driven environmental governance**.

By combining binding prohibitions, pathway control, early-warning systems, and long-term management obligations, the IAS Regulation establishes a robust legal framework for preventing biological invasions—making it a **central**, though often underappreciated, **pillar of EU biodiversity protection** within Layer 1.

6.2.8 Layer 1 in the Green Deal Context

Within the European Green Deal, Layer 1 plays a dual role. First, it **anchors the entire governance framework** by setting ecological limits that other policies must respect. Second, it evolves in response to new scientific insights and societal expectations, as demonstrated by the shift toward restoration.

Layer 1 thus provides:

- legal certainty regarding conservation priorities,
- enforceable ecological baselines for climate, land-use, and financial policies,
- a reference point for assessing trade-offs and policy coherence across governance layers.

Without a strong Layer 1, higher layers risk becoming **procedurally sophisticated but ecologically ineffective**.

6.3 Layer 2 – Ecosystem-Based Management and Pressure-Reduction Instruments

6.3.1 The Role of Layer 2 in EU Nature Protection Governance

Layer 2 comprises those EU policy instruments that **do not primarily protect species or habitats directly**, but instead **regulate the environmental pressures** that drive ecosystem degradation across landscapes, river basins, coastal zones, and marine areas. While Layer 1 defines what must be protected, Layer 2 governs **how human activities interact with ecosystems** by shaping land use, water management, agricultural practices, pollution control, and resource exploitation.

This layer reflects the insight that biodiversity loss is often caused not by isolated illegal acts, but by **cumulative, diffuse, and structurally embedded pressures**—such as nutrient runoff, hydromorphological alteration, air pollution, industrial emissions, and global commodity supply chains. Layer 2 therefore operationalises an **ecosystem-based management approach**, addressing pressures at the scale at which ecological processes function.

In the overall governance framework, Layer 2 plays a **supporting and enabling role**: it reduces background pressures so that the strict protection and restoration objectives of Layer 1 can be achieved in practice.

6.3.2 Defining Features of Pressure-Reduction Governance

Layer 2 instruments share several defining characteristics that distinguish them from core conservation law:

- **Indirect biodiversity protection:** Biodiversity benefits are achieved by reducing pressures rather than by conferring legal protection on species or habitats.
- **Spatially integrated management units:** Governance is organised around river basins, catchments, airsheds, marine regions, or agricultural zones rather than protected sites alone.
- **Strong sectoral interfaces:** These instruments directly shape agriculture, industry, transport, energy production, and land-use planning.
- **Balancing environmental objectives with socio-economic activity:** Unlike Layer 1, Layer 2 allows broader scope for proportionality, flexibility, and phased implementation.

These features make Layer 2 a key arena for **policy coherence and conflict management** between environmental objectives and sectoral policies.

6.3.3 Water, Marine, and Floodplain Systems

6.3.3.1 The Water Framework Directive: Integrated River Basin Management

The **Water Framework Directive (WFD)** (Directive 2000/60/EC) represents a cornerstone of EU ecosystem-based management. Its central objective is the achievement of **good ecological and chemical status** for all surface waters and groundwater bodies.

Key governance innovations include:

- management at the **river basin scale**, transcending administrative boundaries,
- integration of water quality, quantity, and hydromorphology,
- mandatory **River Basin Management Plans and Programmes of Measures**,
- application of ecological indicators and biological quality elements.

Although the WFD is not a biodiversity directive per se, its ecological status concept explicitly incorporates aquatic ecosystems and their functioning. As such, it provides critical **pressure reduction and habitat improvement** that support Layer 1 conservation objectives, including Natura 2000 aquatic sites.

6.3.3.2 The Marine Strategy Framework Directive: Ecosystem-Based Marine Governance

The **Marine Strategy Framework Directive (MSFD)** (Directive 2008/56/EC) extends ecosystem-based management to Europe's seas. Its objective is to achieve **Good Environmental Status (GES)** of marine waters through coordinated regional action.

The MSFD introduces:

- an ecosystem-based approach to marine management,
- descriptors covering biodiversity, food webs, eutrophication, contaminants, noise, and seafloor integrity,
- marine strategies aligned with regional sea conventions.

By addressing cumulative marine pressures rather than isolated activities, the MSFD fills a critical gap between marine conservation under Natura 2000 and sectoral marine uses such as fisheries, shipping, and offshore energy.

6.3.3.3 The Floods Directive: Managing Risk While Restoring Floodplains

The **Floods Directive** (Directive 2007/60/EC) focuses on flood risk assessment and management, but increasingly contributes to biodiversity objectives by promoting **nature-based solutions** and floodplain restoration.

Key elements include:

- flood risk mapping and planning,
- coordination with the Water Framework Directive,
- encouragement of retention areas and natural flood management.

In practice, floodplain restoration under the Floods Directive can generate significant co-benefits for wetlands, riparian habitats, and climate adaptation, reinforcing both Layer 1 and Layer 5 objectives.

6.3.4 Agriculture, Land Use, and Pollution Control

6.3.4.1 The Nitrates Directive: Reducing Diffuse Agricultural Pollution

The **Nitrates Directive** (Directive 91/676/EEC) addresses one of the most persistent pressures on terrestrial and aquatic ecosystems: **nutrient pollution from agriculture**.

Its core mechanisms include:

- designation of **Nitrate Vulnerable Zones (NVZs)**,
- limits on manure and fertiliser application,
- codes of good agricultural practice.

While originally water-focused, the Directive plays a crucial role in reducing eutrophication, improving soil and habitat quality, and mitigating biodiversity loss in agricultural landscapes.

6.3.4.2 The Industrial Emissions Directive: Controlling Point-Source Pollution

The **Industrial Emissions Directive (IED)** (Directive 2010/75/EU) regulates pollution from large industrial installations through:

- integrated permitting,
- application of **Best Available Techniques (BAT)**,
- emission limit values for air, water, and soil.

By reducing toxic emissions and chronic pollution loads, the IED contributes indirectly to ecosystem health across multiple environmental media. Its role in Layer 2 lies in **preventing long-term ecological degradation** caused by industrial activity.

6.3.4.3 The Ambient Air Quality Directive: Addressing Atmospheric Pressures

The **Ambient Air Quality Directive** (Directive 2008/50/EC) sets limit values and targets for key air pollutants. Although primarily designed to protect human health, air pollution control also benefits ecosystems by reducing:

- nitrogen deposition,
- acidification,
- ozone damage to vegetation.

These atmospheric pressures often undermine conservation efforts in sensitive habitats, making air quality regulation a critical—though frequently underestimated—component of biodiversity governance.

6.3.5 Trade- and Sourcing-Based Pressure Control

6.3.5.1 The EU Deforestation Regulation: Externalizing Ecosystem Responsibility

The **EU Deforestation Regulation (EUDR)** (Regulation (EU) 2023/1115) represents a major innovation within Layer 2 by extending pressure-reduction logic beyond EU territory.

The Regulation:

- prohibits placing certain commodities on the EU market if linked to deforestation or forest degradation,
- introduces due diligence obligations for operators and traders,
- links EU consumption patterns to global ecosystem impacts.

Although not a conservation instrument in the traditional sense, the EUDR reduces one of the most significant drivers of global biodiversity loss: **import-driven land-use change**. It exemplifies how pressure reduction can be achieved through **market access conditions and supply-chain governance**.

6.3.6 Layer 2 and Its Relationship to Other Governance Layers

Layer 2 acts as a **functional bridge** between direct conservation law and broader economic governance:

- It supports **Layer 1** by reducing background pressures that would otherwise undermine protected areas and restoration efforts.
- It relies on **Layer 3** instruments (EIA, SEA) for implementation and accountability.
- It aligns with **Layer 4** strategies that promote ecosystem-based management.
- It increasingly intersects with **Layer 5** through climate adaptation and mitigation synergies.
- It prepares the ground for **Layer 6 and 7** by shaping production systems and value chains.

Without effective pressure-reduction governance, strict conservation and restoration obligations risk becoming **ecologically isolated and politically contested**.

6.4 Layer 3 – Procedural Environmental Safeguards and Liability

6.4.1 The Role of Layer 3 in EU Nature Protection Governance

Layer 3 provides the **procedural backbone** of EU nature protection governance. Unlike Layers 1 and 2, which define substantive environmental objectives and pressure-reduction measures, Layer 3 focuses on **how decisions are made, how environmental impacts are assessed, and how responsibility is assigned when environmental damage occurs**.

This layer ensures that biodiversity considerations are **systematically integrated into planning, programming, and project approval processes**, and that environmental harm is not only prevented but also **remedied** when it occurs. Without these procedural mechanisms, conservation law would remain difficult to operationalise, and pressure-reduction instruments would lack transparency, consistency, and accountability.

Layer 3 therefore functions as an **enabling and enforcing layer**, translating ecological knowledge and legal obligations into decision-making practice across all relevant sectors.

6.4.2 Key Characteristics of Procedural Safeguards

The instruments in Layer 3 share several defining features:

- **Process-oriented governance:** They regulate procedures rather than prescribing specific environmental outcomes.
- **Preventive and anticipatory logic:** Environmental risks are addressed before irreversible damage occurs.
- **Cross-sectoral applicability:** These procedures apply to projects, plans, and programmes across energy, transport, agriculture, forestry, industry, and urban development.
- **Strong links to public participation and transparency:** They institutionalise access to information, stakeholder consultation, and reasoned decision-making.

Layer 3 thus operationalises the **precautionary principle** and reinforces the EU's commitment to evidence-based policymaking.

6.4.3 The Environmental Impact Assessment Directive

The **Environmental Impact Assessment (EIA) Directive** (Directive 2011/92/EU, as amended by Directive 2014/52/EU) requires the systematic assessment of environmental impacts for certain public and private projects before development consent is granted.

Key elements of the EIA framework include:

- screening to determine whether an EIA is required,
- scoping to define the content and level of detail of the assessment,
- preparation of an environmental report covering likely significant effects,
- public consultation and access to information,
- reasoned conclusions by competent authorities.

Although the EIA Directive does not prohibit environmentally damaging projects outright, it ensures that **environmental consequences are explicitly identified, assessed, and weighed** in decision-making.

Biodiversity in the EIA Process

Biodiversity considerations are a core component of EIAs. Assessments must examine impacts on:

- species and habitats,
- ecosystem services,
- landscape connectivity and fragmentation,

- cumulative and indirect effects.

Importantly, the EIA Directive interacts closely with **Layer 1 conservation law**, particularly where projects may affect Natura 2000 sites. In such cases, EIA procedures must be coordinated with the **appropriate assessment** requirements under the Habitats Directive, reinforcing the protective function of Layer 1.

6.4.4 The Strategic Environmental Assessment Directive

The **Strategic Environmental Assessment (SEA) Directive** (Directive 2001/42/EC) extends environmental assessment to **plans and programmes** prepared by public authorities, such as land-use plans, transport strategies, energy programmes, and agricultural policies.

The SEA Directive aims to:

- integrate environmental considerations at an early stage of decision-making,
- address cumulative and long-term effects,
- influence strategic choices before project-level decisions are locked in.

SEAs are therefore **upstream instruments**, shaping the policy context within which individual projects are later proposed.

SEA and Ecosystem-Scale Thinking

From a biodiversity governance perspective, SEA is particularly important because it:

- enables assessment at landscape, catchment, or regional scales,
- supports ecosystem-based planning,
- improves coherence between conservation objectives and sectoral strategies.

SEAs thus form a critical interface between **Layer 2 pressure-reduction instruments** and **Layer 4 strategic policy frameworks**, ensuring that environmental objectives are considered systematically rather than retrofitted at the project stage.

6.4.5 The Environmental Liability Directive

The **Environmental Liability Directive (ELD)** (Directive 2004/35/EC) introduces a liability regime based on the “**polluter pays**” principle. Its primary purpose is not compensation for private loss, but the **prevention and remediation of environmental damage**.

The Directive applies to:

- damage to protected species and natural habitats,
- water damage,

- land damage posing significant risks to human health.

Operators responsible for environmental damage are required to:

- take preventive action in case of imminent threat,
- undertake or finance remedial measures to restore the environment.

The Role of Liability in Nature Protection Governance

The ELD complements preventive instruments by ensuring that **environmental harm has legal and financial consequences**. It strengthens biodiversity governance by:

- internalising environmental costs,
- incentivising risk management and compliance,
- reinforcing the credibility of conservation law.

While its practical application varies across Member States, the ELD remains a key accountability mechanism linking environmental protection to legal responsibility.

6.4.6 Interactions with Other Governance Layers

Layer 3 interacts closely with all other layers of the EU Nature Protection Governance Framework:

- It supports **Layer 1** by operationalising conservation obligations through assessment and permitting procedures.
- It enhances **Layer 2** by ensuring that pressure-reduction measures are embedded in planning and project approval.
- It translates **Layer 4** strategies into implementable decisions.
- It underpins **Layer 5 and 6** by providing procedural credibility to climate and sustainability governance.
- It indirectly influences **Layer 7** by shaping product-related infrastructure and industrial development choices.

In this sense, Layer 3 acts as the **procedural glue** that holds the governance framework together.

6.5 Layer 4 – Strategic Policy Frameworks and Agenda-Setting (Soft Law)

6.5.1 The Role of Layer 4 in EU Nature Protection Governance

Layer 4 comprises the **strategic policy frameworks** that provide direction, coherence, and long-term orientation for EU nature protection and sustainability governance. Unlike the binding legal instruments addressed in earlier layers, the instruments in this layer are predominantly **Commission Communications, strategies, and action plans**. They do not, in themselves, create enforceable legal obligations. Instead, they shape the **policy agenda**, define shared problem framings, and structure the interaction between sectoral policies.

Within the EU governance system, Layer 4 performs a critical **architectural and coordinating function**. Strategic frameworks translate scientific evidence, international commitments, and political priorities into integrated policy narratives. These narratives subsequently inform legislative initiatives, funding allocations, and implementation practices across Member States and governance levels.

Layer 4 is therefore best understood as the **strategic design layer** of EU nature protection governance. It defines where the system is heading, how different policy domains—such as biodiversity protection, climate policy, agriculture, forestry, industry, and finance—should interact, and which trade-offs are considered politically and socially acceptable.

Soft Law as a Governance Instrument

In EU environmental governance, **soft law** refers to policy instruments that lack direct legal enforceability but nevertheless exert substantial influence on policy outcomes. Such instruments:

- articulate long-term goals, priorities, and timelines,
- establish shared concepts, definitions, and policy language later embedded in legislation,
- coordinate actions across institutions, sectors, and levels of governance,
- reduce fragmentation and enhance policy coherence in complex regulatory environments.

Soft law is particularly important in policy domains characterised by **cross-sectoral interactions, long-term dynamics, and scientific uncertainty**, such as biodiversity loss, land-use change, and climate–nature interactions. Strategic frameworks enable collective EU action even where legislative competences are dispersed or politically sensitive, allowing for adaptive and iterative governance.

6.5.2 The European Green Deal: A Systemic Policy Umbrella

The **European Green Deal** (Communication COM(2019) 640 final) constitutes the overarching strategic framework for EU environmental and sustainability policy. It redefines environmental protection as an integral component of the EU's **economic, social, and climate transformation**.

Key features relevant to nature protection include:

- the recognition of biodiversity loss as a systemic risk,
- the integration of nature objectives into climate neutrality, circular economy, and industrial policy,
- the commitment to move from damage limitation toward restoration and regeneration.

From a governance perspective, the Green Deal serves as a **horizontal integration platform**, linking conservation objectives to energy transition, finance, agriculture, and trade. It provides the political mandate for subsequent legislative initiatives across multiple governance layers, including the Nature Restoration Regulation and sustainable finance instruments.

6.5.3 The EU Biodiversity Strategy for 2030: Strategic Vision for Nature

The **EU Biodiversity Strategy for 2030** (Communication COM(2020) 380 final) is the central strategic document guiding EU biodiversity policy under the Green Deal.

Its main contributions include:

- setting quantitative and qualitative targets for protected areas and restoration,
- framing biodiversity as a prerequisite for climate resilience and human well-being,
- linking conservation objectives to food systems, forestry, and urban development,
- emphasising ecosystem services and nature-based solutions.

Although the Strategy itself is not legally binding, it has directly shaped binding instruments in **Layer 1** and **Layer 5**, and it guides funding priorities under EU financial instruments. It also provides a common reference point for Member States when developing national biodiversity strategies and action plans.

6.5.4 The EU Forest Strategy for 2030: Integrating Forestry into Nature Governance

The **EU Forest Strategy for 2030** (Communication COM(2021) 572 final) addresses the multifunctional role of forests within EU policy, balancing biodiversity conservation, climate mitigation, and the bioeconomy.

Key governance elements include:

- recognition of forests as critical carbon sinks and biodiversity reservoirs,
- promotion of close-to-nature forestry and ecological resilience,
- emphasis on monitoring, data harmonisation, and long-term planning,
- integration of forestry into climate and biodiversity objectives.

The Strategy exemplifies how soft law can **reframe sectoral policy narratives**, influencing both conservation-oriented instruments (Layer 1) and climate-related governance (Layer 5), while leaving detailed regulatory choices to Member States and subsequent legislation.

6.5.5 The EU Soil Strategy for 2030: Bringing Soil into the Governance Framework

The **EU Soil Strategy for 2030** (Communication COM(2021) 699 final) represents a significant step in elevating soil protection within EU environmental policy.

The Strategy:

- recognises soil as a non-renewable and multifunctional ecosystem component,
- links soil health to biodiversity, food security, climate adaptation, and water management,
- prepares the ground for future binding soil legislation,
- promotes sustainable soil management across land-use sectors.

From a governance perspective, the Soil Strategy demonstrates the **agenda-setting power of Layer 4**, using strategic framing to address policy gaps where binding regulation has historically been weak or absent.

6.5.6 The EU Bioeconomy Strategy: Governing Biological Resource Use

The **EU Bioeconomy Strategy** (Communication COM(2018) 673 final, updated) occupies a central position in Layer 4 by providing a strategic framework for the sustainable mobilisation of biological resources.

The Strategy:

- defines the bioeconomy as a cross-sectoral economic system based on renewable biological resources and biogenic carbon,
- links biomass use to climate mitigation, industrial competitiveness, and rural development,
- explicitly recognises ecological limits and competing ecosystem functions,
- introduces governance principles such as biomass cascading and efficient use.

Within the nature governance framework, the Bioeconomy Strategy functions as a **bridge between conservation objectives and productive land and biomass use**. It aligns with biodiversity, climate, and land-use policies (Layers 1, 2, and 5) while shaping innovation, industrial deployment, and investment pathways. Its soft-law character allows it to coordinate agriculture, forestry, fisheries, industry, and research without pre-empting binding regulation.

6.5.7 The Circular Economy Action Plan: Material Governance for Nature Protection

The **Circular Economy Action Plan** (Communication COM(2020) 98 final) represents another cornerstone of Layer 4, providing a systemic framework for reducing environmental pressures at source through material and product governance.

The Action Plan:

- reframes waste and resource use as design and system-level challenges,
- aims to decouple economic activity from material throughput,
- integrates circularity into climate neutrality, biodiversity protection, and industrial policy,
- provides strategic direction for extensive follow-up legislation in Layer 7.

From a nature protection perspective, the CEAP addresses **diffuse and cumulative ecological pressures** associated with extraction, processing, and waste generation. By shaping product rules, market incentives, and consumption patterns, it reduces upstream impacts on ecosystems and complements conservation-focused instruments.

6.5.8 Coherence Across Governance Layers

Layer 4 plays a central role in ensuring coherence across the EU Nature Protection Governance Framework:

- it translates scientific assessments and political priorities into shared policy narratives,
- it guides the development of binding instruments in Layers 1, 2, and 5,
- it aligns procedural safeguards in Layer 3 with long-term objectives,
- it provides strategic orientation for market-based and product-related instruments in Layers 6 and 7.

Without Layer 4 strategic frameworks, EU nature governance would risk becoming fragmented and reactive, with individual instruments addressing symptoms rather than systemic drivers. Through agenda-setting, coordination, and long-term vision, Layer 4 ensures that biodiversity protection, climate mitigation, and economic transformation are pursued as **mutually reinforcing objectives** rather than competing policy goals.

6.6 Layer 5 – Climate–Nature–Energy Integration Instruments

6.6.1 The Role of Layer 5 in EU Nature Protection Governance

Layer 5 represents a decisive transformation in EU nature protection governance: the integration of biodiversity and ecosystem management into **binding climate and energy law**. While earlier layers focus on conservation, pressure reduction, procedures, and strategic direction, Layer 5 governs **how ecosystems are used, valued, and transformed** in pursuit of climate neutrality and energy transition objectives.

This layer reflects the recognition that climate change is both a **driver of biodiversity loss** and a domain in which ecosystems play a central role as carbon sinks, sources, and substitutes. Forests, soils, wetlands, and biomass are no longer addressed solely as objects of conservation, but also as **functional components of climate policy**.

Layer 5 therefore introduces powerful incentives—and risks—for nature protection. It can support biodiversity through restoration and sink enhancement, but it can also intensify land-use pressures if climate and energy objectives are pursued without adequate ecological safeguards.

Defining Features of Climate–Nature–Energy Integration

The instruments in Layer 5 share several distinctive characteristics:

- **Binding, economy-wide targets:** Climate neutrality and emission reduction goals are legally enshrined and apply across all sectors.
- **Functional valuation of ecosystems:** Nature is increasingly governed through its carbon storage, sequestration, and substitution potential.
- **Strong interaction with land use and forestry:** Ecosystems become part of national accounting systems and compliance mechanisms.
- **Risk of policy trade-offs:** Climate mitigation objectives may conflict with biodiversity protection if not carefully integrated.

Layer 5 thus represents a **high-impact governance layer**, capable of reshaping land-use decisions at scale.

6.6.2 The European Climate Law: Nature in the Climate Neutrality Framework

The **European Climate Law** (Regulation (EU) 2021/1119) establishes the EU’s legally binding objective of **climate neutrality by 2050**, alongside intermediate emission reduction targets.

Although the Regulation does not regulate biodiversity directly, it:

- embeds ecosystems into the climate governance framework,

- mandates consistency across EU policies, including nature protection,
- reinforces the role of land-based sinks in achieving climate targets.

By elevating climate neutrality to a legal obligation, the Climate Law indirectly shapes ecosystem governance across agriculture, forestry, and land-use planning. Nature protection becomes not only an environmental concern but also a **precondition for climate stability**.

6.6.3 The LULUCF Regulation: Accounting for Ecosystems as Carbon Sinks

The **Land Use, Land-Use Change and Forestry (LULUCF) Regulation** (Regulation (EU) 2018/841) operationalises the role of ecosystems within EU climate accounting.

Key elements include:

- binding national targets for net removals in the LULUCF sector,
- detailed accounting rules for forests, croplands, grasslands, and wetlands,
- integration of land-use emissions and removals into EU climate compliance.

From a nature protection perspective, the LULUCF Regulation is ambivalent. On the one hand, it creates incentives to maintain and enhance carbon sinks through sustainable land management and restoration. On the other hand, its accounting logic may prioritise **carbon outcomes over biodiversity values**, particularly where monocultures or intensive management deliver short-term carbon gains. This tension highlights the importance of coordination between **Layer 5 and Layer 1**.

6.6.4 The Carbon Removal Certification Framework: Governing Carbon–Nature Interventions

The **Carbon Removal Certification Framework (CRCF)** (Regulation (EU) 2024/3012) introduces an EU-wide system for certifying carbon removals, including nature-based and technological approaches.

Key features include:

- harmonised quality criteria for carbon removals,
- requirements on additionality, permanence, and monitoring,
- explicit inclusion of land-based and ecosystem-based removals.

The CRCF represents a critical junction between climate policy, land use, and biodiversity governance. It creates the conditions for **market-based incentives** linked to ecosystem management, while simultaneously raising concerns about ecological integrity, land competition, and social impacts.

The Regulation explicitly recognises the need to avoid negative effects on biodiversity, signaling an emerging attempt to **reconcile climate finance with nature protection**.

6.6.5 The Renewable Energy Directive (RED II and RED III): Renewable Energy Governance and Ecosystem Use

The **Renewable Energy Directive**—Directive (EU) 2018/2001 (RED II), as recast by Directive (EU) 2023/2413 (RED III)—plays a central role in shaping ecosystem use through energy policy.

In particular, the Directive:

- promotes renewable energy deployment across sectors,
- includes sustainability and greenhouse gas criteria for bioenergy,
- affects forest management, agricultural land use, and biomass supply chains.

Biomass occupies a sensitive position within Layer 5. While renewable in accounting terms, biomass production can exert substantial pressures on forests and soils if demand increases without adequate ecological safeguards.

Sustainability Criteria and Biodiversity Safeguards

RED II and RED III include sustainability requirements designed to mitigate negative impacts, such as:

- restrictions on sourcing from high-biodiversity areas,
- greenhouse gas savings thresholds,
- reporting and verification obligations.

However, the effectiveness of these safeguards depends heavily on **implementation and enforcement**, and on alignment with conservation law under Layer 1 and pressure-reduction instruments under Layer 2.

6.6.6 Interactions with Other Governance Layers

Layer 5 interacts intensively with the rest of the EU Nature Protection Governance Framework:

- It depends on **Layer 1** to define ecological limits for climate-driven land use.
- It builds on **Layer 2** to manage land-use pressures and resource extraction.
- It relies on **Layer 3** procedures to assess climate- and energy-related projects.
- It is guided by **Layer 4** strategies, particularly the Green Deal and Biodiversity Strategy.
- It increasingly feeds into **Layer 6** through carbon markets and climate finance.

Because of its binding nature and economic reach, misalignment in Layer 5 can **override conservation objectives** unless strong coordination mechanisms are in place.

6.7 Layer 6 – Sustainable Finance and Corporate Governance

6.7.1 The Role of Layer 6 in EU Nature Protection Governance

Layer 6 represents a fundamental shift in EU nature protection governance: the extension of biodiversity objectives into the **financial system and corporate decision-making**. Whereas earlier layers rely primarily on public law instruments—such as conservation law, pressure regulation, and planning procedures—Layer 6 governs nature indirectly through **market transparency, disclosure obligations, and investment incentives**.

This layer reflects the recognition that biodiversity loss is strongly shaped by **capital allocation, corporate strategies, and supply-chain decisions**. As long as environmental degradation remains invisible in financial reporting and market valuation, conservation objectives risk being systematically undermined. Layer 6 therefore aims to **internalise biodiversity considerations into economic governance**, making ecological impacts visible, comparable, and financially relevant.

Within the layered framework, Layer 6 does not replace regulation; rather, it **amplifies and reinforces** other layers by influencing private-sector behaviour at scale.

Market-Based Accountability as a Governance Logic

The defining logic of Layer 6 is **accountability through information and classification**, rather than direct prohibition or permitting. Its instruments are designed to:

- standardise how companies measure and disclose sustainability impacts,
- guide investors toward environmentally sustainable activities,
- prevent misleading environmental claims,
- align private capital flows with EU environmental objectives.

Unlike traditional environmental law, Layer 6 operates primarily through **economic signals and reputational mechanisms**, while remaining legally binding in its procedural requirements.

6.7.2 The Corporate Sustainability Reporting Directive (CSRD)

The **Corporate Sustainability Reporting Directive (CSRD)** (Directive (EU) 2022/2464) fundamentally restructures sustainability reporting in the EU by expanding its scope, depth, and legal significance.

Key features include:

- mandatory sustainability reporting for a broad range of large companies and listed SMEs,
- integration of sustainability reporting into annual management reports,
- application of the **double materiality principle**, covering both environmental impacts and financial risks,
- external assurance requirements.

From a biodiversity governance perspective, CSRD makes nature-related impacts **systematically visible** at the corporate level, transforming biodiversity from a voluntary corporate responsibility topic into a regulated reporting obligation.

6.7.3 European Sustainability Reporting Standards (ESRS)

ESRS as the Operational Core of Corporate Disclosure

The **European Sustainability Reporting Standards (ESRS)**, adopted as a Delegated Act under the CSRD (EU) 2023/2772, operationalise sustainability reporting by defining **what must be disclosed and how**.

The standards cover environmental, social, and governance topics, ensuring comparability and consistency across companies and sectors.

ESRS E4: Biodiversity and Ecosystems

Of particular relevance for nature protection is **ESRS E4 – Biodiversity and Ecosystems**, which requires companies to disclose:

- impacts and dependencies on ecosystems,
- biodiversity-related risks and opportunities,
- policies, targets, and transition plans,
- site-specific pressures and value-chain effects.

ESRS E4 represents a major advance in corporate biodiversity governance, translating ecological complexity into structured disclosure requirements. While it does not mandate specific conservation outcomes, it **creates transparency-based pressure** for improved corporate performance and risk management.

6.7.4 The EU Taxonomy Regulation: Defining What Counts as Sustainable

The **EU Taxonomy Regulation** (Regulation (EU) 2020/852) establishes a classification system for environmentally sustainable economic activities.

An activity qualifies as environmentally sustainable if it:

- contributes substantially to one or more environmental objectives,
- does no significant harm to the other objectives,
- complies with minimum social safeguards,
- meets detailed technical screening criteria.

Biodiversity protection is explicitly recognised as one of the six environmental objectives. The Taxonomy thus introduces **normative definitions** of sustainability that directly affect investment decisions, lending conditions, and corporate strategies.

6.7.5 The Sustainable Finance Disclosure Regulation (SFDR)

The **Sustainable Finance Disclosure Regulation (SFDR)** (Regulation (EU) 2019/2088) governs how financial market participants disclose sustainability risks and impacts.

Its objectives include:

- preventing misleading sustainability claims in financial products,
- increasing transparency regarding environmental impacts,
- supporting informed decision-making by investors.

Through its classification of financial products and disclosure requirements, SFDR indirectly shapes demand for biodiversity-friendly business models, reinforcing the effects of CSRD and the EU Taxonomy.

6.7.6 The Green Claims Directive: Preventing Biodiversity Greenwashing

The proposed **Green Claims Directive** (Proposal COM(2023) 166 final) addresses a critical vulnerability in market-based governance: **misleading environmental claims**.

The Directive aims to:

- require scientific substantiation of explicit environmental claims,
- ensure third-party verification,
- improve comparability and credibility of claims,
- protect consumers from greenwashing.

Although still pending adoption, the Green Claims Directive complements CSRD, ESRS, and SFDR by regulating **how environmental and biodiversity performance is communicated**, not just how it is measured or reported.

6.7.7 Interactions with Other Governance Layers

Layer 6 is deeply interwoven with the rest of the EU Nature Protection Governance Framework:

- It translates **Layer 4 strategic objectives** into market signals.
- It reinforces **Layer 5 climate and land-use governance** through investment and reporting incentives.
- It depends on **Layer 1 and 2** to define substantive ecological limits and pressure-reduction standards.
- It relies on **Layer 3** for procedural credibility and verification.

By influencing private capital allocation, Layer 6 has the capacity to **scale up nature protection beyond the reach of public regulation alone**.

6.8 Layer 7 – Product-Related Ecosystem Protection

6.8.1 The Role of Layer 7 in EU Nature Protection Governance

Layer 7 represents the **most indirect but systemically far-reaching layer** of EU nature protection governance. It addresses biodiversity loss not through conservation law, spatial planning, or climate policy, but through **product-related regulation** that shapes how materials, chemicals, buildings, and goods are designed, produced, used, and disposed of.

The ecological pressures targeted by this layer are typically **diffuse, cumulative, and long-term**. Chemical pollution, pesticide use, material flows, construction practices, and waste generation may individually appear manageable, but together they generate persistent ecosystem degradation that is difficult to attribute to single actors or locations.

Layer 7 therefore complements the earlier layers by **acting upstream and downstream** of ecosystem impacts: upstream through product and substance regulation, and downstream through waste and circularity rules. In doing so, it tackles drivers of biodiversity loss that cannot be effectively addressed by protected areas or project-level controls alone.

Product Regulation as an Environmental Governance Tool

The governance logic of Layer 7 differs markedly from that of other layers:

- **Lifecycle-oriented intervention:** Regulation applies across production, use, and end-of-life stages of products.

- **Preventive rather than restorative logic:** The focus is on avoiding environmental harm before it accumulates.
- **Standard-setting and market harmonization:** Ecological protection is achieved through technical requirements, restrictions, and performance standards.
- **High relevance for everyday economic activity:** These instruments shape construction, agriculture, industry, and consumer behaviour.

From a biodiversity perspective, Layer 7 is crucial because it addresses **background pressures** that operate continuously and ubiquitously across landscapes and ecosystems.

6.8.2 Chemicals and Substances Control

6.8.2.1 The REACH Regulation: Systemic Control of Chemical Risks

The **REACH Regulation** (Regulation (EC) 1907/2006) establishes the EU's comprehensive framework for the registration, evaluation, authorisation, and restriction of chemicals.

Key features include:

- producer responsibility for demonstrating chemical safety,
- progressive substitution of substances of very high concern,
- restrictions and bans on hazardous chemicals,
- information flows along supply chains.

Although REACH is primarily framed around human health and environmental safety, it plays a critical role in biodiversity protection by reducing **chronic toxic exposure** of ecosystems. Many pressures on soil organisms, aquatic species, and food webs stem from persistent chemical contamination rather than discrete pollution events.

6.8.2.2 Plant Protection Products Regulation: Biodiversity and Agricultural Inputs

The **Plant Protection Products Regulation** (Regulation (EC) 1107/2009) governs the authorisation and use of pesticides within the EU.

Its biodiversity relevance lies in:

- hazard-based approval criteria for active substances,
- specific protection of non-target organisms,
- restrictions linked to water bodies, soils, and habitats,
- alignment with integrated pest management principles.

Despite these safeguards, pesticide use remains a major driver of biodiversity decline in agricultural landscapes. The Regulation illustrates both the **necessity and limits** of product-based governance in managing ecosystem pressures arising from intensive land use.

6.8.3 Green Building and Construction Product Regulation

6.8.3.1 Buildings as Long-Term Ecological Drivers

Buildings and infrastructure exert long-term impacts on ecosystems through:

- land take and habitat fragmentation,
- material extraction and resource use,
- operational energy demand,
- waste generation at end of life.

Layer 7 addresses these impacts through a suite of regulatory instruments that integrate **energy performance, material efficiency, and sustainability criteria** into construction and renovation.

6.8.3.2 Energy Performance of Buildings Directive (EPBD)

The **Energy Performance of Buildings Directive** (Directive 2010/31/EU, recast as Directive (EU) 2024/1275) focuses on improving energy efficiency and reducing emissions from the building stock.

While climate-driven in origin, the EPBD affects biodiversity indirectly by:

- influencing renovation rates and construction activity,
- shaping urban form and land use,
- interacting with material demand and lifecycle impacts.

Its relevance for nature protection therefore lies in the **systemic consequences** of large-scale building transformation.

6.8.3.3 Energy Efficiency Directive (EED)

The **Energy Efficiency Directive** (Directive (EU) 2023/1791) complements the EPBD by setting binding energy efficiency targets across sectors.

By reducing overall energy demand, the EED indirectly alleviates pressure on ecosystems linked to energy production, resource extraction, and infrastructure development. It exemplifies how **demand-side regulation** can contribute to nature protection without directly addressing biodiversity.

6.8.3.4 Construction Products Regulation (CPR)

The **Construction Products Regulation** (Regulation (EU) No 305/2011, revised 2024) harmonises rules for placing construction products on the EU market.

Recent revisions strengthen:

- sustainability and environmental performance requirements,
- lifecycle information and product transparency,
- alignment with circular economy objectives.

Through standard-setting and market access conditions, the CPR influences **material choices at scale**, with long-term implications for ecosystems affected by mining, forestry, and waste disposal.

6.8.4 Ecodesign and Circular Product Governance

6.8.4.1 Ecodesign for Sustainable Products Regulation (ESPR)

The **Ecodesign for Sustainable Products Regulation** (Regulation (EU) 2024/1781) significantly expands the scope of EU product regulation beyond energy-related products.

Key elements include:

- durability, reparability, and recyclability requirements,
- information obligations on environmental performance,
- restrictions on environmentally harmful product characteristics.

From a biodiversity perspective, the ESPR addresses ecosystem pressures embedded in **global material flows**, shifting attention from individual sites to entire production systems.

6.8.4.2 Waste Framework Directive: Closing the Loop

The **Waste Framework Directive** (Directive 2008/98/EC) provides the foundation for EU waste and circular economy policy.

Its relevance for biodiversity protection includes:

- waste prevention and reduction targets,
- recycling and recovery obligations,
- reduced landfilling and pollution risks,
- incentives for resource efficiency.

By limiting waste generation and improving material cycles, the Directive helps reduce pressures on ecosystems associated with extraction, disposal, and contamination.

6.8.5 Interactions with Other Governance Layers

Layer 7 interacts with all other layers, but in distinctive ways:

- It complements **Layer 1** by addressing pressures outside protected areas.
- It supports **Layer 2** by reducing diffuse pollution and material flows.
- It relies on **Layer 3** procedures for enforcement and compliance.
- It operationalises **Layer 4** strategies such as circular economy and sustainability transitions.
- It reinforces **Layer 5 and 6** by shaping the physical basis of energy systems and sustainable finance.

Layer 7 thus operates as a **structural pressure-reduction layer**, shaping the ecological footprint of the EU economy at its material foundations.

Core Concepts and Review Questions – Chapter 6

1. Why did EU nature protection governance expand beyond classic species and habitat conservation law?

EU nature protection governance expanded because biodiversity loss is increasingly driven by cumulative and indirect pressures arising from sectoral policies, market dynamics, and production–consumption systems rather than by isolated illegal activities within protected areas. Agricultural intensification, infrastructure development, climate change, global supply chains, and financial incentives shape ecological outcomes across entire landscapes and value chains. As a result, effective biodiversity protection requires integration across land use, water management, climate policy, finance, and product regulation, rather than reliance on conservation law alone.

2. What best describes the European Green Deal’s governance approach to biodiversity protection?

The European Green Deal adopts a horizontal and integrated governance approach by embedding biodiversity objectives across climate, energy, finance, trade, industrial, and agricultural policies. Rather than treating nature protection as a standalone environmental issue, it frames biodiversity as a core public interest linked to economic transformation, climate neutrality, and resilience. This integration enables biodiversity considerations to influence binding legislation, investment decisions, and market regulation across multiple policy domains.

3. Which EU legal instruments are the core foundation for Natura 2000?

The Natura 2000 network is founded on the Birds Directive and the Habitats Directive, which together establish binding conservation obligations for species and habitats of EU interest. The Birds Directive provides for the designation of Special Protection Areas for bird species, while the Habitats Directive establishes Special Areas of Conservation for habitats and non-bird species. Together, these directives form a coherent legal basis for the EU-wide protected area network.

4. What is the primary purpose of the EU Nature Restoration Regulation?

The EU Nature Restoration Regulation aims to impose legally binding restoration targets and timelines across a wide range of ecosystem types, including forests, wetlands, rivers, agricultural landscapes, and urban areas. It marks a shift from a purely preventive conservation logic toward active ecological recovery, recognising that decades of degradation cannot be reversed through protection alone. Restoration thus becomes a positive legal obligation integrated into broader land-use and climate strategies.

5. What is the primary legal objective of the EU Birds Directive?

The primary objective of the EU Birds Directive is to ensure the conservation of all naturally occurring wild bird species within the European Union. It establishes a general system of

protection that prohibits deliberate killing, capture, and disturbance of birds and requires the conservation of habitats essential for breeding, feeding, and migration. The Directive treats bird conservation as a legal obligation rather than a discretionary policy choice.

6. Which type of protected area is designated under the Birds Directive?

Under the Birds Directive, Member States are required to designate Special Protection Areas for species listed in the Directive and for regularly occurring migratory species. These areas form a core component of the Natura 2000 network and are selected on the basis of scientific criteria related to species conservation needs. SPAs play a central role in protecting critical habitats for birds across their life cycles.

7. What is a defining feature of the Birds Directive's approach to protection?

A defining feature of the Birds Directive is that species protection is inseparable from habitat conservation. Although the Directive is species-centred, it explicitly requires the protection and management of habitats essential to birds' survival and reproduction. This integrated approach reflects ecological realities and has been reinforced by consistent case law of the Court of Justice of the European Union.

8. What is the central conservation objective of the Habitats Directive?

The Habitats Directive aims to maintain or restore habitats and species of Community interest to a favourable conservation status. This objective goes beyond preventing extinction by requiring that populations and habitats remain viable and resilient in the long term. The Directive therefore combines protection, management, and, where necessary, restoration measures grounded in ecological science.

9. Which sites are designated under the Habitats Directive?

The Habitats Directive requires the designation of Special Areas of Conservation for habitat types and species listed in its annexes. These sites are selected on the basis of ecological value and scientific criteria and, together with SPAs designated under the Birds Directive, form the Natura 2000 network. SACs are subject to strict protection and management obligations under EU law.

10. When can a plan or project that adversely affects a Natura 2000 site be authorized?

A plan or project that adversely affects a Natura 2000 site may only be authorized if no feasible alternatives exist and if it is justified by imperative reasons of overriding public interest, subject to strict conditions. Even in such cases, compensatory measures must be taken to ensure the overall coherence of the Natura 2000 network. This reflects the high level of protection afforded to these sites under EU law.

11. On what basis must Natura 2000 sites be selected under the Habitats Directive?

Natura 2000 sites must be selected exclusively on the basis of scientific and ecological criteria. Socio-economic considerations may not influence site selection, although they may be

considered at later stages of management or derogation. This ensures that the network reflects ecological priorities rather than political or economic preferences.

12. What best characterizes the Natura 2000 network?

Natura 2000 is a coordinated EU-wide ecological network designed to ensure that land and sea use remains compatible with long-term conservation objectives. It does not seek to exclude human activity entirely but requires that activities be managed in ways that do not undermine conservation goals. This approach allows biodiversity protection to be integrated into working landscapes and seascapes.

13. How do the Birds and Habitats Directives relate within Natura 2000?

The Birds and Habitats Directives jointly underpin Natura 2000 by integrating Special Protection Areas and Special Areas of Conservation into a single ecological network. Each Directive addresses different taxonomic and ecological components, but together they ensure comprehensive coverage of species and habitats of EU interest. Their interaction creates legal and ecological coherence across the network.

14. What fundamentally distinguishes the Nature Restoration Regulation from earlier EU conservation instruments?

The Nature Restoration Regulation is distinguished by its introduction of legally binding ecosystem restoration targets rather than focusing solely on preventing further deterioration. It requires active recovery of degraded ecosystems according to defined timelines and measurable indicators. This represents a significant evolution of EU nature law toward restorative governance.

15. What is the main aim of the EU Invasive Alien Species (IAS) Regulation?

The IAS Regulation aims to prevent and manage invasive alien species through binding restrictions, early detection systems, rapid eradication, and long-term management obligations. By addressing biological invasions as a major driver of biodiversity loss, it directly protects ecosystems and native species. Its focus on prevention and coordinated action reflects a precautionary governance logic.

16. What is a defining feature of the Water Framework Directive (WFD)?

The Water Framework Directive organizes water governance around river basin management and the achievement of good ecological and chemical status for all waters. It integrates water quality, quantity, and hydromorphological considerations at the scale of natural catchments rather than administrative boundaries. This ecosystem-based approach makes the Directive highly relevant for biodiversity protection.

17. What is the core objective of the Marine Strategy Framework Directive (MSFD)?

The MSFD aims to achieve Good Environmental Status of marine waters through an ecosystem-based management approach. It addresses cumulative pressures on marine

ecosystems, including biodiversity loss, pollution, and physical disturbance. By coordinating action at the level of marine regions, it supports long-term marine ecosystem resilience.

18. Why can EU flood risk policy also support biodiversity outcomes?

EU flood risk policy can support biodiversity by promoting floodplain restoration and nature-based retention measures that enhance ecosystem functioning. Such measures reduce flood risk while simultaneously restoring wetlands, improving habitat connectivity, and supporting climate adaptation. This demonstrates the potential for policy synergies between risk management and conservation.

19. What is the main environmental pressure targeted by the Nitrates Directive?

The Nitrates Directive targets diffuse nutrient pollution from agriculture, which contributes to eutrophication of waters and degradation of terrestrial and aquatic ecosystems. By limiting fertilizer and manure application and designating vulnerable zones, it reduces nutrient runoff and associated biodiversity impacts. Its role is therefore central to pressure reduction in agricultural landscapes.

20. What is the main governance tool used by the Industrial Emissions Directive (IED) to control pollution?

The Industrial Emissions Directive controls pollution through integrated permitting systems that require the application of Best Available Techniques and compliance with emission limit values. This approach addresses air, water, and soil pollution simultaneously, reducing chronic environmental pressures. It indirectly supports ecosystem protection by limiting industrial impacts across multiple media.

21. Why is the Ambient Air Quality Directive relevant to ecosystem protection, not only human health?

The Ambient Air Quality Directive is relevant to ecosystems because air pollutants contribute to nitrogen deposition, acidification, and ozone damage that harm vegetation and sensitive habitats. These pressures can undermine conservation objectives even in protected areas. Air quality regulation therefore plays an important supporting role in biodiversity governance.

22. What is the EU Deforestation Regulation (EUDR) mainly designed to do?

The EUDR is designed to prevent certain commodities from entering the EU market if they are linked to deforestation or forest degradation. It achieves this through due diligence obligations imposed on operators and traders, linking EU consumption to global land-use impacts. This market-based approach addresses biodiversity loss beyond EU borders.

23. What is the central purpose of Environmental Impact Assessment (EIA) in EU law?

The central purpose of EIA is to assess the likely significant environmental effects of projects before development consent is granted. It ensures that environmental consequences are identified, evaluated, and considered in decision-making. EIA thus operationalises preventive and precautionary principles in project approval processes.

24. What is the key difference between Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA)?

EIA applies at the project level, while SEA operates upstream at the level of plans and programmes. SEA allows cumulative and long-term environmental effects to be assessed before strategic decisions are locked in, thereby shaping the context for subsequent projects. This distinction enhances early integration of environmental considerations.

25. What is the main logic of the Environmental Liability Directive (ELD)?

The Environmental Liability Directive is based on the polluter pays principle, requiring operators to prevent and remedy environmental damage. Its primary objective is ecological restoration rather than compensation for private loss. By internalising environmental costs, it strengthens accountability and compliance.

26. What is the main function of the LULUCF Regulation in EU climate governance?

The LULUCF Regulation sets accounting rules and binding targets for greenhouse gas emissions and removals from land use, land-use change, and forestry. It integrates ecosystems into climate compliance mechanisms and national targets. This functional valuation of land-based carbon has significant implications for ecosystem management.

27. What is the main purpose of the Carbon Removal Certification Framework (CRCF)?

The CRCF establishes harmonised quality criteria for certifying carbon removals, including land-based and nature-based removals. It aims to ensure environmental integrity through requirements on additionality, permanence, and monitoring. The framework links climate mitigation incentives with ecosystem governance.

28. Why is bioenergy policy often associated with biodiversity and land-use trade-offs?

Bioenergy policy can intensify pressures on forests and soils because increased biomass demand may lead to intensified harvesting or land-use change if safeguards are weak. While bioenergy contributes to climate goals, its land footprint creates potential conflicts with biodiversity protection. Effective governance therefore requires strong sustainability criteria and coordination.

29. What is the primary purpose of the Corporate Sustainability Reporting Directive (CSRD)?

The CSRD requires mandatory sustainability reporting by a broad range of companies, covering both environmental impacts and financial risks under the double materiality principle. It integrates sustainability information into corporate reporting and increases transparency and accountability. Biodiversity thus becomes a regulated reporting topic rather than a voluntary disclosure.

30. What do the European Sustainability Reporting Standards (ESRS) mainly provide?

The ESRS provide detailed and standardized disclosure requirements that ensure comparability and consistency of sustainability reporting across companies. They operationalise the CSRD

by specifying indicators, metrics, and qualitative information. This standardisation strengthens the governance role of transparency.

31. What is the main focus of ESRS E4?

ESRS E4 focuses on corporate disclosure related to biodiversity and ecosystems, including impacts, dependencies, risks, targets, and transition plans. It translates complex ecological relationships into structured reporting requirements. This enhances visibility of biodiversity issues in corporate decision-making.

32. What is the EU Taxonomy Regulation primarily used for?

The EU Taxonomy Regulation establishes a classification system defining when economic activities qualify as environmentally sustainable. It includes the “do no significant harm” principle and explicit biodiversity objectives. The taxonomy influences investment decisions and capital allocation across the EU economy.

33. What is the main objective of the Sustainable Finance Disclosure Regulation (SFDR)?

SFDR aims to increase transparency regarding sustainability risks and impacts in financial products and investment decisions. By regulating disclosures, it reduces greenwashing and enables investors to make informed choices. This indirectly supports biodiversity-friendly capital flows.

34. What problem is the proposed Green Claims Directive mainly intended to address?

The Green Claims Directive targets misleading environmental marketing claims by requiring scientific substantiation and independent verification. It addresses weaknesses in voluntary claims and prevents biodiversity-related greenwashing. This strengthens the credibility of sustainability communication.

35. What is the core governance mechanism of the REACH Regulation?

REACH is based on producer responsibility, requiring companies to register, assess, and manage chemical risks and to substitute or restrict hazardous substances. This shifts the burden of proof to industry and reduces long-term ecological harm. It plays a critical role in protecting ecosystems from chemical pollution.

36. Why is EU pesticide regulation important for biodiversity?

Pesticide regulation is important because authorization criteria and use conditions can reduce harm to non-target organisms, soils, water bodies, and food webs. Despite remaining challenges, regulatory safeguards help limit biodiversity loss in agricultural landscapes. Product-level control complements other conservation measures.

37. Why are building and construction policies relevant to nature protection?

Building and construction policies influence biodiversity through land take, habitat fragmentation, material extraction, energy use, and waste generation. Their long-term effects

shape ecosystem pressures well beyond individual sites. Regulating these sectors is therefore essential for addressing structural drivers of biodiversity loss.

38. What is a key aim of the Ecodesign for Sustainable Products Regulation (ESPR)?

The ESPR aims to set product requirements related to durability, reparability, recyclability, and environmental information. By improving product design, it reduces resource extraction and waste-related ecosystem pressures. This lifecycle-oriented governance approach addresses diffuse environmental impacts.

39. How can the Waste Framework Directive support ecosystem protection?

The Waste Framework Directive supports ecosystem protection by prioritizing waste prevention, recycling, and recovery while reducing landfilling and pollution risks. By improving material efficiency, it lowers pressures associated with extraction, disposal, and contamination. Waste governance thus contributes indirectly to biodiversity conservation.

7. Environmental Credibility in Nature Conservation Policy: Green Labeling, Greenwashing, and the EU Green Claims Framework

7.1 Civil Society in Nature Conservation: Credibility Mechanisms Beyond State Regulation

The civil sector consists of non-state, non-profit actors that operate independently from both governments and profit-oriented enterprises. In the field of nature conservation policy, this sector includes environmental non-governmental organizations (NGOs), consumer and public-interest organizations, certification bodies and standard-setting initiatives, as well as litigation-oriented civil associations. Although these actors lack formal regulatory authority, they exert significant influence on environmental outcomes and policy development.

Civil-sector influence is exercised through the creation and diffusion of environmental norms, the development of market-based governance instruments, the use of judicial accountability mechanisms, and sustained public scrutiny that generates reputational pressure on both companies and public authorities. In contemporary environmental governance, the civil sector functions as a crucial intermediary that links scientific knowledge, market behavior, and public regulation. Many environmental standards that are now widely recognized in policy and markets originated within this sphere before being taken up or formalized by public institutions.

7.1.1 Forms of civil-sector influence

Civil-sector engagement in nature conservation operates through three interconnected governance pathways: **normative governance**, **market governance**, and **judicial governance**. Each represents a distinct mechanism through which non-state actors shape environmental outcomes in the absence of, or alongside, formal public authority.

Normative governance refers to the civil sector's capacity to define, articulate, and diffuse sustainability principles, ethical norms, and performance standards that shape shared understandings of environmentally responsible behaviour. Through scientific expertise, advocacy, and consensus-building, environmental NGOs, research networks, and multi-stakeholder platforms formulate concepts such as sustainable forest management, responsible fisheries, ecosystem integrity, and biodiversity safeguards. These norms often emerge well before their incorporation into binding legislation and subsequently influence both public regulation and private decision-making. Normative governance thus operates primarily through persuasion, legitimacy, and knowledge authority rather than legal coercion.

Market governance denotes the translation of sustainability norms into operational rules embedded in economic transactions. It functions through voluntary certification schemes, green labels, and standards that condition market access, procurement choices, and consumer

behaviour on compliance with environmental criteria. Prominent examples include the Forest Stewardship Council (FSC) in forestry and the Marine Stewardship Council (MSC) in fisheries, which integrate environmental requirements into global supply chains and consumer markets. Alongside NGO-led initiatives, civil-sector market governance also arises from producer- and landowner-based organizations. The Programme for the Endorsement of Forest Certification (PEFC) exemplifies a bottom-up, forest-owner-driven model that endorses nationally developed standards within a shared international framework, allowing adaptation to diverse ecological, ownership, and socio-economic contexts. Market governance operates through incentives, reputational effects, and conditional market participation rather than direct regulation.

Judicial governance involves the use of legal systems by civil actors to enforce environmental norms, challenge environmentally harmful practices, and hold both public authorities and private actors accountable. Strategic environmental litigation enables NGOs, citizen groups, and public-interest organizations to pursue cases that extend beyond individual remedies, seeking wider structural change, regulatory interpretation, and effective enforcement of environmental law. Courts thereby become arenas of environmental governance, where civil-sector actors “harden” otherwise soft norms by subjecting them to legal interpretation and sanction. Judicial governance compensates for regulatory gaps by mobilizing existing legal frameworks to advance environmental protection in practice.

Taken together, these three governance pathways enable the civil sector to exert substantial influence over nature conservation policy. By combining norm creation, market-based implementation, and legal enforcement, civil-sector actors partially offset the structural limitations of state-based regulation, particularly in globalized markets where environmental impacts and supply chains transcend national jurisdictions.

7.1.1.1 Strategic environmental litigation

Strategic environmental litigation refers to legal actions initiated by civil-sector actors with the explicit aim of advancing environmental protection and public interest objectives. Such litigation seeks to enforce environmental law, challenge environmentally harmful corporate conduct, and compel regulatory compliance where public enforcement is weak or absent. Unlike conventional private lawsuits, strategic environmental litigation is not primarily concerned with individual compensation but with achieving broader systemic change.

In recent years, this form of litigation has increasingly targeted misleading sustainability communication. Civil organizations and consumer associations have brought cases against companies using vague or unsubstantiated claims such as “eco-friendly,” “climate neutral,” or “sustainably sourced” without credible evidence. In this way, strategic litigation has become closely linked to the governance of green labeling and environmental marketing.

Governance function of litigation

Strategic environmental litigation plays a crucial governance role by “hardening” civil-sector influence. Courts become arenas in which environmental claims and sustainability narratives are subjected to legally binding scrutiny rather than voluntary self-assessment. This deters

misleading marketing practices, reinforces the credibility of genuine sustainability efforts, and contributes to the gradual juridification of environmental norms that originally emerged within civil society.

7.2 Green Labeling as a Civil-Sector Governance Instrument

7.2.1 Failure of National Regulation at the Global Level

Environmental regulation has historically been constructed within territorially bounded legal systems. National laws, administrative authorities, and enforcement mechanisms operate primarily within the jurisdiction of the state. By contrast, contemporary production systems, environmental impacts, and sustainability claims are increasingly **transnational**. Raw materials may be extracted in one country, processed in another, assembled elsewhere, and marketed globally under a single environmental claim or label. This structural mismatch between territorial regulation and globalized value chains creates a persistent governance gap.

Forest products illustrate this challenge clearly. Timber may be harvested under one national regulatory regime, processed under another, and sold in multiple consumer markets subject to yet different consumer protection and advertising rules. No single national authority is capable of overseeing the full environmental footprint, chain-of-custody integrity, or the consistency of environmental marketing claims associated with such products across borders.

As a consequence, **national regulation alone cannot effectively harmonize environmental standards, control misleading sustainability claims, or ensure consistent consumer protection in global markets**. Even where national environmental laws are stringent, their reach ends at the border, while reputational signals and market communication travel freely. This structural limitation explains why purely state-based regulation has struggled to address greenwashing and sustainability claims in international trade.

In response to this governance gap, civil-sector actors developed **green labeling systems** as transnational instruments capable of operating across jurisdictions. By creating voluntary standards, common criteria, and third-party verification mechanisms, civil-sector labeling initiatives partially substituted for missing international regulation. However, because these systems rely on voluntary participation and lack coercive enforcement powers, they face inherent limitations related to fragmentation, uneven credibility, and contested legitimacy. These weaknesses ultimately justify supranational regulatory intervention—such as the EU Green Claims framework—to stabilize credibility, reduce confusion, and protect consumers.

7.2.2 Concept and rationale of green labeling

Green labeling refers to **voluntary certification and labeling schemes** that signal reduced environmental harm or superior environmental performance of products, services, or organizations. Its primary function is to address **information asymmetry** between producers and consumers by translating complex, multi-dimensional environmental impacts into simplified, recognizable market signals.

From a governance perspective, green labels function as **credibility devices**. They allow consumers to make environmental distinctions without possessing technical knowledge of life-cycle assessment, biodiversity impacts, or supply-chain management. For producers, they offer a mechanism to communicate environmental performance in competitive markets, potentially capturing price premiums, reputational benefits, or preferential access to procurement channels.

Historically, most green labeling systems emerged as **civil-sector responses to regulatory inertia and weak international governance**. In forestry, FSC was created as an NGO-driven global standard emphasizing biodiversity conservation, social safeguards, and independent third-party verification in response to deforestation and the absence of effective global forest governance. In parallel, PEFC developed as a forest-owner- and producer-led initiative designed to ensure broad participation, national adaptability, and practical implementation, particularly in regions dominated by small and medium-sized forest owners. In marine contexts, the Marine Stewardship Council (MSC) emerged in response to overfishing and the lack of enforceable international fisheries regulation.

Together, these initiatives demonstrate how green labeling evolved as a **functional substitute for missing global environmental regulation**, providing transnational standards where intergovernmental agreements remained weak, fragmented, or unenforceable.

7.2.3 Civil-sector roles in green labeling

Civil-sector actors play a central role throughout the entire life cycle of green labeling systems. They participate in **standard-setting, institutional design, verification, monitoring, and communication**. Through these roles, civil actors translate abstract sustainability principles into operational market rules.

In the FSC system, environmental NGOs, social organizations, and economic stakeholders jointly define conservation requirements, social safeguards, and management criteria within a formal multi-chamber governance structure. Independent third-party auditors then verify compliance at the level of forest management units and along the chain of custody. This model emphasizes strong environmental ambition and international uniformity.

PEFC follows a different but equally significant governance logic. National multi-stakeholder processes develop forest management standards that reflect local ecological conditions, ownership structures, and socio-economic contexts. These national standards are subsequently endorsed at the international level, ensuring transnational recognition while preserving domestic legitimacy. This bottom-up approach prioritizes inclusiveness and scalability, particularly in regions where forestry is dominated by private smallholders.

Through these mechanisms, green labeling systems embed environmental norms directly into market transactions. Compliance becomes a condition for market access, procurement eligibility, or reputational acceptance. As a result, civil-sector labels exert **indirect regulatory influence**, shaping corporate behaviour along global supply chains without relying on formal state coercion.

7.2.4 Strengths and limitations of green labeling

Green labeling offers several governance advantages. Its voluntary nature allows rapid innovation, adaptive standards, and global reach that often exceed those of intergovernmental regulation. Certification schemes such as FSC, PEFC, and MSC have succeeded in mainstreaming sustainability considerations in sectors where binding international rules remain weak or politically contested. They have also raised awareness, structured supply-chain transparency, and created reference points for later public regulation.

At the same time, green labeling suffers from inherent limitations. Participation is voluntary, enforcement depends on contractual and reputational mechanisms, and methodological rigor varies significantly across schemes. The coexistence of multiple labels with differing standards creates fragmentation and confusion, weakening comparability and trust. Moreover, the absence of uniform oversight allows weaker schemes to coexist alongside high-integrity systems, diluting the overall credibility of environmental labeling.

These weaknesses are particularly visible in markets saturated with **self-declared environmental claims** that mimic the appearance of certification without adhering to robust standards or independent verification. Such practices exploit the visual language of sustainability while avoiding its substantive requirements, creating fertile ground for greenwashing.

For these reasons, green labeling alone cannot guarantee credibility at scale. Its effectiveness increasingly depends on **hybrid governance arrangements** in which civil-sector innovation is complemented by public regulatory frameworks—such as the EU Green Claims Directive—that set minimum credibility requirements, constrain proliferation, and protect consumers while preserving space for high-quality voluntary schemes.

7.3 Greenwashing: Definition and Governance Significance

Greenwashing refers to the practice by which a company **communicates misleading, exaggerated, vague, or unsubstantiated environmental claims** in order to portray itself, its products, or its activities as more environmentally benign than they actually are. Rather than reflecting genuine environmental performance, such claims are designed to capture reputational or market advantages associated with sustainability without corresponding changes in production, management, or supply chains.

Typical greenwashing techniques include the **selective disclosure of positive environmental attributes** while omitting significant negative impacts; the use of **ambiguous, undefined, or non-comparable terms** such as “eco-friendly,” “green,” or “nature-positive”; and reliance on claims that lack robust scientific substantiation or **independent verification**. Greenwashing may also involve presenting legally required minimum standards as voluntary environmental excellence or framing marginal improvements as transformative environmental achievements.

A particularly problematic feature of greenwashing is its tendency to **imitate the visual language and symbolic cues of credible certification systems**. By adopting logos, colour

schemes, icons, or terminology reminiscent of established schemes such as FSC or PEFC, greenwashing exploits consumer trust that has been built over decades by legitimate civil-sector initiatives. In this way, greenwashing does not merely misinform consumers; it actively parasitizes existing credibility structures.

7.3.1 Greenwashing as a governance problem

From a governance perspective, greenwashing constitutes more than deceptive marketing; it represents a **systemic failure of environmental communication and accountability mechanisms**. When misleading claims proliferate, consumers lose confidence in environmental information and become unable to distinguish between robust certification systems and weak or purely promotional labels. As trust erodes, even genuinely sustainable producers face diminished returns on environmental investments.

Greenwashing also **distorts competition**. Firms that incur real costs to improve environmental performance are placed at a disadvantage compared to competitors that rely on low-cost reputational signalling. This creates perverse incentives, rewarding symbolic compliance over substantive change and slowing the diffusion of environmentally superior practices.

For legitimate green labeling schemes such as FSC or PEFC, greenwashing poses a direct threat to institutional credibility. The coexistence of high-integrity certification systems with unverified or misleading claims weakens the signaling function of all labels, reducing their ability to guide consumer choice and discipline supply chains. Over time, this can lead to a credibility dilution effect, where the informational value of environmental labels collapses under excessive noise.

In governance terms, greenwashing exposes the **limits of voluntary, market-based environmental regulation**. While civil-sector initiatives have been effective in creating norms and standards, they lack the coercive authority needed to prevent opportunistic misuse of environmental language by non-participating actors. Greenwashing thus reveals a structural enforcement gap: norms exist, but compliance cannot be ensured solely through reputational mechanisms.

7.3.2 Relationship between green labeling and greenwashing

Green labeling and greenwashing are not opposites operating in isolation; they are **structurally interconnected phenomena** within the same governance environment. Green labeling creates sustainability signals intended to reduce information asymmetry and guide consumer choice. Greenwashing exploits precisely those signals where governance is weak, fragmented, or absent.

The stronger and more valuable sustainability signals become in the marketplace, the greater the incentive for actors to imitate them without bearing their underlying costs. This explains why greenwashing tends to proliferate in sectors with well-recognized labels, growing consumer awareness, and high reputational stakes. In this sense, greenwashing is not an accidental by-product but a predictable outcome of partially regulated sustainability markets.

This structural tension clarifies why **civil-sector initiatives alone cannot guarantee credibility at market scale**. While NGOs, certification bodies, and multi-stakeholder platforms can define standards and verify participants, they cannot prevent non-certified actors from making misleading claims unless supported by public enforcement mechanisms. As markets globalize and digital marketing expands, the reach of greenwashing increasingly exceeds the corrective capacity of voluntary systems.

Consequently, the persistence of greenwashing has driven the shift toward **hybrid governance arrangements**, in which civil-sector innovation is complemented by public regulation. Instruments such as the proposed EU Green Claims Directive respond directly to this structural imbalance by setting minimum substantiation, verification, and governance requirements for environmental claims, thereby protecting both consumers and high-integrity labeling systems from credibility erosion.

7.4 Green Claims Directive: From Greenwashing to Regulated Credibility

7.4.1 A Dedicated Regulatory Framework for Environmental Claims

To address **market failures driven by asymmetric information**, the European Commission proposed the Green Claims Directive in March 2023. The proposal is explicitly framed as a **stand-alone Directive** that complements the wider consumer-law reform on empowering consumers for the green transition. In legal terms, it is intended as **lex specialis**, providing more detailed requirements for substantiating and communicating voluntary environmental claims, while the Unfair Commercial Practices Directive (UCPD) continues to function as the **lex generalis** framework for misleading practices and omissions.

The objectives follow directly from the diagnosis. The Directive aims to: (1) make environmental claims **reliable, comparable and verifiable** across the EU; (2) protect consumers and companies from greenwashing; (3) enable informed purchasing decisions that support the circular and green economy; and (4) establish a more level playing field for firms competing on environmental performance. At the same time, the Commission links the initiative to broader Green Deal priorities and internal market functioning, arguing that credibility rules can support both environmental protection and competitive fairness.

A key design choice is that the instrument is a **Directive**, not a Regulation, because it must plug into enforcement systems that are already built around directive-based consumer protection and national supervisory mechanisms. Harmonisation is pursued through common minimum requirements, while leaving Member States with implementation pathways that fit their enforcement architectures.

7.4.2 Scope and key regulatory measures: turning marketing into verifiable claims

7.4.2.1 Scope: explicit claims in business-to-consumer contexts, with sectoral carve-outs

The Directive applies to **explicit environmental claims in business-to-consumer commercial practices**. “Explicit” is defined broadly: it includes text claims and claims contained in labels. At the same time, the Directive is designed as a safety net: it does not apply where specific EU rules already regulate or substantiate claims (for example, established EU label regimes and certain product-policy frameworks). This layered approach prevents duplication while ensuring that unregulated claims do not escape governance entirely.

7.4.2.2 Substantiation rules: life-cycle logic, boundaries, trade-offs, and offsets

The technical core of the proposal is the substantiation obligation. Traders must carry out an **assessment** before making explicit environmental claims, and that assessment must meet minimum criteria. It must rely on widely recognised scientific evidence, use accurate information and consider relevant standards; it must demonstrate the significance of impacts from a **life-cycle perspective**; and it must make the boundaries of the claim explicit (whole product vs part; whole life cycle vs stage; whole organisation vs subset of activities).

The Directive also requires that substantiation explicitly confronts governance-relevant distortions. Claims cannot merely repackage legal compliance as a distinctive environmental feature. Traders must provide information on whether the product or trader performs significantly better than common practice for the relevant product group or sector, where this is relevant to the claim being made. Most importantly, substantiation must identify potential **trade-offs**: a positive claim in one area must not conceal significant harm in another (e.g., biodiversity, pollution, resource use and circularity, water, or climate impacts).

Climate-related claims receive special treatment where offsets are involved. Offsets must be **separated** from actual greenhouse gas emissions as additional environmental information, and traders must specify whether offsets represent emission reductions or removals and describe how they are of high integrity and correctly accounted for. The governance logic is clear: offsetting cannot function as an unstructured narrative device; it must be disclosed transparently so consumers and authorities can see what is being claimed and on what basis.

The Directive also addresses data realism. Where available, traders should include **primary information**; where primary information is not available, representative **secondary information** may be used. This creates a balance between robustness and feasibility in complex value chains. Microenterprises are exempt from these requirements unless they opt in to verification to obtain an EU-recognised certificate of conformity.

7.4.2.3. Communication rules: meaningful transparency, not just compliant substantiation

Substantiation alone is not enough if consumer-facing communication remains strategically ambiguous. Communication rules therefore require that claims cover only those impacts/aspects/performance that are substantiated and significant, and that consumers are given access to the information needed to understand the basis of the claim. The proposal

anticipates digital and physical communication formats and avoids prescribing a single medium, reflecting stakeholder concerns that rigid formats would be impractical and could undermine effective communication.

7.4.2.4 Label governance and anti-proliferation strategy: from many labels to credible schemes

A distinctive feature of the Green Claims proposal is that it does not treat labels as harmless market signals. It treats them as a governance challenge requiring institutional quality control. Environmental labels are defined as sustainability labels that predominantly cover environmental aspects, and their schemes must meet governance requirements: transparency about ownership and decision-making, expert development of criteria with stakeholder review, complaint and resolution mechanisms, and credible non-compliance responses (withdrawal/suspension in cases of persistent and flagrant non-compliance).

Beyond quality control, the proposal directly targets **proliferation**. It introduces restrictions on new national/regional public schemes and creates approval logic for new schemes, including a role for Member States and the Commission in assessing whether a new label provides added value compared to existing schemes. The Commission is tasked with publishing and updating a list of officially recognised labels allowed on the Union market after transposition.

7.4.2.5 Ex-ante verification and the certificate of conformity: credible signals with cross-border portability

The proposal's central enforcement-support mechanism is **ex-ante verification**. Member States must establish procedures to verify substantiation and communication of claims (and compliance of labelling schemes) before a claim is made public or a label is displayed. Verification is carried out by accredited third-party verifiers, with strict independence and competence requirements. Where the claim/label complies, the verifier issues a **certificate of conformity**.

The certificate is recognised across the EU and notified via the Internal Market Information System (IMI), which aims to reduce fragmentation and improve legal certainty for firms operating across borders. At the same time, the certificate does **not** immunise the trader from assessment under the Unfair Commercial Practices Directive: competent authorities and courts remain able to evaluate misleading practices. This preserves the architecture of hybrid governance—technical certification supports credibility, while general consumer-law enforcement retains its corrective role.

7.4.2.6 Enforcement, complaints, and penalties: making credibility enforceable

The Directive is designed to be enforceable in digital markets and cross-border commerce. Member States must designate competent authorities and provide minimum powers (access to information, investigations, remedies, injunctive relief, and penalties). Authorities must conduct regular market checks and publish reports. Where non-compliance is found, traders must take corrective action within a defined timeframe or cease use of the claim/label.

A major civil-society link is the complaint and access-to-justice mechanism. NGOs and other actors with legitimate interest can submit substantiated complaints; authorities must assess

them and act where necessary; complainants must have access to judicial review where authorities fail to act or make unlawful decisions. In governance terms, this creates a structured pathway for **strategic greenwashing litigation** and administrative triggering by civil actors, embedding public-interest enforcement in the Directive’s architecture.

Penalties are explicitly designed to be dissuasive and to deprive traders of economic benefit from infringement, including fines, confiscation of revenues, and temporary exclusion from public procurement and funding. For widespread infringements with EU dimension, the maximum fines must reach at least a turnover-based level. This penalty logic targets the core incentive problem: greenwashing must be more costly than compliance.

7.4.3 Relationship to civil-sector initiatives: from soft law to stabilised hybrid governance

The Green Claims Directive does not attempt to eliminate civil-sector sustainability governance. Instead, it responds to the limits of purely voluntary signalling by **stabilising credibility through public rules**. Historically, many sustainability labels originated as civil initiatives, filling gaps created by territorially bounded regulation and globalised markets. Yet the Commission’s evidence base shows that unregulated proliferation and uneven verification weaken trust and comparability. The Directive’s answer is not to suppress civil innovation, but to require that environmental labels and claims—where they function as consumer-facing credibility instruments—meet transparent governance and verification standards that can be enforced.

In this sense, high-integrity certification systems such as **FSC** and **PEFC** can be understood as part of the “credible end” of the civil-sector spectrum: they provide governance structures, standards, and auditing systems aimed at producing trustworthy signals in global value chains. The Directive’s logic is to ensure that the market for labels does not reward weak schemes equally with robust ones. Where credible schemes exist, the Directive strengthens their relative competitive position by filtering out unreliable labels and by aligning market communication with minimum governance and verification requirements.

At the same time, the Directive institutionalises a civil role in oversight through complaint rights and access to justice. This means the civil sector remains not only an originator of standards but also a **watchdog** capable of triggering enforcement and judicial review—an explicit bridge between civil accountability and public authority.

7.4.4 EU Ecolabel and EMAS under the Green Claims Framework

Within the architecture established by the Green Claims Directive, **EU-level environmental schemes function as benchmarks for credible voluntary participation under public law**. The Commission explicitly acknowledges that the internal market already contains a number of harmonised labelling and management instruments that provide robust rules on substantiation, verification, and governance. Accordingly, the scope provisions of the Directive

exclude environmental claims that are already regulated or substantiated under certain EU legal regimes, including the EU Ecolabel and EMAS.

This approach reflects a deliberate **governance hierarchy**. Where comprehensive EU frameworks already ensure methodological rigour, independent verification, and public oversight, the Green Claims Directive does not seek to duplicate or replace them. Instead, it operates as a complementary regulatory layer, addressing the large remainder of voluntary environmental claims that fall outside established EU schemes. In this sense, the Directive functions as a stabilising mechanism for the broader claims landscape, while EU-run schemes serve as reference models for credibility, transparency, and accountability.

The **EU Ecolabel** represents the most developed example of an EU-wide voluntary product label for environmental excellence. It is based on harmonised, life-cycle-oriented criteria adopted at Union level and applied consistently across Member States. Governance is ensured through transparent decision-making, stakeholder involvement, and independent verification by competent bodies. By enabling comparability across borders and product groups, the EU Ecolabel addresses one of the central failures of purely national or private labeling systems: the fragmentation of standards within the internal market.

Within the broader logic of the Green Claims framework, the EU Ecolabel illustrates the **direction of regulatory evolution**: from fragmented, voluntary sustainability signals toward environmental communication anchored in clearly defined criteria, institutional oversight, and enforceable verification requirements. It demonstrates how voluntary participation can be combined with strong public credibility safeguards, ensuring that environmental claims remain meaningful and comparable for consumers.

EMAS (Eco-Management and Audit Scheme) fulfils a complementary role at the organisational level. Rather than certifying individual product claims, EMAS provides a structured system for environmental management, performance monitoring, and public reporting at the level of the organisation. Participation requires the implementation of an environmental management system, the preparation of an environmental statement, and verification by an accredited third party, followed by registration with public authorities.

In the governance narrative of this chapter, EMAS exemplifies a demanding form of voluntary participation that prioritises **continuous improvement, transparency, and accountability** over one-off marketing assertions. Environmental performance under EMAS is not communicated through simplified slogans, but through validated and publicly accessible information that is periodically reviewed. This sharply contrasts with unsubstantiated environmental claims and illustrates why EMAS-based communication is excluded from the scope of the Green Claims Directive.

Together, the EU Ecolabel and EMAS demonstrate how **voluntary instruments can be institutionally robust when embedded in public governance structures**. They also clarify the role of the Green Claims Directive: not to replace such schemes, but to extend minimum credibility requirements to the wider universe of environmental claims that lack comparable governance safeguards. In doing so, the Directive protects both consumers and high-integrity

schemes from the erosion of trust caused by weak or misleading environmental communication.

7.4.5 Governance significance: credibility consolidation in globalised markets

The Green Claims Directive is best understood as a **credibility-consolidation instrument** in a multi-level governance system. Civil society and multi-stakeholder actors pioneered many standards and labels, markets diffused them through supply chains, and public authority now intervenes to stabilise the signalling environment. This intervention reflects the structural limits of national regulation in global markets: claims circulate transnationally, labels multiply, and enforcement gaps can be exploited—especially online.

The Directive therefore combines multiple governance logics into a single framework:

- **Market governance**, by treating claims and labels as signals that need credibility conditions;
- **Administrative governance**, through competent authorities, monitoring, corrective action, and penalties;
- **Conformity-assessment governance**, through accredited verifiers and certificates of conformity recognised across borders;
- **Civil accountability**, by embedding complaint rights and access to justice for NGOs and other actors with legitimate interest;
- **Adaptive governance**, by requiring monitoring, EEA reporting, and evaluation/review clauses that allow the regime to tighten as the claims market evolves (including potential future harmonisation of methods and rules for specific claim types).

In short, the Green Claims Directive marks a shift from green marketing as voluntary speech toward **environmental communication as a regulated credibility domain**. It does not end civil-sector innovation; it changes the environment in which innovation competes, by rewarding robust substantiation and governance while making weak or misleading claims more costly and more contestable across the internal market.

Core Concepts and Review Questions – Chapter 7

1. Which description best defines the civil sector in nature conservation policy?

The civil sector in nature conservation policy consists of non-state, non-profit actors such as environmental NGOs, consumer and public-interest organizations, certification bodies, professional associations, and litigation-oriented civil groups. These actors operate independently from both government institutions and profit-driven enterprises, yet play a significant role in shaping environmental outcomes. Rather than exercising formal regulatory authority, the civil sector influences policy, markets, and public behaviour through advocacy, standard-setting, monitoring, litigation, and reputational pressure. Historically, many sustainability norms and governance instruments now embedded in public policy—such as sustainable forest management or biodiversity safeguards—originated within this sphere before being taken up or formalised by public authorities.

2. How do civil-sector actors typically influence nature conservation outcomes despite lacking formal regulatory authority?

Civil-sector actors influence nature conservation through a combination of normative, market-based, and judicial mechanisms. They contribute to norm creation and diffusion, develop voluntary standards and certification schemes that condition market access, and use strategic litigation to enforce environmental law where public enforcement is weak or ineffective. In addition, civil actors mobilise public opinion and reputational pressure, shaping both corporate behaviour and political agendas. Through these pathways, they exert indirect but often substantial influence over environmental governance, particularly in globalised systems where state regulation alone is insufficient.

3. What is meant by “normative governance” in environmental policy?

Normative governance refers to the process by which shared understandings of environmentally responsible behaviour are defined, articulated, and diffused by actors with legitimacy and knowledge authority. It operates through sustainability principles, ethical norms, and performance standards rather than legal coercion. Concepts such as sustainable forest management, ecosystem integrity, or biodiversity-friendly production emerged through normative governance before becoming embedded in public regulation or market standards. Its influence lies in shaping expectations and guiding behaviour across policy, markets, and society.

4. What best characterizes “market governance” in nature conservation?

Market governance in nature conservation is characterised by voluntary standards, certification schemes, and eco-labels that embed environmental norms directly into economic transactions. These instruments influence market access, procurement decisions, investment flows, and consumer choice by making compliance with environmental criteria a condition for participation or competitive advantage. Unlike binding regulation, market governance relies on

incentives, reputational effects, and contractual relationships, allowing sustainability norms to operate across global value chains even where public authority is fragmented or limited.

5. What best describes “judicial governance” by civil actors?

Judicial governance refers to the use of courts and legal procedures by civil actors to advance environmental protection and enforce existing legal obligations. Through strategic litigation, NGOs and public-interest groups challenge environmentally harmful practices, compel regulatory compliance, and seek authoritative interpretations of environmental law. Courts thus become arenas of environmental governance, where otherwise soft norms are subjected to binding legal scrutiny. Judicial governance strengthens accountability and can partially compensate for weaknesses in administrative enforcement.

6. What is strategic environmental litigation primarily aimed at?

Strategic environmental litigation is primarily aimed at achieving broader public-interest environmental outcomes rather than individual compensation. Such litigation seeks to enforce environmental law, clarify legal obligations, deter environmentally harmful practices, and induce systemic improvements in governance and corporate behaviour. By focusing on precedent-setting issues and structural failures, strategic cases can reshape regulatory interpretation and strengthen environmental protection across sectors and jurisdictions.

7. Why do green labels exist as governance tools in consumer markets?

Green labels exist to reduce information asymmetry between producers and consumers by translating complex, multi-dimensional environmental impacts into simplified and recognisable signals. Most consumers lack the technical expertise to assess life-cycle impacts, biodiversity effects, or supply-chain management, and labels function as credibility devices that support informed purchasing decisions. From a governance perspective, green labels embed environmental norms into market transactions, influencing demand, procurement, and corporate strategies without relying solely on state enforcement.

8. What structural problem makes national regulation alone insufficient for governing sustainability claims in global value chains?

The core structural problem is that production, processing, and marketing increasingly operate across borders, while legal jurisdiction and enforcement remain territorially limited. Environmental claims and labels circulate globally, but national authorities can regulate only within their own territory. This mismatch creates governance gaps in which misleading, inconsistent, or unverifiable sustainability claims can proliferate across value chains, undermining both consumer protection and environmental credibility.

9. Which is a core reason civil-sector labeling schemes emerged historically?

Civil-sector labeling schemes emerged to fill governance gaps where global or intergovernmental regulation was weak, fragmented, or unenforceable. In sectors such as forestry and fisheries, international agreements failed to provide binding and effective sustainability standards, prompting NGOs, producers, and other civil actors to develop

transnational certification systems. These schemes created common criteria and verification mechanisms where state-based governance was absent or insufficient.

10. Which feature is most typical of high-integrity certification systems?

High-integrity certification systems are distinguished by independent third-party verification of compliance with clearly defined environmental and social requirements. Verification is carried out by accredited auditors who operate independently from producers and standard-setters, reducing the risk of conflicts of interest. When embedded in transparent criteria and governance frameworks, third-party verification provides assurance that exceeds the credibility of self-reported claims.

11. Which aspect best distinguishes FSC and PEFC as governance models?

FSC is typically NGO-driven and based on globally defined principles and criteria developed through a formal multi-stakeholder governance structure. PEFC, by contrast, endorses nationally developed forest management standards within a shared international framework, allowing adaptation to local ecological conditions, ownership structures, and socio-economic contexts. This distinction reflects different governance logics: FSC emphasises global uniformity and environmental ambition, while PEFC prioritises inclusiveness and scalability.

12. What is a major strength of voluntary green labeling schemes?

A major strength of voluntary green labeling schemes is their ability to spread rapidly across borders and markets, often faster than treaty-based or legislative regulation. Their flexibility allows innovation, adaptation, and global reach in sectors characterised by complex supply chains. As a result, they can mainstream sustainability considerations even in the absence of binding international law.

13. What is a major limitation of green labeling as a governance approach?

A key limitation is that voluntary participation and uneven methodological rigor across schemes can lead to fragmentation, proliferation, and consumer confusion. When multiple labels coexist with varying standards and verification quality, trust erodes and comparability declines. This weakens the signalling function of green labels and creates opportunities for low-credibility schemes and greenwashing.

14. What is greenwashing?

Greenwashing refers to misleading, vague, exaggerated, or unsubstantiated environmental claims made to portray products, services, or organisations as more environmentally benign than they actually are. Such claims aim to capture reputational or market advantages associated with sustainability without corresponding substantive changes in production or management. Greenwashing undermines trust in environmental communication and distorts governance incentives.

15. Which practice is a classic greenwashing technique?

A classic greenwashing technique is selective disclosure, where a single positive environmental attribute is highlighted while significant negative impacts are omitted. This creates a misleading overall impression of environmental performance and exploits consumers' limited ability to assess environmental trade-offs.

16. Why is greenwashing a governance problem, not just a marketing problem?

Greenwashing undermines the credibility of environmental information, distorts competition by rewarding symbolic claims over real improvements, and weakens incentives for firms to invest in genuine sustainability. As trust erodes, even high-integrity schemes and responsible producers suffer reduced returns. These systemic effects make greenwashing a governance failure with direct implications for environmental outcomes.

17. How are green labeling and greenwashing structurally related in markets?

Green labeling and greenwashing are structurally linked because valuable sustainability signals create incentives for imitation without compliance when oversight is weak. As labels gain reputational value, some actors attempt to mimic their language or appearance without meeting their standards. Greenwashing thus emerges as a predictable by-product of partially regulated sustainability markets.

18. What is the main policy rationale for an EU-level framework on environmental claims?

The main policy rationale is to ensure that environmental claims are comparable, verifiable, and enforceable across the internal market. An EU-level framework reduces fragmentation, strengthens consumer trust, and creates a level playing field for companies competing on environmental performance, while supporting broader Green Deal objectives.

19. What is the Green Claims Directive proposal mainly intended to address?

The proposal addresses the widespread problem of vague or unfounded environmental claims, uncontrolled label proliferation, and declining consumer trust. By introducing common substantiation, verification, and governance requirements, it aims to curb greenwashing and stabilise the credibility of environmental communication across the EU.

20. Which claims are the primary focus of the Green Claims Directive proposal?

The proposal focuses on explicit environmental claims made to consumers in business-to-consumer contexts, including textual claims and labels that directly influence purchasing decisions. Claims already regulated under specific EU legal frameworks are generally excluded to avoid duplication.

21. What is the core obligation introduced for making explicit environmental claims under the Green Claims Directive proposal?

The core obligation is that environmental claims must be substantiated in advance using recognised scientific evidence and minimum methodological criteria. This shifts environmental

communication from self-declared marketing toward evidence-based, verifiable claims assessed before market use.

22. Why does the Green Claims Directive proposal emphasize life-cycle logic and claim boundaries?

Life-cycle logic and clear claim boundaries ensure that environmental claims specify exactly what they cover and do not imply broader benefits than supported by evidence. This prevents misleading generalisation and improves transparency for consumers and enforcement authorities.

23. How does the Green Claims Directive proposal address environmental trade-offs in claims?

The proposal requires that substantiation does not conceal significant harms in other environmental impact areas. A positive claim in one domain must not obscure serious negative effects elsewhere, reinforcing holistic assessment rather than selective communication.

24. How are climate claims involving offsets treated in the Green Claims Directive proposal's logic?

Offset-based claims must be clearly separated from a company's own emissions and described transparently. This allows consumers to distinguish between actual emission reductions and offsetting measures and prevents offsets from functioning as vague credibility shortcuts.

25. What is the Green Claims Directive proposal's key credibility mechanism before a claim or label is used?

The key mechanism is ex-ante verification by an accredited independent verifier, resulting in a certificate of conformity. This ensures that claims meet minimum credibility requirements before being communicated to consumers.

26. What is the function of the certificate of conformity in the Green Claims Directive proposal?

The certificate of conformity provides an evidence-backed credibility signal recognised across the EU, supporting cross-border consistency, legal certainty, and enforcement while not replacing ongoing market surveillance or consumer-law controls.

27. Why does the Green Claims Directive proposal include governance rules for environmental label schemes (not just individual claims)?

Because labels can proliferate without oversight and vary widely in rigor, governance rules are necessary to prevent confusion, weak schemes, and credibility dilution. Label governance addresses structural risks that cannot be resolved by assessing individual claims alone.

28. What enforcement role is explicitly strengthened for civil society under the Green Claims Directive proposal's logic?

Civil society is empowered through formal complaint mechanisms and access to judicial review when authorities fail to act. This embeds civil accountability into enforcement and strengthens oversight against greenwashing.

29. Which penalty logic best matches the Green Claims Directive proposal's intent?

Penalties are designed to be dissuasive and to remove the economic benefits of infringement, ensuring that greenwashing becomes more costly than compliance and discouraging opportunistic behaviour.

30. Why are EU-run schemes like the EU Ecolabel and EMAS treated differently from many private claims?

They are treated differently because they operate with harmonised criteria, independent verification, and public oversight, which significantly reduces greenwashing risk and ensures high credibility within the internal market.

31. What best distinguishes EMAS from a product eco-label?

EMAS (Eco-Management and Audit Scheme) is an organisation-level environmental management and reporting system that requires the implementation of a comprehensive environmental management system, monitoring of overall environmental performance, publication of a verified environmental statement, and regular independent audits. Its focus is on continuous improvement, transparency, and accountability across the entire organisation rather than on individual products. By contrast, a product eco-label is attached to a specific product or service and signals compliance with predefined environmental criteria for selected life-cycle stages or impact categories. Eco-labels function primarily as consumer information tools, whereas EMAS governs organisational behaviour and environmental performance over time.

8. Ecological Economics in Sustainability Governance: Ecosystem Services, Circularity and the Bioeconomy

8.1 Ecological Economics: The Foundational Paradigm

8.1.1 Definition and intellectual roots

Ecological economics is an interdisciplinary field that studies economic systems as **subsystems of the Earth's ecological system**, subject to biophysical laws and ecological limits. It emerged in the late twentieth century at the intersection of economics, ecology, systems theory, and thermodynamics, drawing on contributions from scholars such as Nicholas Georgescu-Roegen, Herman Daly, and Kenneth Boulding.

A core insight of ecological economics is that economic activity involves the transformation of **energy and materials** drawn from the environment into goods, services, and waste. This process is governed by the laws of thermodynamics, particularly the second law, which implies that energy and material transformations are irreversible and generate entropy. As a result, economic processes inevitably degrade natural resources and ecosystems, placing physical limits on growth in material throughput.

This perspective contrasts with **environmental economics**, which typically operates within the neoclassical framework and focuses on correcting market failures through pricing mechanisms, such as taxes, subsidies, and emissions trading. While environmental economics assumes that natural capital can largely be substituted by manufactured capital or technology, ecological economics questions this assumption, especially where critical ecosystem functions are concerned.

Ecological economics therefore shifts the analytical focus from marginal efficiency to **system-scale sustainability**, emphasising long-term viability over short-term optimisation.

8.1.2 Core principles of ecological economics

Several core principles distinguish ecological economics and are particularly relevant for sustainability policy in the EU.

Strong sustainability

Ecological economics is grounded in the concept of strong sustainability, which holds that certain forms of natural capital—such as climate regulation, biodiversity, fertile soils, and freshwater systems—are non-substitutable. Losses in these systems cannot be fully compensated by technological progress or financial capital, making their preservation a precondition for sustainable development.

Scale, allocation, and distribution

Ecological economics differentiates between three fundamental economic questions:

- Scale: How large can the economy be relative to the biosphere without undermining ecological stability?
- Allocation: How should resources be allocated efficiently within that scale?
- Distribution: How should benefits and burdens be distributed within and across generations?

In this framework, scale is the primary constraint, setting the boundaries within which allocation and distribution take place.

Throughput and material flows

Rather than focusing solely on monetary indicators such as GDP, ecological economics emphasises **material and energy throughput**—the physical flow of resources from extraction to waste. Sustainability requires not only relative efficiency improvements but often **absolute reductions** in throughput to remain within planetary boundaries.

Precaution and irreversibility

Ecological systems often exhibit thresholds and tipping points beyond which changes become irreversible. Given scientific uncertainty and the potential for catastrophic outcomes, ecological economics supports a **precautionary approach** to decision-making, prioritising risk avoidance over ex post correction.

8.1.3 Policy implications of ecological economics

The ecological economics perspective has profound implications for public policy.

First, it challenges the idea that **prices alone can ensure sustainability**. Many environmental values—such as ecosystem resilience or biodiversity—are difficult or inappropriate to monetise, and market signals often fail to reflect long-term or systemic risks. As a result, relying exclusively on price-based instruments can lead to delayed or insufficient action.

Second, ecological economics highlights the central role of **institutions, regulation, and planning** in shaping economic activity. Rules governing product design, land use, resource extraction, and waste management are essential to align economic systems with ecological constraints. Markets function within these institutional frameworks rather than independently of them.

Third, the concept of a **safe operating space**—closely related to planetary boundaries—provides a normative and analytical basis for sustainability governance. Policy objectives should be defined not only in terms of efficiency or growth but also in terms of maintaining economic activity within biophysical limits that safeguard ecosystem functioning and human well-being.

In the EU context, these insights underpin the shift toward systemic policy frameworks such as the Circular Economy Action Plan and the Bioeconomy Strategy. Both strategies can be understood as applied expressions of ecological economics, translating abstract principles into concrete rules governing materials, products, land use, and industrial systems.

8.2 Ecosystem Services: Linking Ecology and the Economy

8.2.1 Concept and definition

The concept of **ecosystem services** provides a structured way to describe how ecosystems contribute to human well-being and economic activity. Ecosystem services are the **direct and indirect benefits that humans derive from ecosystems**, including material goods, regulatory functions, and non-material values. This concept has become a central bridge between ecology, economics, and policy, making the dependence of economic systems on healthy ecosystems explicit.

Within ecological economics, ecosystem services are understood as **flows of benefits generated by stocks of natural capital**. Natural capital refers to the biophysical assets of the Earth system—such as forests, soils, wetlands, rivers, oceans, and biodiversity—from which ecosystem services arise. Unlike manufactured capital, natural capital is often self-regenerating but only within ecological limits. When these limits are exceeded, ecosystem functions can degrade or collapse, reducing the flow of services and undermining economic and social systems.

The ecosystem services framework challenges the conventional economic view that nature is merely an input to production. Instead, it emphasises that ecosystems perform **life-support functions**—such as climate regulation, nutrient cycling, and water purification—that are foundational to all economic activity and cannot be fully replaced by technological solutions.

8.2.2 Typology of ecosystem services

Ecosystem services are commonly classified into four broad categories, reflecting different ways in which ecosystems support human societies and economies.

Provisioning services

Provisioning services are material outputs from ecosystems that are directly used or consumed by humans. These include food, fresh water, timber, fibre, biomass for energy, and genetic resources. Provisioning services are most directly linked to markets and economic production and form the biophysical basis of sectors such as agriculture, forestry, fisheries, and the bioeconomy.

Regulating services

Regulating services are benefits obtained from the regulation of ecological processes. They include climate regulation through carbon sequestration, flood control, erosion prevention, water purification, pollination, and disease regulation. These services often operate at larger

spatial and temporal scales and are critical for maintaining environmental stability and reducing risks to economic systems. Their degradation can lead to high social and economic costs, often far exceeding the value of provisioning services.

Cultural services

Cultural services encompass the non-material benefits people derive from ecosystems, including recreation, aesthetic enjoyment, cultural identity, spiritual values, and educational opportunities. Although these services are less tangible and harder to quantify, they play an important role in quality of life, social cohesion, and regional development, particularly in rural and peri-urban areas.

Supporting services

Supporting services, such as soil formation, primary production, and nutrient cycling, underpin all other ecosystem services. By sustaining core ecosystem processes and functions, they make the ongoing delivery of provisioning, regulating, and cultural services possible. While sometimes excluded from direct valuation to avoid double counting, supporting services are fundamental to long-term sustainability.

This typology highlights the multifunctional nature of ecosystems and underscores the fact that economic activities often depend simultaneously on multiple service categories.

8.2.3 Ecosystem services in policy and economics

The integration of ecosystem services into economic analysis and public policy raises important conceptual and practical questions.

One key debate concerns **valuation versus non-monetary recognition**. Economic valuation methods—such as market pricing, avoided cost, and willingness-to-pay approaches—can help make ecosystem services visible in decision-making processes dominated by financial metrics. However, ecological economics cautions against overreliance on monetisation, as many ecosystem services involve ethical, cultural, and ecological values that cannot be adequately captured in monetary terms. Non-monetary indicators, qualitative assessments, and participatory approaches therefore play a complementary role.

Another central issue is the management of **trade-offs and synergies** among ecosystem services. Land-use decisions, for example, often increase provisioning services (such as food or biomass production) at the expense of regulating or cultural services (such as biodiversity, carbon storage, or landscape values). Conversely, well-designed management strategies can generate synergies, such as agroforestry systems that enhance production while improving soil health and climate regulation. Recognising and managing these trade-offs is a core challenge for sustainable land-use governance.

Ecosystem services are increasingly embedded in **EU land-use and climate policy**. In climate mitigation and adaptation, regulating services such as carbon sequestration, flood regulation, and microclimate control play a critical role. In land-use policy, ecosystem services inform

spatial planning, nature restoration, and sustainable resource management. Concepts such as nature-based solutions, green infrastructure, and carbon farming are direct applications of ecosystem services thinking in EU policy frameworks.

Within the broader context of ecological economics, ecosystem services provide a practical lens for translating abstract ecological limits into **policy-relevant concepts**. They help align economic activities with ecological functions and support integrated strategies such as the EU Bioeconomy Strategy and the Circular Economy Action Plan, which depend on maintaining healthy ecosystems to achieve long-term sustainability.

8.3 The Circular Economy: Reducing Throughput in Material Systems

8.3.1 Definition and evolution of the circular economy concept

The **circular economy** refers to an economic system designed to maintain the value of products, materials, and resources for as long as possible, while minimising waste generation and environmental impacts. Unlike the traditional linear model—based on extraction, production, consumption, and disposal—the circular economy seeks to **slow, narrow, and close material loops** across the economy.

Historically, circular economy thinking emerged from waste management and industrial ecology, focusing on recycling and improved waste treatment. Over time, the concept has evolved toward a **systemic transformation framework** that addresses upstream design choices, business models, and consumption patterns. This shift reflects growing recognition that recycling alone cannot offset rising material demand and that environmental impacts are largely determined before products become waste.

It is therefore important to distinguish the circular economy from a narrow **recycling economy**. While recycling is a necessary component of circularity, a recycling-focused approach remains reactive and energy-intensive, often involving material downcycling. The circular economy prioritises prevention, reuse, repair, and remanufacturing, with recycling positioned as a last resort rather than a primary solution.

8.3.2 Core principles of the circular economy

Several core principles define circular economy strategies and distinguish them from conventional resource efficiency approaches.

Design for durability, reparability, and reuse

Product design plays a decisive role in determining material use and waste generation. Circular economy strategies promote products that last longer, can be easily repaired or upgraded, and are suitable for multiple use cycles. This reduces the need for new resource extraction and lowers lifecycle environmental impacts.

Closing material loops

Circularity aims to keep materials circulating within the economy at their highest possible value. This includes reuse of products, remanufacturing of components, and high-quality recycling that preserves material properties. Closed loops reduce dependence on primary raw materials and mitigate supply risks.

Secondary raw materials and waste prevention

A functioning circular economy depends on reliable markets for secondary raw materials. However, waste prevention remains the highest priority. Preventing waste through better design, longer product lifetimes, and changes in consumption patterns delivers greater environmental benefits than managing waste after it occurs.

Together, these principles reorient material systems away from throughput expansion toward value retention and efficiency within ecological limits.

8.3.3 The circular economy from an ecological economics perspective

From the perspective of ecological economics, the circular economy is primarily a tool for **managing the scale of material throughput** in the economy.

A key distinction is between **relative and absolute decoupling**. Relative decoupling occurs when resource use grows more slowly than economic output, while absolute decoupling implies a reduction in total material use despite economic activity. Ecological economics emphasises that sustainability requires absolute reductions in material throughput, particularly in high-income economies, to remain within planetary boundaries.

Circularity contributes to this objective by extending product lifetimes and reducing demand for virgin materials. However, ecological economics also highlights potential **rebound effects**, whereby efficiency gains lower costs and stimulate increased consumption, partially or fully offsetting environmental benefits. Without complementary policies—such as regulatory limits, pricing, or sufficiency-oriented measures—circular strategies alone may fail to deliver absolute reductions.

In this sense, the circular economy should be understood as a **scale-management tool**, effective when embedded in broader governance frameworks that define ecological limits and align economic incentives accordingly.

8.4 The Bioeconomy: Governance of Biological Resources and Biogenic Carbon

8.4.1 Definition of the bioeconomy

The **bioeconomy** encompasses economic activities that use renewable biological resources—such as plants, animals, microorganisms, and derived biomass—to produce food, materials, chemicals, energy, and services. Central to the bioeconomy is the use of **biogenic carbon**,

which is part of the natural carbon cycle, in contrast to fossil carbon extracted from geological reservoirs.

The scope of the bioeconomy spans multiple sectors, including agriculture, forestry, fisheries and aquaculture, industrial biotechnology, biomanufacturing, bio-based materials, and bioenergy. In policy terms, the bioeconomy is often presented as a pathway for reducing fossil resource dependence, fostering innovation, and supporting rural development.

8.4.2 Evolution of bioeconomy thinking

Early bioeconomy narratives were strongly **innovation- and technology-focused**, emphasising biotechnology, bio-based products, and new value chains as engines of green growth. These approaches often assumed that substituting fossil-based inputs with biological ones would automatically yield environmental benefits.

Over time, this perspective has evolved in response to concerns about land-use change, biodiversity loss, and competing demands for biomass. Contemporary bioeconomy strategies, particularly in the EU, place greater emphasis on **sustainability governance**, recognising that biological resources are finite and multifunctional. The focus has shifted from expansion toward efficiency, prioritisation, and integration with environmental and climate objectives.

8.4.3 The bioeconomy in ecological economics

From an ecological economics perspective, the bioeconomy is not inherently sustainable. Its environmental performance depends on how biological resources are sourced, allocated, and governed.

Biomass as a constrained resource

Ecological economics emphasises that biomass availability is limited by ecological regeneration rates, land availability, and competing ecosystem functions. Treating biomass as an unlimited substitute for fossil resources risks exceeding ecological boundaries and undermining ecosystem services.

Cascading use and efficiency logic

The principle of cascading use prioritises higher-value, longer-lived applications of biomass—such as construction materials or durable products—over short-lived uses like energy generation. This reflects an efficiency-oriented allocation of scarce biological resources consistent with ecological economics.

Land-use, biodiversity, and climate trade-offs

Bioeconomy expansion can create trade-offs between production, biodiversity conservation, and climate mitigation. For example, increased biomass harvesting may reduce carbon sinks or

threaten habitats. Ecological economics stresses the need to manage these trade-offs through integrated land-use planning and sustainability criteria.

This analysis underscores that the bioeconomy should not be equated with “green growth” by default but requires careful governance to align economic activities with ecological limits.

8.5 Complementarity and Tensions: Circular Economy and Bioeconomy Together

The circular economy and the bioeconomy address sustainability challenges from **distinct but complementary angles**.

The circular economy focuses on **reducing material and energy throughput** by extending product lifetimes, closing material loops, and preventing waste. In contrast, the bioeconomy aims to **change the nature of inputs**, replacing fossil-based resources with renewable biological ones.

From an ecological economics perspective, both strategies are necessary. Circularity reduces pressure on ecosystems by limiting overall resource use, while the bioeconomy enables decarbonisation of sectors where material and chemical functions cannot be easily electrified. When properly aligned, the two approaches can reinforce each other within a constrained and sustainability-oriented economic system.

8.6 Translating Sustainability Concepts into EU Policy Architecture

The preceding sections established a conceptual toolkit for analysing sustainability transitions in policy-relevant terms. **Ecological economics** provides the overarching framing: the economy is embedded in the biosphere and must operate within biophysical limits, implying that sustainability is ultimately a question of managing the **scale** of material and energy throughput. **Ecosystem services** translate this framing into an applied language of benefits, risks, and dependencies, showing how economic activity relies on ecological functions that are not fully substitutable by technology or capital. Building on these foundations, the **circular economy** and the **bioeconomy** emerge as two major transition pathways: circularity seeks to reduce throughput by preventing waste and retaining value in materials and products, while the bioeconomy seeks to transform the carbon and material basis of production by shifting from fossil to renewable biological resources.

Yet conceptual coherence does not, by itself, generate systemic change. Sustainability transitions require **institutional design**: rules, standards, incentives, and coordination mechanisms capable of reshaping production systems, consumption patterns, innovation trajectories, and investment decisions. This need is particularly acute in the European Union. The EU is characterised by a highly integrated internal market and tightly interconnected value chains, but also by major diversity among Member States in biomass availability, industrial structure, technological capacity, land-use patterns, and administrative practice. As a result,

sustainability governance cannot rely solely on decentralised experimentation or voluntary initiatives; it also requires EU-level frameworks that provide common direction, reduce fragmentation, and create predictable conditions for investment and innovation.

In this context, EU strategies function as more than policy declarations. They operate as **policy architectures** that integrate multiple instruments—product regulation, standardisation, market surveillance, public procurement, research and innovation funding, State aid rules, sustainable finance, and monitoring systems—into coordinated packages. Strategies also play an agenda-setting role: they define a shared diagnosis of the problem, identify leverage points, and prioritise sectors where intervention can trigger economy-wide effects. Crucially, they provide a bridge between environmental objectives (climate neutrality, biodiversity protection, zero pollution) and industrial and competitiveness objectives (innovation deployment, market scale-up, resilience, and strategic autonomy). This dual positioning is increasingly central to EU governance under the European Green Deal and related industrial policy frameworks.

The EU’s **Bioeconomy Strategy** and **Circular Economy Action Plan** represent two cornerstone examples of this architecture-building approach. Both respond to the ecological economics insight that marginal efficiency improvements are insufficient when resource extraction, material processing, and waste generation continue to rise. Both therefore shift the governance focus upstream—from end-of-pipe environmental management toward design, market formation, and system transformation. At the same time, each strategy targets a different structural dimension of the transition. The Bioeconomy Strategy addresses how Europe mobilises and governs biological resources, develops biotechnology and biomanufacturing capacity, and substitutes fossil carbon in materials, chemicals, and construction. The Circular Economy Action Plan addresses how Europe reduces material throughput by redesigning products and value chains, strengthening secondary raw materials markets, and preventing waste at source. Their interaction is therefore central to policy coherence: a bioeconomy that scales without circularity risks overexploiting biomass and ecosystems, while circularity without bio-based substitution may leave fossil carbon locked into key material systems.

The following two chapters examine these strategies in detail as governance frameworks. They focus on how each strategy defines its scope and objectives, how it constructs implementation logic through specific instruments and priority sectors, and how it seeks to balance competitiveness with ecological constraints.

8.7 The EU Bioeconomy Strategy: Content, Structure and Policy Logic

8.7.1 Strategic rationale and positioning

The EU Bioeconomy Strategy defines the bioeconomy as a strategic pathway for economic transformation that mobilises Europe’s biological resources, scientific capacity, and industrial ecosystems to generate prosperity while reducing dependence on fossil-based materials and energy carriers. In contrast to earlier bioeconomy concepts—often centred on biotechnology research or sector-specific innovation—the current strategy positions the bioeconomy as a core pillar of EU industrial, climate, and resilience policy.

The strategy responds to three interlinked challenges. First, the climate challenge requires deep decarbonisation not only of energy systems but also of materials, chemicals, construction, and food systems—domains in which carbon is structurally embedded. Second, the competitiveness challenge reflects intensifying global competition, particularly from the United States and China, in biotechnology, biomanufacturing, and advanced materials. Third, the resilience and strategic autonomy challenge stems from Europe’s dependence on imported fossil resources and critical raw materials, combined with increasing exposure to climate-related, geopolitical, and supply-chain shocks.

The bioeconomy is therefore framed not as a niche environmental policy but as a cross-sectoral economic strategy encompassing primary production (agriculture, forestry, fisheries and aquaculture), industrial biotechnology, biomanufacturing, and downstream bio-based materials and services. Crucially, sustainability constraints—planetary boundaries, ecosystem integrity, and finite biomass availability—are treated as structural conditions shaping feasible development pathways rather than as externalities to be corrected *ex post*. This marks a shift from expansion-oriented bioeconomy narratives toward a governed, efficiency-oriented, and nature-conscious model.

8.7.2 Definition of the bioeconomy in the Communication

The Communication defines the bioeconomy as the set of activities that deliver sustainable solutions based on biological resources to produce products, services, science, and technologies across multiple sectors. These activities span the full value chain, from biomass production to processing, manufacturing, and service provision.

Biological resources are understood broadly and functionally. They include living organisms and genetic resources; primary biomass from agriculture, forestry, fisheries, and aquaculture; secondary biomass such as residues, by-products, and bio-waste; and biogenic carbon, including carbon captured and utilised through biological and hybrid bio-based technologies.

This definition integrates material production, biotechnology, and carbon management within a single conceptual framework. The bioeconomy is therefore not limited to the use of biomass as a raw material but encompasses how biological carbon is mobilised, transformed, circulated, stored across economic systems and how it substitutes for fossil carbon.

The bioeconomy comprises economic activities that use biological resources and biogenic carbon to produce sustainable products, services, and technologies across multiple sectors. It spans the full value chain from biomass production to processing and manufacturing, integrating material production, biotechnology, and carbon management to substitute for fossil-based resources and circulate biological carbon within the economy.

8.7.3 Why the bioeconomy matters in EU policy

The Communication emphasises the strategic relevance of the bioeconomy because it simultaneously advances climate, economic, and security objectives.

From a climate perspective, the bioeconomy enables decarbonisation in sectors where electrification alone is insufficient, including chemicals, materials, construction, fertilisers, and parts of the food system. Bio-based materials can substitute fossil-based inputs, while selected applications—particularly in construction—allow long-term storage of biogenic carbon, complementing emission-reduction strategies.

From an economic and industrial perspective, the bioeconomy builds on Europe’s comparative advantages in science, technology, and sustainable land and marine management. The strategy explicitly links bioeconomy development to value creation, innovation, and employment, particularly in rural, coastal, and industrial transition regions.

From a resilience and strategic autonomy perspective, the bioeconomy reduces dependence on imported fossil fuels, petrochemicals, and certain critical raw materials. By strengthening domestic and regional value chains, it contributes to supply security and mitigates exposure to geopolitical and climate-related disruptions.

8.7.4 Vision for the EU bioeconomy in 2040

The Communication articulates a long-term vision for the European bioeconomy in 2040, providing strategic direction rather than legally binding targets.

By 2040, bio-based materials and products—including construction materials, chemicals, textiles, plastics, fertilisers, and plant protection products—are widely deployed and competitive within the EU internal market. Integrated biorefineries and advanced fermentation facilities operate at industrial scale, converting diverse and sustainable feedstocks into high-value products. Biotechnology and biomanufacturing, supported by enabling frameworks such as the Biotech Acts, function as key drivers of productivity, scalability, and cost reduction.

Agriculture, forestry, and aquatic systems supply most of Europe’s biomass needs through sustainable domestic production, underpinned by climate-resilient, knowledge-based management. The systematic use of residues and by-products increases resource efficiency while strengthening Europe’s position in global markets. At international level, the EU acts as a leading exporter of sustainable bio-based technologies, standards, and governance approaches, shaping global bioeconomy development.

8.7.5 The four strategic pillars of the Bioeconomy Strategy

8.7.5.1 Scaling innovation and investments: from laboratory to industrial deployment

A central diagnosis of the Bioeconomy Strategy is the persistence of structural investment bottlenecks, commonly described as “valleys of death”. These arise, first, between pilot or demonstration phases and the first commercial-scale facility, and second, between initial market entry and full industrial deployment. Bio-based technologies—such as advanced fermentation, biorefineries, and novel bio-based materials—are capital-intensive, technologically complex, and exposed to regulatory and market uncertainty. As a result, technically viable innovations often fail to reach scale.

To address these barriers, the strategy combines regulatory, institutional, and financial instruments. Regulatory simplification is a core element, notably through the forthcoming Biotech Acts, which aim to streamline authorisation procedures, introduce regulatory sandboxes, and accelerate permitting for biomanufacturing projects while maintaining high safety standards. These measures reduce uncertainty and time-to-market, particularly for SMEs and scale-ups.

Institutional coordination is reinforced through the establishment of a European Bioeconomy Regulators and Innovators’ Forum, which provides a structured platform for dialogue among regulators, innovators, and investors. The Forum addresses fragmented risk-assessment practices across EU agencies and Member States, facilitating early guidance and consistent regulatory interpretation.

On the financial side, the strategy emphasises de-risking and blended finance, mobilising public and private capital through coordination with the European Investment Bank Group and national promotional banks. New instruments target later stages of innovation, when capital needs are highest but revenue streams remain uncertain. The Bioeconomy Investment Deployment Group supports pipeline development by assembling bankable projects, sharing risk, and crowding in private investment.

The overarching objective is not merely to increase research expenditure but to convert knowledge into operating industrial capacity—such as first-of-a-kind biorefineries, fermentation facilities, and bio-based manufacturing plants—capable of competing in global markets.

8.7.5.2 Developing lead markets for bio-based materials and technologies

A second pillar of the strategy focuses on lead markets, defined as sectors in which bio-based solutions are technologically mature or near maturity but face persistent barriers related to cost, demand uncertainty, or regulatory complexity. Rather than promoting bio-based products indiscriminately, the strategy prioritises applications with high potential for fossil substitution, carbon storage, and value creation.

Identified lead markets include bio-based plastics and polymers; textiles and fibres; chemicals; construction materials; fertilisers and plant protection products; and enabling

technologies such as biorefineries, advanced fermentation, and biogenic carbon capture and storage. These sectors are closely linked to existing industrial value chains, allowing bio-based inputs to be integrated incrementally rather than requiring systemic replacement.

Policy instruments to stimulate these markets are primarily demand-oriented. Harmonised standards and testing methods ensure comparability between bio-based and fossil-based alternatives, reducing uncertainty for investors and buyers. Public procurement is used strategically to generate early and predictable demand, while voluntary industry alliances based on collective offtake commitments help secure markets for first-of-a-kind facilities.

Lead market development is aligned with horizontal product legislation, including construction product regulation, packaging rules, ecodesign requirements, and environmental footprint methodologies. Bio-based solutions are thus embedded within mainstream regulatory frameworks rather than treated as exceptional cases. Their integration into carbon accounting and sustainability reporting further strengthens their market position by making climate benefits transparent and verifiable.

8.7.5.3 Securing sustainable biomass supply within ecological limits

A defining feature of the current Bioeconomy Strategy is its explicit recognition of biomass as a constrained and contested resource. Unlike earlier strategies that implicitly assumed expanding biomass availability, the current approach emphasises efficiency, prioritisation, and ecological integrity.

The strategy promotes efficient and cascading use of biomass, favouring higher-value and longer-lived applications—such as materials and construction products—over short-lived or low-value uses where feasible. Greater reliance on secondary biomass streams, including residues, by-products, and bio-waste, is encouraged to reduce pressure on primary ecosystems and land.

Domestic supply resilience is pursued through sustainable agriculture, forestry, and aquatic systems, closely aligned with land-use and climate objectives under the LULUCF framework. Forests, for example, are expected to provide renewable materials while maintaining carbon sinks and biodiversity functions. In agriculture, circular nutrient management and water-efficient practices are promoted.

Primary producers—farmers, foresters, and fishers—are recognised as strategic actors in the bioeconomy rather than merely as raw-material suppliers. The Common Agricultural Policy, forest governance processes such as Forest Europe, and blue bioeconomy initiatives are positioned as key enablers of sustainable biomass provision, income diversification, and rural resilience.

Biomass cascading and efficient-use logic

The principle of biomass cascading and efficient use constitutes a core governance logic of the Bioeconomy Strategy. It recognises biomass as a finite, multifunctional resource whose allocation should maximise long-term value, climate benefits, and ecosystem integrity.

Under this logic, food security, feed provision, and ecosystem services take priority. Where feasible, biomass should first be used for high-value materials and products that substitute fossil-based alternatives and store carbon over extended periods. Residual streams and end-of-life biomass may then be directed toward energy use, particularly in sectors with limited alternative decarbonisation pathways.

This is not a rigid hierarchy but a context-dependent decision framework informed by life-cycle assessment, local conditions, and sustainability criteria. It provides a conceptual bridge between the bioeconomy and circular economy policy frameworks.

8.7.5.4 Harnessing global partnerships and external engagement

The Bioeconomy Strategy has a strong external dimension, reflecting the global nature of biomass markets, technological development, and environmental impacts. The EU aims to expand exports of bio-based technologies, materials, and know-how, positioning itself as a global leader in sustainable bio-based solutions.

At the same time, the strategy emphasises sustainable and traceable biomass trade to prevent ecological damage, social conflict, and supply disruption. Engagement in international fora such as the FAO and World Trade Organization (WTO) supports convergence on sustainability principles, standards, and data, facilitating fair competition and market access.

Through initiatives such as Global Gateway, the EU supports regional bioeconomy development in partner countries, particularly in Africa and neighbouring regions. These partnerships are framed both as economic opportunities and as risk-management instruments, reducing the likelihood of biomass scarcity, environmental degradation, and geopolitical dependency.

8.7.6 The Biotech Acts as an enabling framework

The Biotech Acts constitute a **horizontal enabling framework** within the Bioeconomy Strategy. Their objective is to **address regulatory fragmentation and procedural bottlenecks** that currently constrain innovation and industrial deployment in biotechnology and biomanufacturing.

Key functions include streamlining and accelerating authorisation procedures for bio-based innovations; introducing regulatory sandboxes for controlled experimentation; improving coordination among EU agencies and national authorities; and increasing legal certainty and predictability for investors. The Biotech Acts signal a shift from a purely precautionary

regulatory approach toward a strategic, innovation-compatible governance model, while maintaining high standards of safety and environmental protection.

8.7.7 Governance and implementation

Implementation of the Bioeconomy Strategy relies on multi-level governance combining EU-level coordination with national and regional action. Bioeconomy dialogues with Member States support alignment between EU objectives and national strategies, while regional bioeconomy ecosystems play a central role in translating policy into practice.

Skills development, education, and workforce reskilling are treated as enabling conditions, reflecting the knowledge-intensive and labour-demanding nature of bioeconomy sectors. Monitoring is ensured through the EU **Bioeconomy Monitoring System**, which tracks economic, environmental, and innovation performance.

The strategy is explicitly iterative and adaptive. Periodic reporting, stakeholder engagement, and evidence-based revision are integral components, acknowledging technological uncertainty, evolving markets, and changing ecological constraints.

8.8 The Circular Economy Action Plan: Content, Instruments and Systemic Role

8.8.1 Core framing and problem diagnosis

The Circular Economy Action Plan (CEAP) is grounded in a systemic diagnosis of Europe's prevailing linear economic model. Resource extraction and processing account for roughly half of global greenhouse gas emissions and more than 90% of biodiversity loss and water stress. At the same time, material consumption and waste generation continue to grow, exposing the EU to environmental degradation, supply risks, and economic inefficiencies.

The Action Plan recognises that incremental improvements in waste management are insufficient to address these structural challenges. Instead, a fundamental transformation of product design, production systems, consumption patterns, and material governance is required. Circularity is therefore framed not as an environmental add-on but as a **precondition for climate neutrality, long-term competitiveness, and resource security**.

Within the European Green Deal, the CEAP functions as a horizontal enabling strategy. It provides the material and product-level architecture needed to decouple economic growth from resource use while preserving the integrity of the internal market.

8.8.2 The Circular Economy as Defined in the Action Plan

Circularity extends beyond waste management to encompass:

- product design and durability,
- material efficiency and substitution,
- safe circulation of secondary raw materials,
- and systemic reduction of resource extraction.

The CEAP thus shifts the focus from downstream waste treatment toward **upstream design and system optimisation**, recognising that a large share of environmental impacts is determined at the product design stage.

The Circular Economy Action Plan defines the circular economy as an economic system in which **the value of products, materials, and resources is maintained for as long as possible**, waste generation is prevented at source, and materials are returned to productive use through reuse, repair, remanufacturing, and high-quality recycling.

8.8.3 Strategic objectives of the Action Plan

The CEAP pursues four interrelated strategic objectives:

1. **Decoupling economic growth from resource use**, while maintaining competitiveness within the EU single market.
2. **Making sustainable products the norm**, rather than the exception, across all relevant sectors.
3. **Reducing waste generation and environmental harm at source**, rather than managing impacts ex post.
4. **Strengthening Europe's strategic autonomy**, by reducing dependence on primary and imported raw materials.

These objectives are embedded in a broader transition toward a regenerative economic model that operates within planetary boundaries while generating employment, innovation, and social value.

8.8.4 Architecture of the Circular Economy Action Plan

The CEAP is structured around a coherent policy architecture that integrates product regulation, market instruments, waste legislation, and governance mechanisms. Its architecture can be understood through six interlinked pillars.

8.8.4.1 Pillar I – A sustainable product policy framework

At the core of the CEAP lies a comprehensive **sustainable product policy framework**, based on the recognition that up to 80% of a product’s environmental impacts are determined at the design phase.

This framework expands traditional ecodesign approaches by:

- extending ecodesign principles beyond energy-related products,
- introducing requirements on durability, reparability, upgradability, and recyclability,
- increasing recycled content where appropriate,
- restricting hazardous substances and premature obsolescence,
- banning the destruction of unsold durable goods,
- enabling digital product passports and lifecycle information systems.

The objective is to ensure that sustainability performance becomes a **standard market attribute**, embedded in EU product law rather than reliant on voluntary schemes.

8.8.4.2 Pillar II – Consumers, public procurement and demand-side governance

The CEAP strengthens the demand side of the circular transition by empowering consumers and mobilising public purchasing power.

Consumer-focused measures include:

- improved access to reliable sustainability information,
- protection against greenwashing,
- and the establishment of a right to repair, including access to spare parts and repair services.

Public procurement is treated as a strategic market-making instrument. Given that public authorities account for approximately 14% of EU GDP, the Action Plan promotes:

- minimum mandatory green public procurement criteria in selected sectors,
- systematic reporting on procurement practices,
- and capacity-building for public buyers.

Through these instruments, demand-side governance complements regulatory and supply-side measures.

8.8.4.3 Pillar III – Priority product value chains

The CEAP adopts a value-chain-based approach, targeting sectors with high environmental impact, strong material intensity, and significant circularity potential. **Priority value chains** include:

- **electronics and ICT,**
- **batteries and vehicles,**
- **packaging and plastics,**
- **textiles,**
- **construction and buildings,**
- **food, water, and nutrients.**

For each value chain, the Action Plan combines:

- product design requirements,
- recycled-content targets,
- extended producer responsibility schemes,
- waste collection and treatment rules,
- and market development measures.

This integrated approach ensures coherence across the full product lifecycle, from design to end-of-life.

8.8.4.4 Pillar IV – Waste prevention and secondary raw materials

Waste policy under the CEAP shifts decisively toward **prevention and value retention**. While waste management remains important, the primary objective is to reduce waste generation in absolute terms.

Key elements include:

- waste reduction targets for selected streams,
- harmonised separate collection systems across Member States,
- improved quality standards for recycling,
- strengthened markets for secondary raw materials,
- and restrictions on exporting waste-related environmental problems outside the EU.

By improving the quality, traceability, and reliability of secondary materials, the CEAP lays the material foundation for a functioning circular economy.

8.8.4.5 Pillar V – Circularity, climate neutrality and carbon governance

A major innovation of the CEAP is its explicit integration of circularity into climate and carbon governance. The Action Plan recognises three key climate-related functions of circularity:

1. **Emission reduction** through material efficiency, substitution, and longer product lifetimes.
2. **Avoided emissions** from reduced primary resource extraction and processing.
3. **Long-term carbon storage** in products, particularly in buildings and construction materials.

The CEAP anticipates the development of robust certification frameworks for carbon removals and storage, **linking circular material use to emerging carbon accounting and certification systems**. This logic later underpins initiatives such as carbon removal certification and carbon farming methodologies.

8.8.4.6 Pillar VI – Finance, economics and governance

The CEAP integrates circular economy objectives into the EU’s economic and financial governance framework.

Key instruments include:

- integration of circularity into the EU sustainable finance taxonomy,
- enhanced corporate sustainability reporting,
- alignment with State aid rules and fiscal instruments,
- targeted use of EU funding programmes, including Horizon Europe, InvestEU, and Cohesion Policy.

The Action Plan also strengthens monitoring and evaluation by expanding circularity indicators beyond GDP to include material footprints, consumption impacts, and resource productivity.

8.8.5 The global dimension: the EU as a circular economy norm-setter

The CEAP explicitly positions the EU as a **global norm-setter** in circular economy governance. Recognising the global nature of value chains and environmental impacts, the Action Plan seeks to externalise EU standards and approaches through:

- international cooperation and trade agreements,
- leadership in global initiatives on plastics and waste,
- promotion of circular economy principles in development cooperation,

- and engagement with international organisations and partner countries.

By aligning internal market rules with external engagement, the EU aims to shape global norms on sustainable product design, resource use, and waste management.

8.8.6 Systemic role of the Circular Economy Action Plan

Within EU governance, the Circular Economy Action Plan functions as a **horizontal operating framework** that:

- standardises product and material rules across sectors,
- aligns markets for primary and secondary raw materials,
- reduces environmental pressures at source,
- and creates the material and regulatory conditions under which sectoral strategies—such as the bioeconomy—can scale without exceeding ecological limits.

In this sense, the CEAP provides the **material backbone of the European Green Deal**, translating climate and sustainability ambitions into concrete rules governing products, materials, and markets.

Core Concepts and Review Questions – Chapter 8

1. What best defines ecological economics?

Ecological economics is an interdisciplinary field that treats the economy as embedded within, and dependent on, the Earth's ecological system. It focuses on the fact that economic activity is constrained by biophysical laws (including thermodynamics), finite resources, and ecological thresholds, so long-run sustainability depends on keeping material and energy use within ecological limits rather than assuming the environment can always be substituted by technology or managed only through market adjustments.

2. How does ecological economics most clearly differ from standard environmental economics?

Ecological economics differs most clearly by emphasizing system-scale constraints and the possibility of non-substitutable critical natural capital, not merely marginal optimization. While standard environmental economics typically works within a neoclassical frame of market failures and corrective pricing, ecological economics asks first whether the overall scale of the economy's material throughput is compatible with ecological stability, and then considers allocation and distribution within those limits.

3. What is meant by “strong sustainability”?

Strong sustainability means that certain forms of natural capital—such as biodiversity, fertile soils, stable climate regulation, and functioning freshwater systems—perform life-support functions that cannot be fully replaced by manufactured capital or technology. Therefore, sustainability requires maintaining these critical stocks in physical/ecological terms, not merely compensating their loss with money, infrastructure, or efficiency gains elsewhere.

4. Which sequence best reflects the ecological economics priority among scale, allocation, and distribution?

In ecological economics, scale comes first because the economy must fit within the biosphere's carrying capacity and ecological thresholds; it defines the feasible safe operating space. Only within that biophysical boundary can society meaningfully debate allocation (how resources are used efficiently) and distribution (how benefits and burdens are shared across people and generations).

5. What does “throughput” mean in ecological economics?

Throughput refers to the physical flow of energy and materials that move from extraction (inputs) through production and consumption to emissions and waste (outputs). It highlights that the economy is not only a monetary system but also a metabolic process that transforms matter and energy—so sustainability requires managing and often reducing total throughput, not just improving financial indicators.

6. Which policy stance best matches ecological economics under uncertainty and tipping points?

Ecological economics generally supports a precautionary stance because ecosystems can exhibit thresholds, non-linear responses, and irreversible changes once tipping points are crossed. When uncertainty is high but potential damages are severe and hard to reverse, it is more rational to prevent risky pathways and maintain resilience than to rely on wait-and-see strategies or ex post correction after damage becomes visible.

7. Which statement reflects ecological economics critique of relying only on prices for sustainability?

A key critique is that many ecological values and systemic risks are difficult to monetize and may not be captured by market prices in time to prevent irreversible harm. Prices often reflect short-term scarcity and current preferences, not long-term resilience, biodiversity integrity, or catastrophic risks; therefore, institutions, standards, planning rules, and hard constraints are needed alongside (or sometimes instead of) pricing instruments.

8. What does the concept of a “safe operating space” emphasize for sustainability governance?

“Safe operating space” emphasizes that governance should keep human activities within biophysical limits that maintain ecosystem functioning and human well-being—often framed in terms of planetary boundaries or critical thresholds. The central idea is that sustainability is not only about efficiency, but about avoiding ecological destabilization by defining and respecting boundary conditions for land use, emissions, resource extraction, and pollution.

9. What are ecosystem services?

Ecosystem services are the direct and indirect benefits people obtain from ecosystems, including material outputs (like food, timber, fresh water), regulating functions (like flood control, water purification, pollination, climate regulation), and non-material values (like recreation, cultural identity, and education). The concept makes the dependence of economies and societies on functioning ecosystems explicit, beyond what is traded in markets.

10. In ecosystem services thinking, what is “natural capital” best described as?

Natural capital refers to the biophysical assets—forests, soils, wetlands, rivers, oceans, species, and ecological processes—that generate flows of ecosystem service benefits over time. It is the stock that produces service flows, and if the stock is degraded beyond regeneration capacity, the flow of benefits declines, creating long-term social and economic costs.

11. Which ecosystem service category includes timber, food, and fresh water?

These are provisioning services, because they are tangible, material goods directly obtained from ecosystems and used in consumption and production. They often enter markets and supply chains, which makes them highly visible economically, even though their sustainable supply depends on less visible supporting and regulating functions.

12. Which ecosystem service category includes flood regulation and water purification?

These are regulating services, because ecosystems reduce risks and stabilize environmental conditions through ongoing ecological processes. Healthy floodplains, wetlands, soils, and riparian zones can store water, slow runoff, filter pollutants, and reduce damage costs—benefits that are often large but not fully priced in markets.

13. Which ecosystem service category includes recreation, landscape aesthetics, and cultural identity?

These are cultural services, because they provide non-material benefits linked to human experience, meaning, and social life. They matter for quality of life, public health, education, and local development, even when they are difficult to measure in monetary terms.

14. Which ecosystem service category includes soil formation and nutrient cycling?

These are supporting services, because they underpin the functioning of ecosystems and enable other services to exist. Soil formation, primary production, and nutrient cycling are foundational processes: without them, provisioning outputs decline and regulating and cultural benefits erode over time.

15. Why does ecological economics often caution against overreliance on monetizing ecosystem services?

Because many ecosystem-related values are ethical, cultural, relational, or ecological and cannot be adequately represented as prices without losing essential meaning or ignoring irreversibility and distributional issues. Monetization can be useful for visibility in cost–benefit contexts, but ecological economics stresses that valuation should be complemented by biophysical indicators, precaution, rights-based constraints, and participatory judgments about what must not be traded off.

16. What is a typical ecosystem-services trade-off in land-use decisions?

A common trade-off occurs when land management increases provisioning services—such as biomass, food, or timber output—while reducing regulating services like carbon storage, water regulation, and biodiversity maintenance. For example, intensification can raise short-term yields but weaken soil health, pollination, habitat quality, and long-term resilience, shifting costs to the future or to other stakeholders.

17. What best defines the circular economy?

The circular economy is an economic system in which the value of products, materials, and resources is maintained for as long as possible, waste generation is prevented at source, and materials are returned to productive use through reuse, repair, remanufacturing, and high-quality recycling. It shifts the system from “take–make–dispose” toward strategies like reuse, repair, remanufacturing, and high-quality recycling, so that fewer virgin resources are extracted and less pollution and waste are generated.

18. What is a key difference between a circular economy and a narrow “recycling economy”?

Circular economy thinking prioritizes upstream prevention and value retention—designing products to last longer and be repairable and reusable—while recycling is treated as important but not the first or only solution. A narrow “recycling economy” tends to focus on end-of-pipe waste handling, which can be energy-intensive, prone to downcycling, and insufficient if total material consumption keeps rising.

19. Which principle best reflects “design for circularity”?

Design for circularity means products are intentionally designed to be durable, repairable, upgradable, and easy to disassemble, so they can go through multiple use cycles and recover materials at high quality. This matters because many environmental impacts are locked in at the design stage: design choices determine lifetime, repairability, and whether materials can circulate safely and effectively.

20. What does “closing material loops” mean in circular economy policy?

Closing loops means keeping materials circulating within the economy at the highest feasible value by enabling reuse of products, remanufacturing of components, and high-quality recycling that preserves material properties. The goal is to reduce dependence on virgin extraction and to prevent leakage of materials into landfill, incineration, or low-value downcycled uses.

21. From an ecological economics perspective, what is the main sustainability challenge circularity aims to address?

The main challenge is the scale of material throughput: even large efficiency gains can be overwhelmed if total production and consumption keep expanding. Circularity is therefore a key strategy for enabling absolute reductions in resource use and environmental pressure by preventing waste and extending lifetimes, but it works best when paired with policies that limit rebound effects and align consumption with ecological boundaries.

22. What is a “rebound effect” risk in circular economy transitions?

A rebound effect occurs when efficiency and cost reductions from circular strategies (e.g., longer life, cheaper repair, cheaper materials) lower prices or increase convenience, which can stimulate more consumption and partially or fully offset environmental gains. Without complementary measures—such as sufficiency-oriented policies, standards, or caps—improvements in circular performance may not translate into proportional reductions in total resource use.

23. What is the difference between relative and absolute decoupling?

Relative decoupling means resource use or environmental pressure grows more slowly than economic output, so intensity improves but totals may still rise. Absolute decoupling means total resource use (or total environmental impact) declines while the economy continues to function—an outcome ecological economics often sees as necessary in high-consumption contexts to stay within planetary boundaries.

24. What best defines the bioeconomy?

The bioeconomy refers to economic activities that use renewable biological resources—plants, animals, microorganisms, and biomass streams—to produce food, feed, materials, chemicals, energy, and services. It emphasizes replacing fossil-based inputs with bio-based alternatives where appropriate, and it spans agriculture, forestry, fisheries, industrial biotechnology, biomanufacturing, and bio-based product value chains.

25. What distinguishes biogenic carbon from fossil carbon?

Biogenic carbon circulates in the contemporary carbon cycle: it is taken up by organisms and can be released back to the atmosphere on relatively short timescales depending on management and product lifetimes. Fossil carbon is stored in geological reservoirs for millions of years and adds “new” carbon to the active cycle when extracted and burned, which is why its use has a structurally different climate effect.

26. Why does ecological economics argue that the bioeconomy is not automatically sustainable?

Because biomass is a constrained, multifunctional resource governed by regeneration rates, land availability, biodiversity needs, and competing ecosystem services. A bioeconomy can reduce fossil dependence, but if it expands without strong sustainability criteria and careful allocation, it can intensify land-use pressure, reduce carbon sinks, harm habitats, or shift burdens elsewhere—so outcomes depend on governance, not on “bio-based” inputs alone.

27. What is meant by “cascading use” of biomass?

Cascading use means prioritizing higher-value and longer-lived applications of biomass—such as construction materials or durable products that substitute fossil materials and store carbon—before allocating remaining residues and end-of-life streams to lower-value, short-lived uses such as energy. The principle aims to maximize climate and resource benefits from a scarce feedstock while reducing pressure on ecosystems.

28. Which trade-off is commonly highlighted in bioeconomy expansion debates?

A widely discussed trade-off is that higher biomass harvest or expanded bio-based production can threaten carbon sinks and biodiversity if ecological safeguards, spatial planning, and sustainable sourcing are weak. For instance, increased extraction can reduce forest carbon stocks, simplify habitats, or intensify agricultural pressures, undermining the regulating services that bioeconomy narratives often rely on.

29. How are the circular economy and the bioeconomy best described in relation to each other?

They are complementary but not interchangeable: circularity reduces total throughput by preventing waste and keeping materials in use, while the bioeconomy changes the input base by substituting fossil carbon with renewable biological resources. A bioeconomy without circularity can overexploit biomass, while circularity without bio-based substitution can leave fossil carbon embedded in key material systems; coordinated governance is needed to align both with ecological limits.

30. What is the main governance purpose of EU sustainability strategies such as the Bioeconomy Strategy and the Circular Economy Action Plan (CEAP)?

Their main governance purpose is to provide coordinated policy architecture: aligning regulation, standards, funding, innovation support, public procurement, monitoring, and market formation to steer systemic change across the internal market. Rather than acting as isolated declarations, they package instruments and priorities to reduce fragmentation, create investment predictability, and connect environmental objectives (climate, biodiversity, resource security) with industrial and competitiveness goals.

31. What is a central policy challenge for EU-wide sustainability governance?

A central challenge is balancing a highly integrated EU internal market with substantial Member State diversity in biomass availability, land-use patterns, industrial structure, administrative capacity, and local ecological conditions. This diversity makes “one-size-fits-all” implementation difficult and increases the importance of EU-level coordination that still allows context-sensitive national and regional pathways.

32. What type of barrier does the “valley of death” concept describe in bio-based innovation?

It describes the financing and scaling gap between successful research/pilots and commercial, industrial-scale deployment—especially for capital-intensive first-of-a-kind facilities like biorefineries and fermentation plants. At this stage, technological risk, regulatory uncertainty, and unproven markets deter investment even when the underlying science works, so policy often targets de-risking and demand creation.

33. What is the primary enabling purpose of EU “Biotech Acts” in bioeconomy governance?

Their enabling purpose is to reduce regulatory fragmentation and procedural bottlenecks that slow innovation and scale-up, by streamlining authorisation processes, improving coordination, and increasing predictability—potentially including regulatory sandboxes—while maintaining high safety and environmental protection standards. The aim is to shorten time-to-market and reduce uncertainty for innovators and investors without lowering core safeguards.

34. What is the CEAP’s definition of the circular economy most closely centered on?

It is centered on keeping the value of products, materials, and resources in the economy for as long as possible, preventing waste at source, and returning materials to productive use through reuse, repair, remanufacturing, and high-quality recycling. This framing makes circularity a system-level shift in product and material governance, not merely a waste-management program.

35. Why does the CEAP emphasize product design in circularity governance?

Because design choices largely determine durability, reparability, disassembly, recycled-content feasibility, and ultimately whether products can circulate with low environmental

impact. By shifting intervention upstream to design, CEAP targets root causes of waste and resource demand, recognizing that downstream recycling cannot compensate for products designed for short lifetimes or difficult material recovery.

36. Which set of value chains is most consistent with CEAP priority sectors?

Electronics/ICT, batteries and vehicles, packaging and plastics, textiles, and construction/buildings are classic CEAP priority value chains because they combine high material intensity, major environmental footprints, and strong circularity potential. Focusing on these chains allows integrated measures from design requirements and right-to-repair to recycled-content rules, collection systems, and secondary-material market development.

37. What is the main shift in CEAP waste policy emphasis?

The shift is from downstream waste treatment toward upstream prevention and value retention: avoiding waste generation, extending product lifetimes, and improving the quality and usability of secondary raw materials. Waste management remains important, but it is positioned within a broader strategy that addresses why waste is created in the first place.

38. How does circularity contribute to climate objectives according to the CEAP logic?

Circularity contributes by reducing emissions through material efficiency and longer product lifetimes, avoiding emissions associated with primary extraction and processing, and enabling carbon storage in long-lived products—especially in buildings and construction materials. In CEAP’s logic, material-system transformation is a major climate lever because a large share of emissions is embedded in producing and processing materials, not only in energy use.

9. Carbon Pricing and Carbon Markets in Nature Protection

9.1 Why Carbon Pricing Matters for Nature Protection?

Climate change and biodiversity loss represent systemic environmental externalities that are insufficiently addressed by unregulated markets. Greenhouse gas (GHG) emissions impose global social costs through climate-induced impacts on ecosystems, human health, and economic systems, while land-use change, deforestation, and ecosystem degradation generate long-term environmental damage that is rarely reflected in private decision-making.

Carbon pricing is a policy instrument designed to address these market failures by **assigning an explicit economic value to greenhouse gas emissions or, conversely, to emission reductions and carbon removals**. By altering relative prices, carbon pricing seeks to align private incentives with collective climate and environmental objectives.

From the perspective of nature protection, carbon pricing is not an objective in itself. Rather, it functions as a **governance mechanism** that can:

- influence land-use and production decisions,
- create financial incentives for ecosystem conservation and restoration,
- mobilise private investment toward climate mitigation activities with co-benefits for biodiversity and ecosystem services.

Carbon pricing therefore occupies an important position at the interface of **climate policy, environmental economics, and nature conservation governance**.

Carbon pricing

Carbon pricing is a climate policy approach that assigns an explicit economic value to greenhouse gas emissions, and in some cases to emission reductions or removals, in order to internalize climate-related externalities and create financial incentives for mitigation. It operates through instruments such as carbon taxes, emissions trading systems, and crediting mechanisms, influencing investment, production, and consumption decisions by making carbon-intensive activities more costly while rewarding low-carbon alternatives.

9.1.1 Core Types of Carbon Pricing Instruments

Carbon pricing instruments can be broadly divided into **price-based instruments** and **quantity-based market mechanisms**. Although closely related, these instruments differ in their economic logic, regulatory design, and governance implications.

9.1.1.1 Carbon Taxes

A carbon tax establishes a **fixed price per unit of greenhouse gas emissions**, usually expressed as a price per tonne of CO₂ equivalent. Emitters are required to pay the tax in proportion to their verified emissions.

Key characteristics include:

- **Price certainty**, as the cost of emissions is known in advance;
- **Uncertain emissions outcomes**, which depend on behavioural and technological responses;
- Relatively **simple administration** compared with trading systems.

In practice, carbon taxes are primarily applied in energy and industrial sectors. Their direct application to land-use and forestry activities is rare, largely due to challenges related to measurement, reporting, and verification (MRV). Nevertheless, carbon taxes may indirectly affect nature protection by influencing fossil fuel demand, land-use pressures, and energy prices.

9.1.1.2 Emissions Trading Systems (Cap-and-Trade)

Emissions trading systems (ETS) establish a **quantitative limit (cap)** on total emissions within a defined scope. Emission allowances corresponding to this cap are allocated or auctioned, and regulated entities must surrender allowances equal to their verified emissions.

Key characteristics include:

- **Quantity certainty**, as total emissions are constrained by the cap;
- **Price formation through markets**, resulting in allowance price variability;
- Strong alignment with predefined environmental targets.

ETS have become the dominant carbon pricing instrument at regional and national levels. However, traditional ETS designs focus primarily on fossil fuel-based emissions and generally exclude land-use and forestry sectors due to concerns regarding permanence, reversibility, and accounting complexity.

9.1.1.3 Carbon Markets: Allowances and Credits

Carbon markets translate carbon pricing into **tradable instruments**. A fundamental distinction must be made between **emission allowances** and **carbon credits**, as these instruments serve different regulatory and economic functions.

Emission Allowances

Emission allowances are **compliance instruments** issued under cap-and-trade systems. Each allowance authorises the emission of one tonne of CO₂ equivalent within a specified period.

Their defining features are:

- issuance and regulation by public authorities,
- fungibility within a given trading system,
- exclusive use for regulatory compliance.

Allowances do not represent mitigation activities in themselves; rather, they allocate limited emission rights under an established emissions cap.

Carbon Credits

Carbon credits represent **verified emission reductions or carbon removals** generated by specific activities relative to a defined baseline scenario.

Key characteristics include:

- project- or activity-based generation,
- issuance following monitoring, reporting, and verification,
- potential use for compliance (in certain systems) or voluntary purposes.

From a nature protection perspective, carbon credits are particularly relevant because they can be generated through land-use and ecosystem-based activities such as forest conservation, afforestation and reforestation, agroforestry, soil carbon enhancement, and long-term carbon storage in harvested wood products.

9.1.2 Carbon Pricing and Nature Protection: Opportunities and Constraints

Carbon pricing and carbon markets can support nature protection, but they also introduce significant governance challenges.

Opportunities

- Creation of financial incentives for ecosystem conservation and restoration;
- Monetisation of carbon-related ecosystem services;
- Mobilisation of private capital for nature-based climate mitigation;

- Integration of land-use sectors into climate policy frameworks.

Constraints and Risks

- Measurement uncertainty and natural variability in biological systems;
- Reversibility of ecosystem carbon stocks due to disturbances;
- Risk of prioritising carbon outcomes over broader biodiversity objectives;
- Distributional and land-tenure concerns.

These challenges explain the historically cautious treatment of land-use and forestry mitigation within international climate governance.

9.1.3 The UNFCCC Framework: Carbon Pricing without a Global Carbon Price

The United Nations Framework Convention on Climate Change (UNFCCC), adopted in 1992, establishes the foundational principles of international climate governance. While the Convention recognises the role of economic instruments, it does **not** prescribe a global carbon price or mandate specific carbon pricing mechanisms.

Instead, the UNFCCC provides:

- harmonised greenhouse gas inventory accounting rules,
- principles such as environmental integrity and common but differentiated responsibilities,
- an institutional framework for international cooperation.

Carbon pricing instruments therefore emerge within the UNFCCC framework through subsequent agreements and national policy choices, rather than being imposed by the Convention itself.

9.1.3.1 From Kyoto to Paris: Evolving Carbon Market Architecture

Under the Kyoto Protocol, binding, top-down emission targets were negotiated for a subset of industrialised countries. These commitments were accompanied by flexible mechanisms, including international emissions trading and project-based crediting.

The Paris Agreement, adopted in 2015, introduced a fundamentally different architecture. All Parties submit **Nationally Determined Contributions (NDCs)**, which define national mitigation objectives and policies within a common transparency framework. Targets are nationally determined rather than internationally negotiated, and all Parties are subject to reporting and review obligations.

This shift has profound implications for carbon markets, particularly for land-use and nature-based mitigation.

Article 6 of the Paris Agreement and Cooperative Approaches

Article 6 of the Paris Agreement establishes a legal basis for **voluntary cooperation** among Parties in achieving their NDCs. It recognises three complementary approaches:

- **Article 6.2:** decentralised cooperative approaches using internationally transferred mitigation outcomes (ITMOs);
- **Article 6.4:** a centralised, UN-supervised crediting mechanism;
- **Article 6.8:** non-market approaches based on finance, technology transfer, and capacity building.

Importantly, Article 6 allows for both **emission reductions and carbon removals**, thereby **enabling land-use and ecosystem-based mitigation to participate in international cooperation**, subject to robust accounting and avoidance of double counting.

Nature-Based Solutions under the Paris Agreement

Under the Paris Agreement, land-use and forestry activities are fully integrated into national mitigation accounting through the Land Use, Land Use Change and Forestry (LULUCF) sector. This represents a departure from earlier climate regimes, where land-based mitigation often played a supplementary role.

Nature-based solutions can:

- contribute to national mitigation targets,
- generate transferable mitigation outcomes under Article 6,
- deliver co-benefits for adaptation, biodiversity, and ecosystem resilience.

However, participation in international carbon markets requires stringent accounting rules, including corresponding adjustments, which remain technically and institutionally demanding.

9.1.4 Regulated and Voluntary Carbon Markets in Nature Protection

Alongside intergovernmental mechanisms, voluntary carbon markets have expanded as a means of financing mitigation outside formal compliance systems. While these markets have channelled resources toward nature-based projects, they have also raised concerns regarding quality, transparency, and environmental integrity.

Recent regulatory developments—most notably the establishment of EU-level certification frameworks for carbon removals—indicate a transition toward **regulated voluntary carbon markets**, in which nature-based mitigation is subject to public oversight, harmonised methodologies, and sustainability safeguards.

Carbon pricing and carbon markets are not substitutes for environmental regulation or nature protection law. Rather, they function as **complementary instruments** that can enhance the

economic viability of conservation and restoration when embedded within robust legal, ecological, and governance frameworks.

Within the UNFCCC and the Paris Agreement architecture, carbon markets have evolved from narrowly defined flexibility mechanisms into a broader governance system capable of integrating climate mitigation, land use, and nature-based solutions. A clear understanding of their conceptual foundations, regulatory design, and limitations is therefore essential for contemporary environmental policy and sustainable land management.

9.2 The Role of the Forest-Based Sector in Emissions Trading: Intergovernmental Mechanisms and Compliance Markets

While carbon pricing instruments were initially developed for fossil fuel-based emissions, their gradual extension toward land-use and nature-based mitigation has raised complex governance and accounting questions. The forest-based sector illustrates these challenges particularly clearly, as carbon fluxes in forests and wood products are governed by ecological processes, management decisions, and disturbance risks that differ fundamentally from industrial emission sources.

As a result, **forestry and harvested wood products have been incorporated into emissions trading and accounting frameworks through distinct regulatory pathways, rather than being directly included in conventional compliance markets.** Examining these pathways provides important insights into the limits and possibilities of integrating nature-based mitigation into carbon market architectures.

In this context, it is particularly timely to review emissions trading regulation relevant to the forestry and wood industry sectors—both intergovernmental emissions trading and compliance markets, as well as currently operating voluntary markets. In the first part of this chapter, we provide an overview of mandatory emissions trading systems already regulated through international agreements and EU legislation, with particular emphasis on the role of the land-use sector (Land Use, Land Use Change and Forestry; LULUCF), which encompasses forestry and harvested wood products.

9.2.1 The Emissions Trading Architecture of the Paris Agreement

Adopted in 2015 by 196 countries, the Paris Agreement marked a new phase in international climate governance. Its central objective is to hold the increase in global average temperature well below 2°C above pre-industrial levels. Replacing the Kyoto Protocol, the Agreement requires all Parties to define mitigation commitments and to monitor progress on a continuous basis.

A key instrument supporting this requirement is the national greenhouse gas inventory reporting system, which provides annual, detailed information on emission and removal balances across the energy, industrial processes, waste, and agriculture sectors, as well as land

use and forestry. Robust accounting of emission and removal balances is essential for assessing progress toward emission reduction and carbon removal commitments.

A practical challenge arises when a country is unable to meet its commitments. Intergovernmental emissions trading is designed to help address this problem. Carbon markets incentivise mitigation by enabling Parties to trade units associated with emission reductions and carbon removals, thereby allowing mitigation to occur where marginal abatement costs are relatively lower.

This raises the question of what a CO₂ allowance or credit means in practice. In a first approximation, an allowance is an emission unit authorising the emission of one tonne of carbon dioxide (CO₂). In compliance carbon markets, regulated entities (or, in some cases, countries) receive a defined quantity of allowances on an annual basis, which determines the maximum amount of CO₂ they may emit in that year. Participants may then trade allowances among themselves, enabling a cost-effective redistribution of emission allowances without increasing total emissions.

In the land-use sector, however, accounting does not concern emissions and avoided emissions only. Ecosystem-based approaches enable the removal and storage of atmospheric carbon through photosynthesis. In this context, units may also represent the removal of one tonne of CO₂ from the atmosphere, in which case they function as carbon removal credits. The eligibility and permissible uses of such units vary substantially across trading and accounting systems.

Article 6 of the Paris Agreement provides the legal basis for cooperative approaches through which countries can work together to achieve their mitigation commitments. Under Article 6, a country may transfer mitigation outcomes—generated through additional emission reductions or removals—so that another country can use them toward meeting its Nationally Determined Contribution (NDC). This is the basis for Internationally Transferred Mitigation Outcomes (ITMOs).

In Figure 10, Country “A” is the transferring country and Country “B” is the acquiring country. The rationale for the transaction is that Country “A” achieved mitigation beyond its commitment, while Country “B” did not meet its NDC target. Following the transaction, both countries apply accounting adjustments, resulting in corrected emission balances consistent with their respective targets.

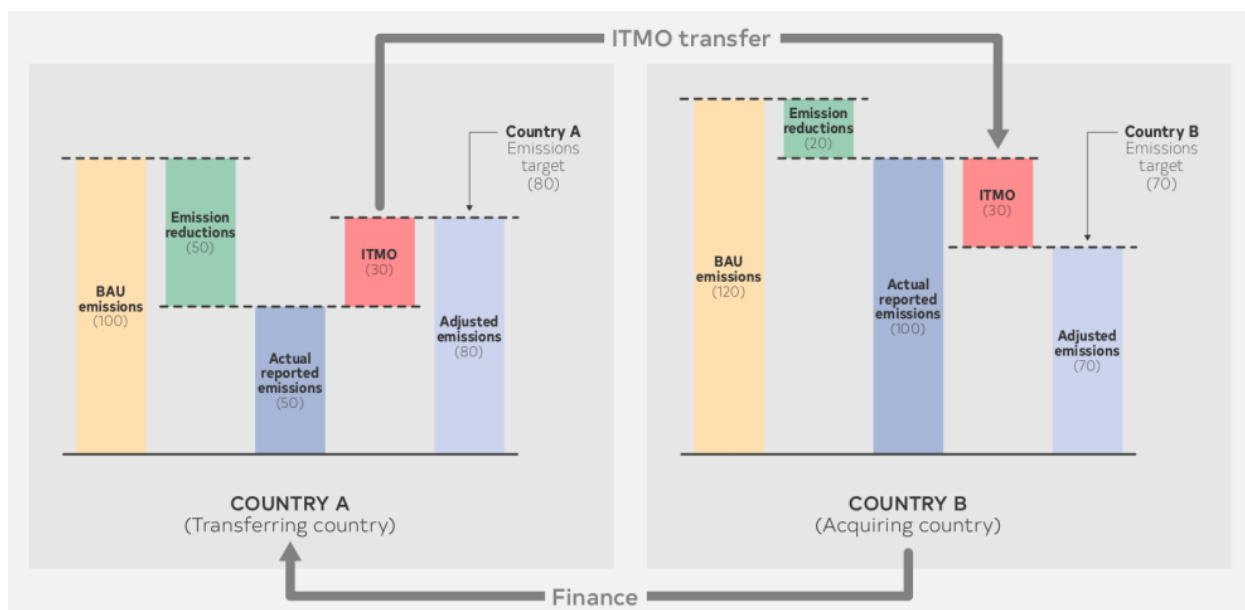


Figure 10: ITMO transfer and corresponding accounting adjustments. (Source: VCM Primer 2023)

Article 6 defines three cooperative approaches for Parties to support the achievement of climate objectives, regulated under Articles 6.2, 6.4, and 6.8.

Article 6.2 establishes a decentralised governance approach for ITMO transfers, under which countries may enter bilateral or multilateral agreements on how ITMOs will be used toward NDC achievement. Under this approach, governance remains decentralised: participating countries retain responsibility for the issuance, transfer, cancellation, and quality assurance of ITMOs, as well as for monitoring, reporting, and registry management. This requires adequate institutional capacity at the national level, including the operation of national registries.

By contrast, the Article 6.4 mechanism establishes a centralised governance system under the supervision of a UN-established Supervisory Body created at the Glasgow climate conference. This body is mandated to oversee the recording and governance of outcomes generated under Article 6.4. In this case, issuance, transfer, cancellation, quality assurance, and oversight are organised through the central mechanism rather than solely through national systems. The relationship between the Article 6.2 and 6.4 approaches is illustrated in Figure 11.

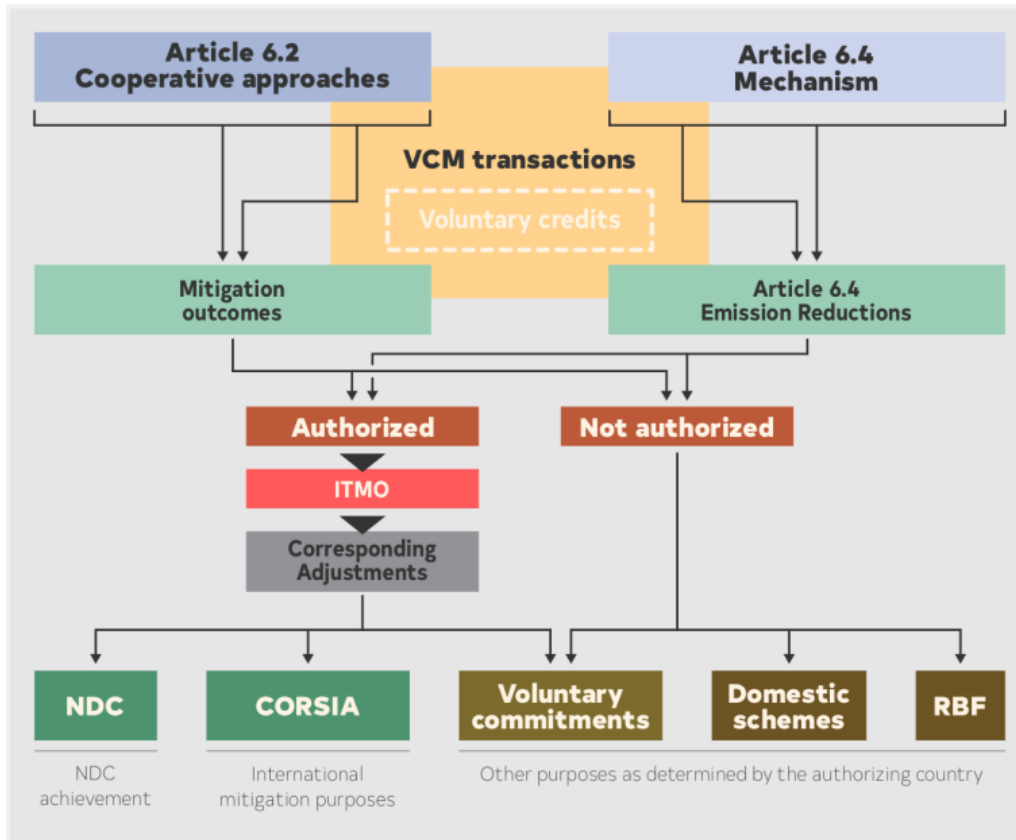


Figure 11: The emissions trading architecture of the Paris Agreement. (Source: VCM Primer 2023)

Article 6.8, in addition to market-based cooperation, recognises non-market approaches aimed at advancing mitigation and adaptation. It provides a framework for cooperation based on technology transfer, capacity building, and financing arrangements without the use of emissions trading.

Importantly, **the cooperative approaches under Articles 6.2 and 6.4 are economy-wide in scope and do not exclude specific sectors, activities, or methodologies.** As a result, ecosystem-based approaches (e.g., forest carbon removals) are no longer implicitly disadvantaged within the international framework for cooperative mitigation. Accordingly, **units arising from land-use sector activities, including REDD+ activities (avoided deforestation, afforestation and reforestation, and sustainable forest management), may in principle be used toward national mitigation targets**—provided they comply with both international rules and relevant national requirements.

Under the Article 6.4 mechanism, the Supervisory Body is expected to assess methodological compliance, including the robustness of accounting approaches and quantification methods. Methodological standardisation is particularly challenging in the land-use and forestry sector, as no fully transferable or universally accepted precedents exist. Consequently, while the opportunity is clear in principle, implementation depends on further methodological development and the adoption of harmonised protocols.

The Paris Agreement thus provides a framework within which cities, regions, countries, or groups of countries may establish emissions trading systems consistent with Article 6, while

adopting diverse detailed design features. Figure 12 summarises the geographic coverage of existing and emerging emissions trading systems.

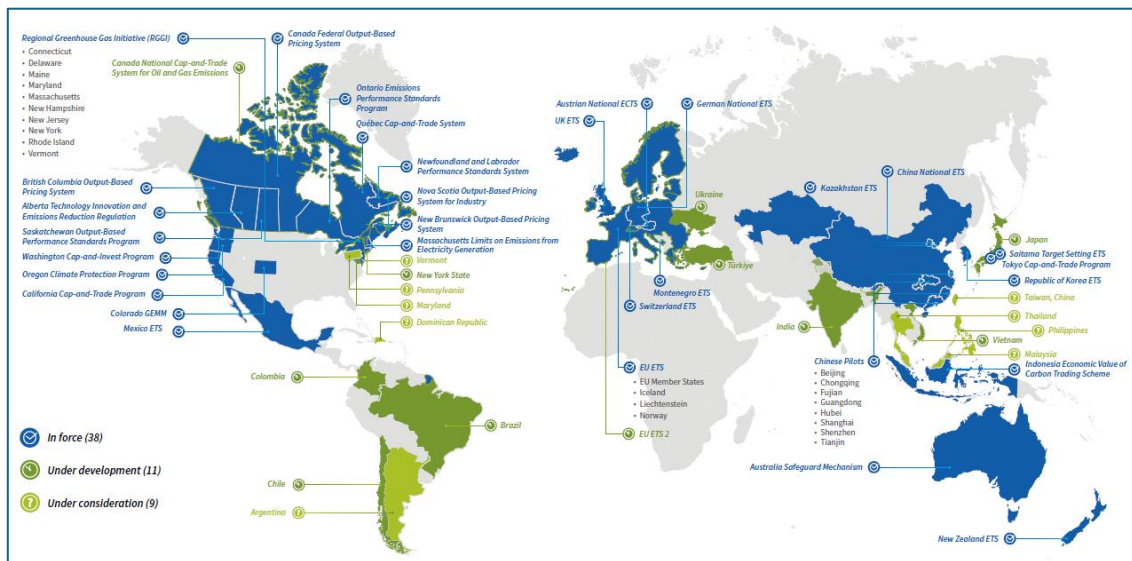


Figure 12: Geographic coverage of emissions trading systems. (Source: ICAP 2025 <https://icapcarbonaction.com/en/publications/emissions-trading-worldwide-icap-status-report-2025>)

The first emissions trading system was the EU Emissions Trading System (EU ETS), established in 2005. Figure 13 illustrates the evolution of emissions covered by trading systems between 2005 and 2024. Alongside the EU ETS, China’s national system is now among the largest by covered emissions. At present, **emissions trading systems cover roughly 23% of global GHG emissions.**

Emissions trading systems also differ markedly in sectoral coverage. In covered sectors, allowances are allocated under a centrally governed framework and compliance obligations apply to regulated entities. As shown in Figure 14, New Zealand’s system covers all sectors, whereas many systems focus primarily on power and industry. **The EU ETS covers power generation and industry, and also includes aviation and maritime transport.**

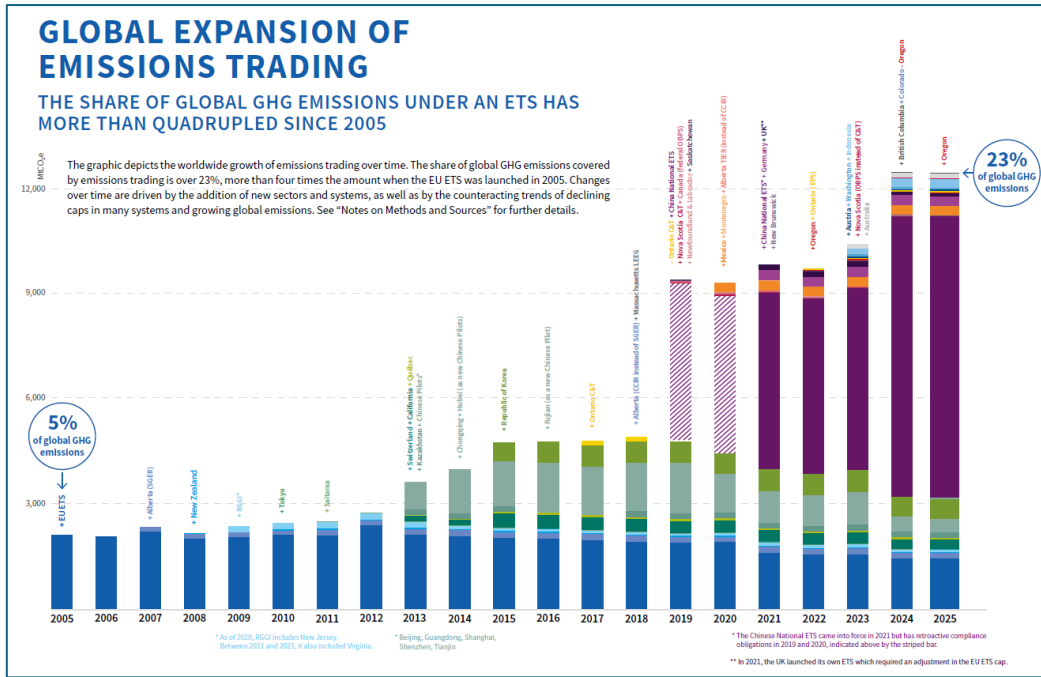


Figure 13: Emissions covered by trading systems, 2005–2024. (Source: ICAP 2025 <https://icapcarbonaction.com/en/publications/emissions-trading-worldwide-icap-status-report-2025>)

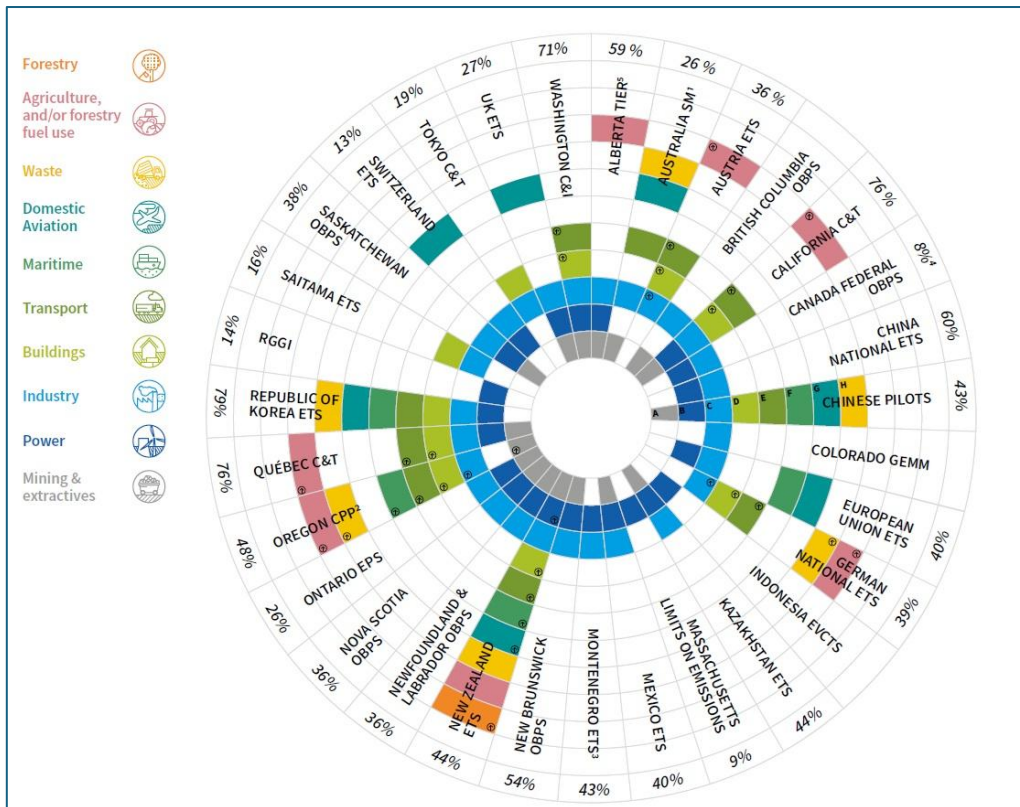


Figure 14: Sectoral coverage of emissions trading systems. (Source: ICAP 2025 <https://icapcarbonaction.com/en/publications/emissions-trading-worldwide-icap-status-report-2025>)

9.2.2 EU Emissions Trading and Complementary Climate Governance Instruments

From Hungary’s perspective, EU emissions trading regulation is particularly influential, as EU rules shape national obligations and inform the design of domestic climate policy. The EU ETS is the EU’s primary emissions trading system, covering the energy and industrial sectors, as well as aviation and maritime transport.

Within ETS-covered sectors, regulated entities receive emission allowances that define an annual emissions cap. If an entity emits more than its allocated allowances, it must acquire additional allowances from entities that have emitted less than their allocation and therefore hold tradable surplus allowances.

In the ETS, allowance trading among industrial and energy actors is therefore mandatory and operates through a tightly regulated market-based framework. **Under EU climate governance, national non-compliance is relevant under the Effort Sharing Regulation and the LULUCF Regulation, where Member States hold explicit targets** and may face penalties, transfers, and corrective action plans. By contrast, the EU ETS operates under an EU-wide cap with installation-level compliance, and therefore does not generate national emission targets or national non-compliance.

The EU ETS is characterised by active trading and high transparency. Allowance prices and their fluctuations are publicly available and updated, comparable to other market price indicators. Figure 15 illustrates allowance price dynamics over the 2010–2024 period. Allowance prices exceeded €100 per tonne of CO₂ equivalent during several periods in recent years and stood at approximately €62 per tonne of CO₂ in April 2025. Price dynamics have been sensitive to major policy announcements, as well as to macroeconomic shocks such as the COVID-19 pandemic and the Russia–Ukraine war.



Figure 15: EU ETS allowance prices (EUR per tCO₂e), 2017–2022. (Source: <https://sandbag.be/carbon-price-viewer/>)

Emissions not covered by the EU ETS are addressed through complementary instruments. The **Effort Sharing Regulation (ESR) covers emissions from road transport, waste management, agriculture, and buildings**. In these sectors, Member States are subject to

national targets, but intra-national allowance trading among firms is not applied under the ESR. If a Member State fails to meet its ESR targets, it may use flexibility mechanisms and intergovernmental transfers to address the shortfall.

From the perspective of the forest-based sector, an important limitation is that **the LULUCF sector is not covered by either the ETS or the ESR**. Instead, the sector is governed by the LULUCF Regulation (Regulation (EU) 2018/841). While national removal targets exist, direct access to tradable value streams for land managers was, prior to the adoption of the CRCF Regulation, often seen as a more distant prospect.

Intergovernmental transfers also exist in the LULUCF context: if a country does not meet its LULUCF target, it may acquire LULUCF units from another country that has overachieved due to stronger net removals. However, **LULUCF unit prices have historically not been publicly transparent, and they are likely to have been lower than ETS allowance prices.** A key reason is that under EU rules, LULUCF units are generally restricted to compensating shortfalls within the LULUCF sector itself; they cannot be used to offset excess emissions in energy, industry, or transport. Although limited flexibility exists between ESR and LULUCF through specific mechanisms, this does not fundamentally change the constrained fungibility and tradability of LULUCF units.

Figure 16 illustrates the sectoral allocation of emissions and removals as reflected in national inventory reporting, and their coverage by EU trading and regulatory frameworks.

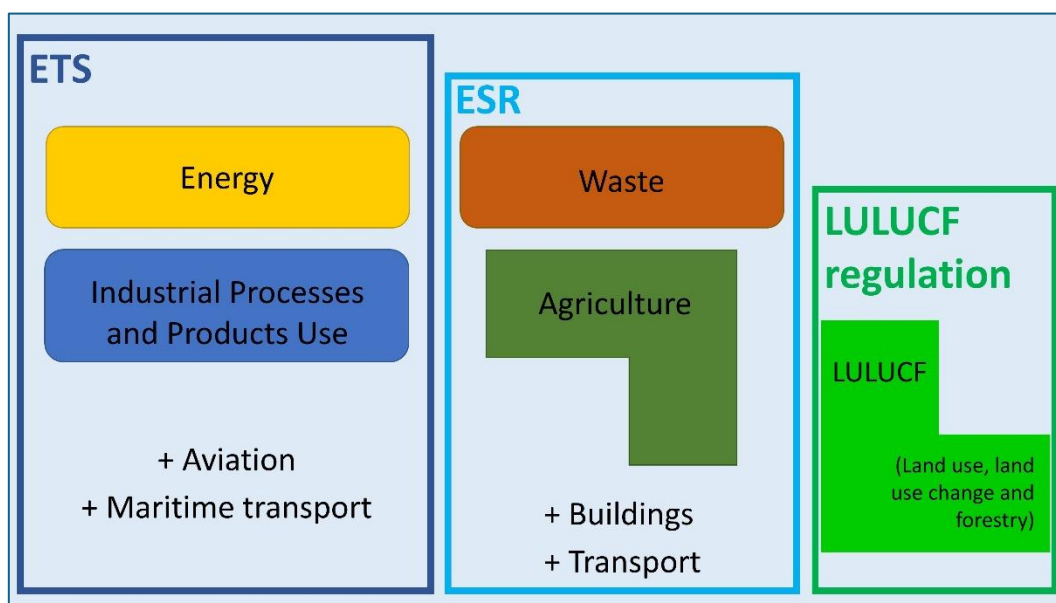


Figure 16: Coverage of emissions and removals under EU emissions trading and regulatory frameworks.

9.2.3 The Specific Accounting Rules of LULUCF

Beyond limited fungibility, the **LULUCF sector is further constrained by the complexity of accounting rules governing emissions and removals**. Although LULUCF includes certain emissions and removals from cropland, grassland, wetlands, and settlements, forests and harvested wood products are the dominant determinants of the sectoral balance in many countries.

Forests' removal capacity and the carbon storage potential of harvested wood products represent a significant mitigation opportunity, as this is the only accounting domain in which net removals can, in principle, compensate for emissions elsewhere within land-use accounting. This could suggest a straightforward approach—namely that removals achieved by forests translate directly into creditable units. This was broadly the case under the first Kyoto Protocol commitment period (2008–2012), as illustrated in Figure 17, although accounting was already constrained by the application of the CAP value.

The CAP value is equal to 3.5% of average national emissions in the base year and sets an upper limit on the annual quantity of removals that can be credited. Removals above this threshold could not be converted into tradable units. In the case of new afforestation, the CAP correction did not have to be applied. During the first Kyoto commitment period, harvested wood products were not included in LULUCF accounting; consequently, the balance reflected forest (and other land-use) emissions and removals only.

During the second Kyoto commitment period (2013–2020), harvested wood products were incorporated into LULUCF accounting. At the same time, forest accounting became substantially more complex. The balance of forests existing already in 1990 was accounted relative to a Forest Management Reference Level (FMRL). Only removals exceeding the FMRL were creditable, and even then only to the extent that they remained below the CAP. The FMRL was established using forest growth projection modelling and economic modelling; in Hungary's case, the modelling was conducted by the Joint Research Centre.

The first Paris Agreement commitment period (2021–2025) is currently in force. Under this framework, forest removals are accounted relative to a Forest Reference Level (FRL), which Hungary established using forest growth projection modelling. For this purpose, Hungary applied the domestically developed CASMOFOR-NFD model (Somogyi et al. 2019; Somogyi 2023), which is consistent with the National Forest Inventory database and IPCC methods and enables forward projections of forest carbon balance (Somogyi 2020).

In the second Paris Agreement commitment period, LULUCF accounting rules are expected to change significantly. The application of forest reference levels and the CAP will cease. Instead, a 2030 LULUCF target will apply, as specified in Regulation (EU) 2023/839. Progress will be monitored against a trajectory toward achieving this target.

The 2030 target was defined relative to the average net balance over 2016–2018, thereby specifying the additional removals required compared with that baseline. For Hungary, the target implies an additional –934 kilotonnes of CO₂ removals, meaning that by 2030 the LULUCF sector must achieve net removals of approximately –5.7 million tonnes of CO₂. If the target is not met, debits are generated; if the target is exceeded, credits can be accounted.

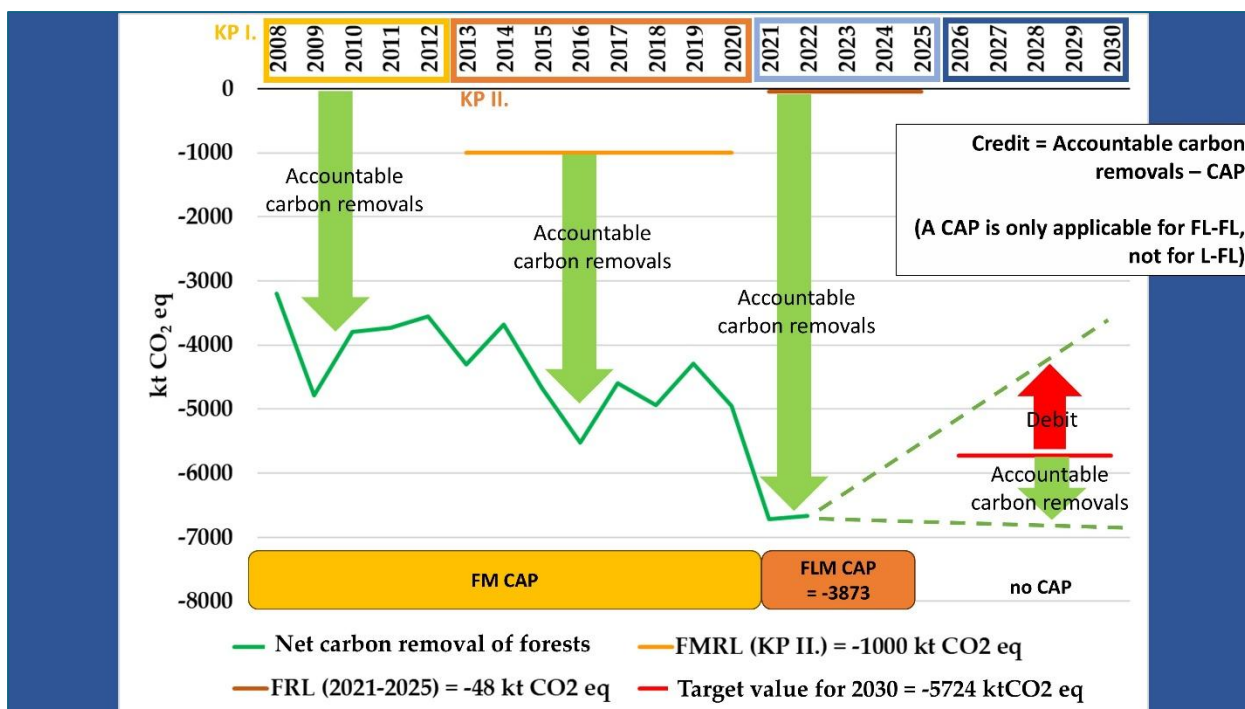


Figure 17: Rules for converting LULUCF balances into creditable units across commitment periods.

Given the high ambition of the target, achieving it is uncertain. As Hungarian forests continue to age, it remains unclear whether they will sustain increment levels sufficient to meet removal targets by 2030. This challenge is compounded by the increasing likelihood of drought and other climate-related forest disturbances. Moreover, because within the LULUCF sector only the forest- and wood-based system generates substantial removals, it must effectively compensate for emissions arising from other land-use categories within the LULUCF sector.

Several strategic pathways may contribute to meeting the target. These include reducing harvesting, strengthening conservation measures, and adopting more extensive management approaches. An alternative set of scenarios is based on active forest management coupled with increased utilisation and intensified value creation in the wood-processing sector.

9.3 Voluntary Carbon Market Mechanisms and the Regulatory Framework of the CRCF Regulation

The **Carbon Removal and Carbon Farming (CRCF) Regulation (EU 2024/3012)** entered into force on 26 December 2024, establishing the first EU-level voluntary framework for the harmonised certification of carbon removals and carbon farming activities. From the perspective of the forest- and wood-based sector, this constitutes a major regulatory milestone, as the new framework redefines the sector's position within carbon markets and is expected to generate both new opportunities and significant regulatory and methodological challenges.

In this subchapter, we review the role and key characteristics of voluntary carbon markets and present the regulatory system established by the CRCF Regulation, together with its expected implications for voluntary carbon market processes. The analysis is based primarily on the text of the CRCF Regulation, as well as the most recent information presented within the framework of the Expert Group on Carbon Removals. Particular emphasis is placed on the Land Use, Land Use Change and Forestry (LULUCF) sector, which encompasses the forestry and wood-processing industries, and on the sector-specific rules applicable to it.

9.3.1 Voluntary Carbon Markets: General Overview

Voluntary carbon markets have existed alongside compliance-based mechanisms since the Kyoto Protocol period, and they continue to operate as a parallel channel under the Paris Agreement architecture. In practice, voluntary markets provide an alternative pathway for trading emission reduction or carbon removal claims, particularly where participation in Article 6.2 or 6.4 cooperation may involve higher transaction costs, complex governance requirements, or institutional capacity constraints.

From the perspective of the forestry and wood-based sector, participation in voluntary carbon markets enables forest owners, land managers, and actors incorporating wood into long-lived products to monetise carbon sequestration in forests or carbon storage in products in the form of carbon credits. Purchasers of such credits are typically large corporations and financial institutions, although in principle any market participant may acquire them.

Voluntary carbon markets are, by definition, non-mandatory and until recently lacked EU-level regulation. The **Integrity Council for the Voluntary Carbon Market (ICVCM)** is a non-profit initiative established in 2021 with the support of more than 250 organisations, aiming to promote global integrity standards for voluntary carbon markets. The ICVCM formulated ten Core Carbon Principles (Figure 18), designed to enhance credit quality, ensure that credits represent genuine mitigation outcomes, and reduce the risk of greenwashing. Nevertheless, because participation remains voluntary, compliance with these principles is not guaranteed across the market.



Figure 18: Core principles for voluntary carbon markets defined by the Integrity Council for the Voluntary Carbon Market. (Source: <https://icvcm.org/core-carbon-principles/>)

The operational structure of voluntary carbon markets is illustrated in Figure 19. In the forest-based sector, project developers implementing carbon sequestration or storage activities may include forest managers, wood-processing companies, or enterprises integrating wood into long-lived structures. These actors implement activities that generate additional carbon sequestration or storage relative to a baseline scenario.

The feasibility and performance of such activities are verified by certification bodies, which apply specific certification schemes to validate projects, quantify mitigation outcomes, issue certificates, and maintain registries of credited units. Buyers—such as multinational corporations—may acquire credits directly from certification bodies or via intermediaries. Following purchase, credits are retired, meaning their sold status is recorded in registries to prevent double counting or multiple use.

Because voluntary carbon credits are not fungible with EU ETS allowances or ESR compliance units, prices are generally lower than ETS allowance prices. For 2024, indicative market information suggests that certain LULUCF-related credits were traded in the range of approximately €30–€50 per tonne of CO₂, although prices vary substantially by project type, certification standard, crediting year, co-benefits, and perceived integrity attributes. This relatively elevated price range already reflects market expectations regarding the forthcoming operationalization of the CRCF Regulation.

A further challenge arises from the fragmented certification landscape, with multiple certification standards and bodies operating in parallel. This diversity complicates the assessment and comparison of the actual mitigation value and integrity of credits. Examples of certification systems active in the LULUCF domain include the Verified Carbon Standard, the Gold Standard for the Global Goals, Nori Carbon, and Tree.ly. These are private organisations applying different certification methodologies and criteria.



Figure 19: Actors in the voluntary carbon market. (Source: <https://decode6.org/articles/differences-between-voluntary-and-compliance-markets/>)

9.3.2 The CRCF Regulation: Establishing a Regulated Voluntary Carbon Market in the EU

The core objective of the CRCF Regulation is to establish an EU-wide, harmonised, and methodologically robust framework to ensure the high-quality, transparent, and regulated functioning of voluntary carbon markets.

The adoption of the European Green Deal, the Fit for 55 package, and the articulation of the EU’s 2050 climate neutrality target marked the beginning of a new phase of climate ambition. This shift has been accompanied by the adoption of multiple legislative instruments, including the EU **Sustainable Finance Framework** (Figure 20), which introduces new climate-related obligations for both corporations and financial institutions.

For companies, EU regulation requires the assessment of greenhouse gas emissions across the entire value chain, while financial institutions must also evaluate the GHG impacts of their investment portfolios. In addition to reporting obligations, affected entities are required to implement mitigation measures aimed at improving their climate performance and progressing toward net-zero emissions.

Within this context, voluntary carbon markets represent one potential instrument for addressing residual emissions, as the purchase of voluntary carbon credits is recognised as a possible pathway—though not a substitute—for achieving corporate mitigation objectives. Together with the introduction of the CRCF Regulation, these developments are expected to stimulate growth in voluntary carbon markets, potentially leading to higher credit prices and transaction volumes. These trends suggest that revenues from carbon credits may become a tangible and increasingly relevant income source for forest managers and wood-based industries.

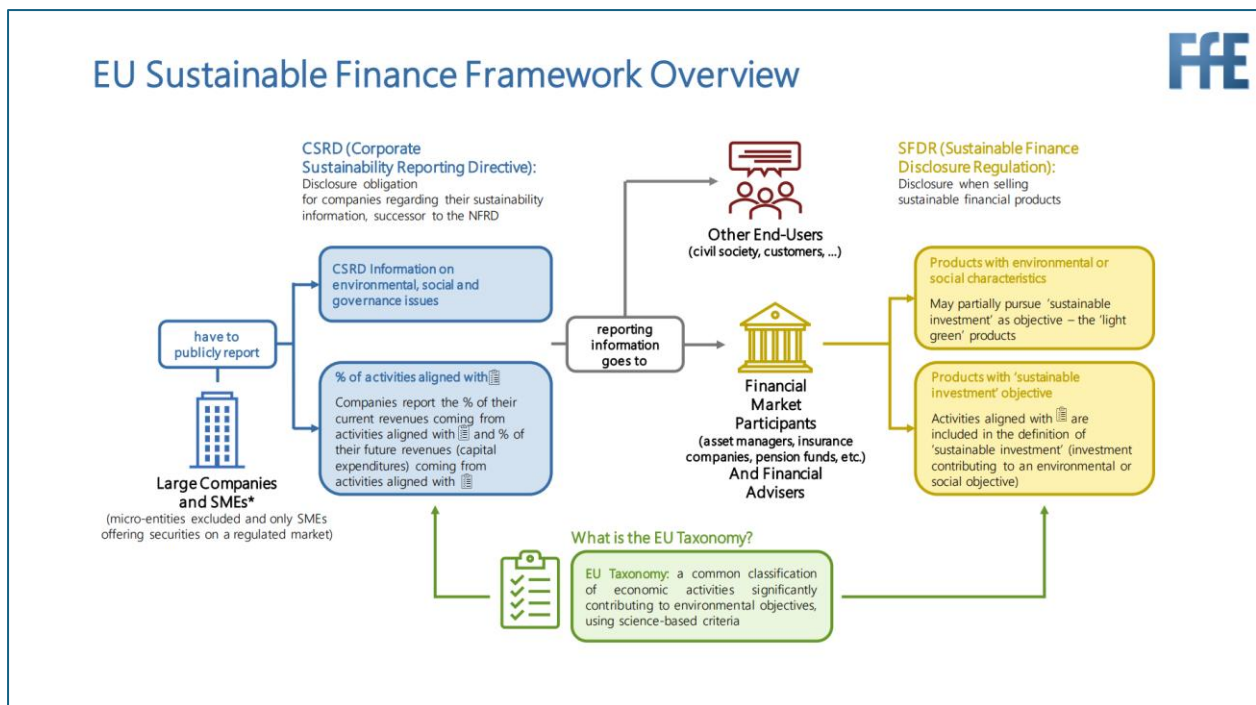


Figure 20: Components of the EU Sustainable Finance Framework. (Source: <https://www.ffe.de/en/publications/info-what-is-the-sustainable-finance-disclosure-regulation/>)

9.3.3 Certification Framework and Eligible Activities under the CRCF Regulation

Given these developments, the EU-level regulation and transparency of voluntary carbon markets has become increasingly important. The CRCF certification framework is illustrated in Figure 21, while Figure 22 presents the certification process established under the Regulation.

Under the CRCF Regulation, certification schemes are recognized by the European Commission, whereas certification bodies responsible for auditing activities are accredited at Member State level. The scope of certifiable activities is broad: both carbon removal and storage technologies and carbon farming activities are eligible for certification and participation in voluntary carbon markets.

Carbon farming encompasses a wide range of agricultural and forestry practices that contribute to sustainable carbon sequestration or emission reductions within the land-use sector. This includes projects targeting carbon sequestration in forest biomass, deadwood, and soils, as well as activities aimed at reducing soil-related emissions.

The Regulation also allows certification of technologies resulting in permanent carbon removals, typically involving industrial processes that capture CO₂ either directly from the atmosphere or during bioenergy production, followed by long-term storage, for example through geological injection.

A third major category includes carbon storage in products, with wood-based buildings representing the most prominent example. Importantly, the Regulation recognises not only ecosystem-based carbon sequestration, but also the carbon storage potential of harvested wood products. However, only storage durations equal to or exceeding 35 years are eligible for certification, and the permanence of storage must be monitored throughout the storage period. This requirement presents methodological challenges, particularly for products not intended for long-term use in buildings. Consequently, the primary focus of product-based carbon storage—consistent with the EU Energy Performance of Buildings Directive—is on long-lived structural applications of buildings.

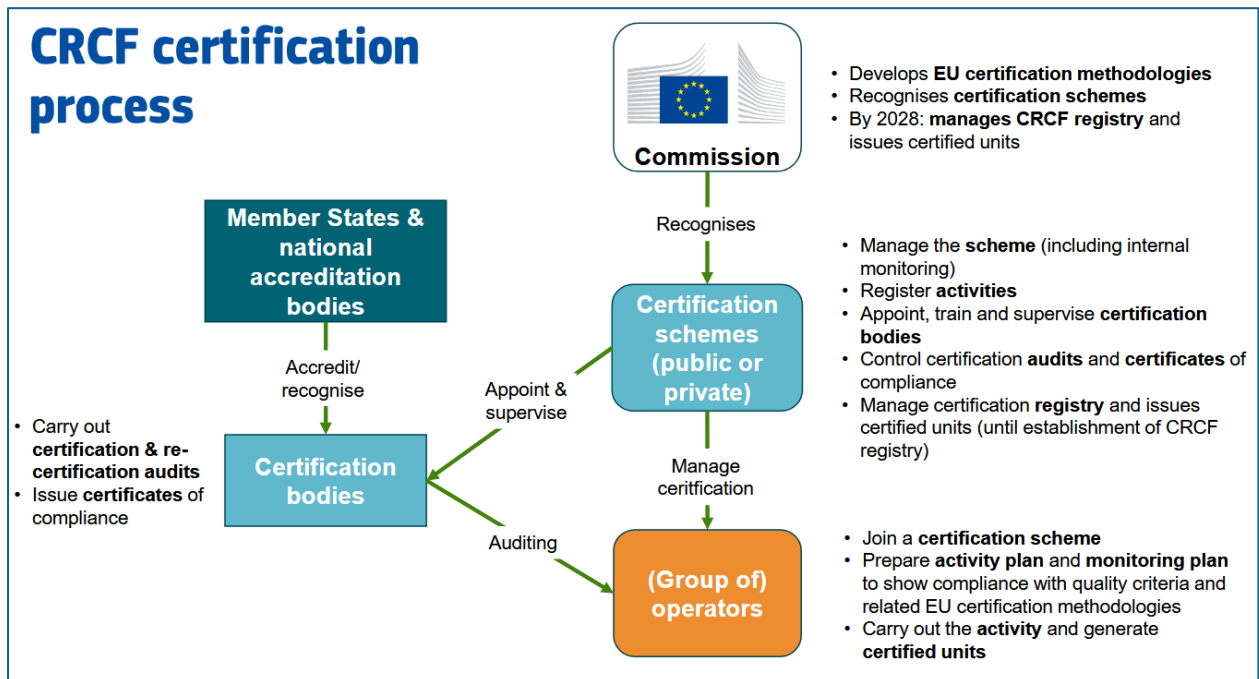


Figure 21: Certification framework established by the CRCF Regulation. (Source: European Commission https://climate.ec.europa.eu/document/download/134fd5c7-8c2d-43d5-ba71-34a9466c6abe_en?filename=event_20241021_day_1_en.pdf)

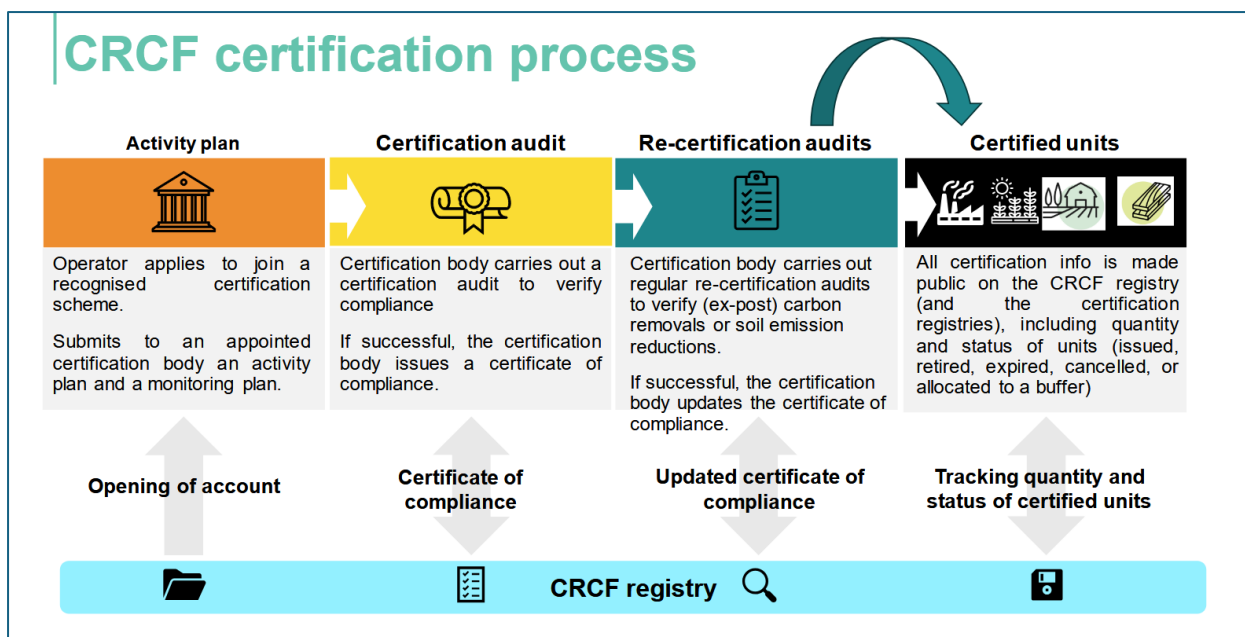


Figure 22: Certification process under the CRCF Regulation. (Source: European Commission https://forest.jrc.ec.europa.eu/media/filer_public/34/66/3466ae62-07f2-462e-a9fd-acbeecd8af8a/711_jurij_krajcic_ec.pdf)

9.3.4 Carbon Credit Types and Issuance Rules

Different categories of certifiable activities are presented in Figure 23, while Figure 24 classifies the corresponding types of carbon credits recognised under the CRCF framework. The Regulation distinguishes between permanent and temporary credits. Emission reductions and permanent carbon storage generate **permanent credits**, whereas ecosystem-based carbon sequestration and carbon storage in products generate temporary credits.

Temporary credits are subject to five-year commitment periods, which define the cycles for implementation, monitoring, and re-certification. Credit issuance occurs ex post, meaning that credits may only be issued after completion of the first five-year period and following a successful re-certification audit. By contrast, a compliance certificate confirming conformity with CRCF requirements is issued already at the project design stage, following the initial audit. This allows for the conclusion of forward contracts for future credits and provides opportunities for pre-financing. However, for projects requiring substantial upfront investment, the delayed issuance of tradable credits may represent a financial constraint.

Although the text of the CRCF Regulation is already available, the detailed methodological rules are still under development. The regulated voluntary market under the CRCF framework can only become operational once these implementing acts and methodological guidelines are adopted. An EU-level carbon credit registry must be established within four years of the Regulation's entry into force, implying that registry operations are expected to commence around 2028.

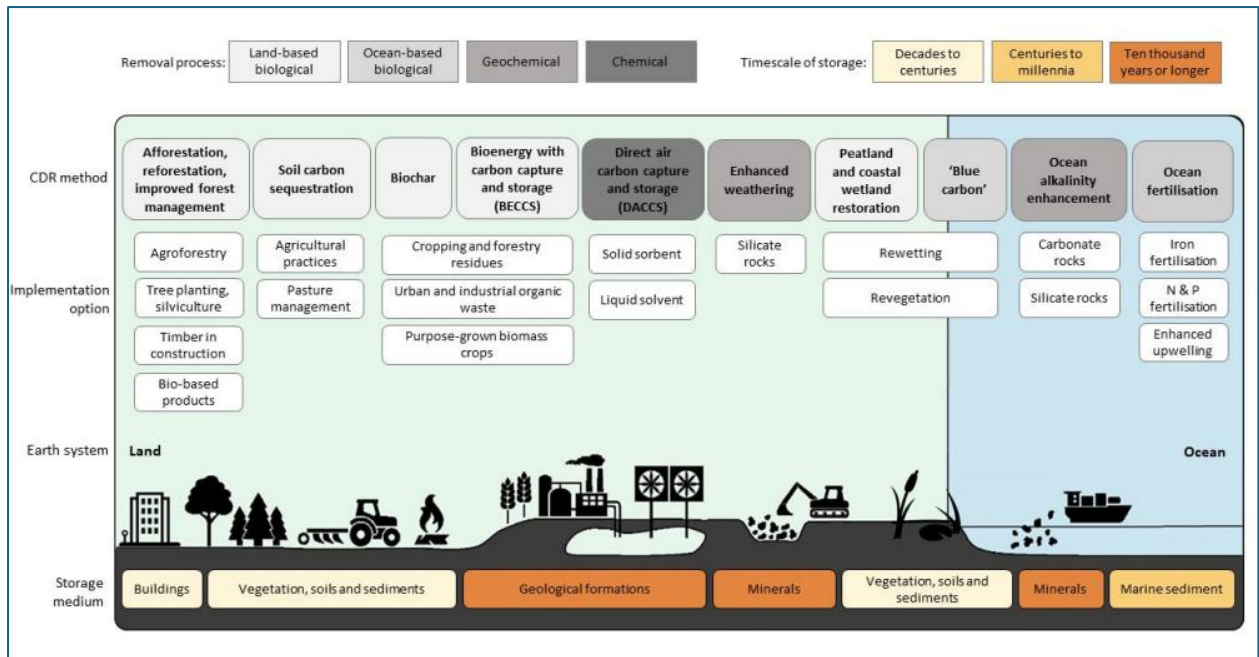


Figure 23: Types of activities certifiable under the CRCF Regulation. (Source: <https://energypost.eu/eu-carbon-removal-certification-framework-new-rules-to-turn-greenwashing-into-genuine-removals/>)

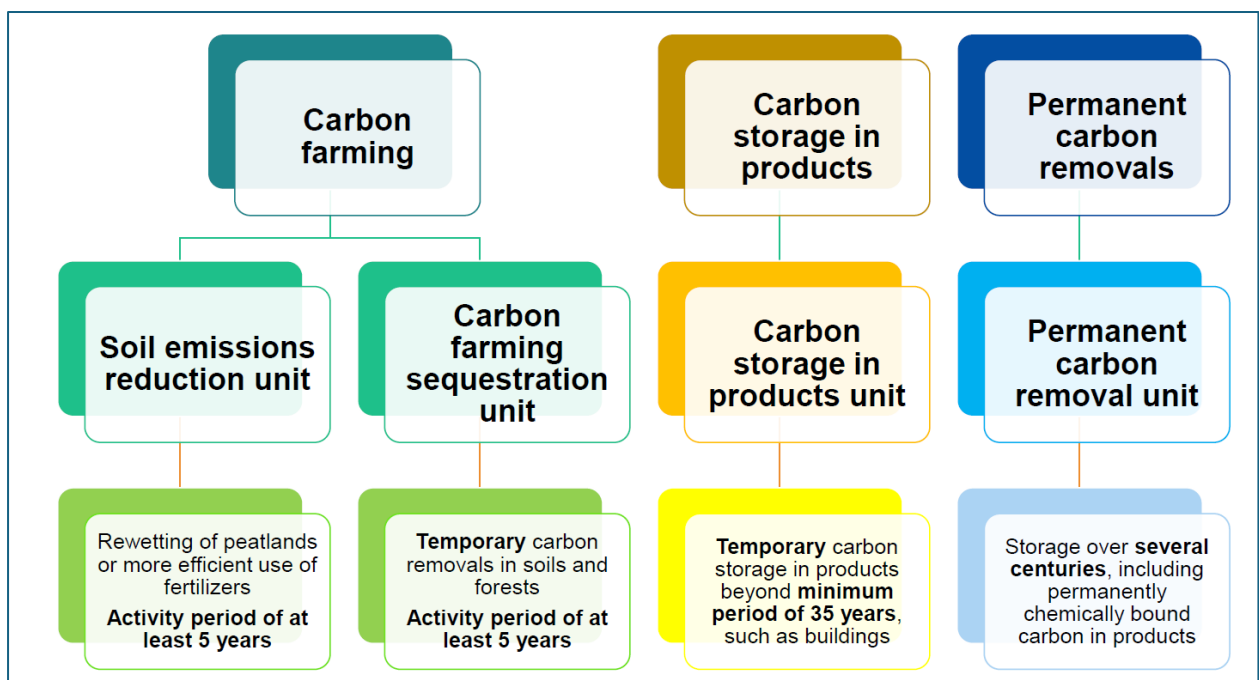


Figure 24: Types of carbon credits under the CRCF Regulation. (Source: European Commission https://forest.jrc.ec.europa.eu/media/filer_public/34/66/3466ae62-07f2-462e-a9fd-acbeec8af8a/711_jurij_krajcic_ec.pdf)

9.3.5 Governance, Quality Criteria, and Additionality

The development of detailed certification rules is carried out separately for each activity type by the Expert Group on Carbon Removals, an advisory body to the European Commission. The group comprises approximately 70 experts representing national authorities, companies, civil

society organisations, and research institutions. While members meet in person twice per year, substantive work continues on an ongoing basis through online collaboration.

The key quality criteria of the CRCF Regulation are illustrated in Figure 25. These are the so-called **QU.A.L.I.TY criteria**, which ensure the quantifiability, additionality, sustainability, and durability of mitigation outcomes.

While detailed discussion of quantification methodologies will be provided in the final part of this chapter, particular emphasis is placed here on **additionality**, which constitutes a core principle of the regulated voluntary market. Under this principle, only activities that generate mitigation outcomes beyond a defined business-as-usual baseline scenario may be certified and rewarded with carbon credits. Additionality also has a regulatory dimension: activities that would occur anyway due to existing legal obligations are not eligible. Furthermore, the framework requires financial additionality, meaning that projects must demonstrate that they would be unlikely to proceed, or would proceed at a materially smaller scale, in the absence of revenues from carbon credits. For carbon farming activities, the additionality framework is complemented by explicit **biodiversity and sustainability safeguards**. Only activities that enhance biodiversity, improve soil conditions, and do not cause harm to other sustainability objectives may be certified. Sustainability assessments must consider impacts on the circular bioeconomy, climate change adaptation, water resources, and environmental protection. Certification is possible only if the activity does not cause significant harm in any of these sustainability domains, consistent with the safeguards set out in the Regulation.

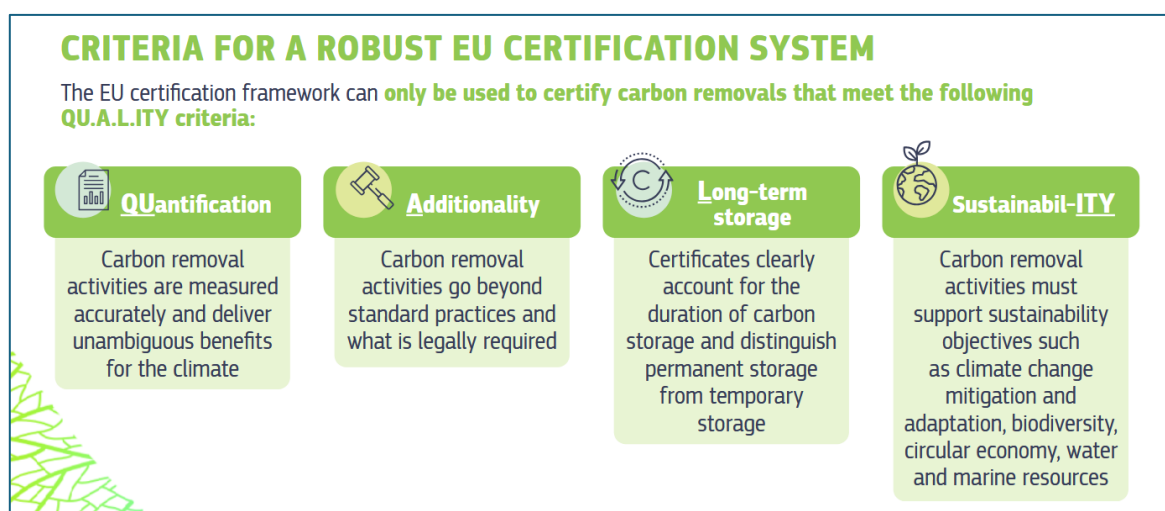


Figure 25: Certification criteria for carbon removals under the CRCF Regulation. (Source: https://ec.europa.eu/commission/presscorner/api/files/attachment/874097/Factsheet%20-%20Certification%20of%20carbon%20removals_en.pdf)

Following this overview of voluntary carbon market mechanisms and the general regulatory framework established by the CRCF Regulation, a key question emerges: which specific activities and project types will be certifiable in the forest-based sector, and what measurements, calculations, methodological developments, or modelling efforts will be required to demonstrate project eligibility?

9.4 Quantification of Carbon Farming Projects and Carbon Storage in Harvested Wood Products under the CRCF Regulation

In the last part of this chapter, we review the types of projects eligible for certification under the CRCF Regulation, together with the criteria governing quantification and certification, and the methodological rules currently available. As in the previous parts, particular emphasis is placed on project types and methodological requirements relevant to forestry and the wood-based industries.

As noted earlier, although the text of the CRCF Regulation is already available, the detailed methodological guidance associated with the Regulation is still under development. These rules will be adopted by the European Commission in the form of delegated acts. Consequently, the activity-specific rules for quantifying carbon removals are not yet fully defined.

9.4.1 General Rules for the Quantification of Carbon Removals

The CRCF Regulation **combines methodological elements from life-cycle assessment (LCA) and greenhouse gas (GHG) inventory accounting**. For the quantification of carbon removals, it requires the application of robust, transparent, and high-tier quantification approaches, consistent with the IPCC Guidelines for National Greenhouse Gas Inventories (IPCC, 2006), and drawing on model- and measurement-based methods (up to Tier 3 where appropriate).

Certified projects must apply a **baseline**, representing the business-as-usual (BAU) level of carbon removals or storage. Only carbon removals that exceed this baseline are eligible for certification (Figure 26). Conceptually, this baseline is analogous to the Forest Reference Level (FRL) applied in national LULUCF accounting; however, under the CRCF Regulation it is defined and applied at project level rather than at national level, and it does not constitute a compliance reference for national accounting.

Two types of baselines may be applied: **standardised baselines and activity-specific baselines**. Standardised baselines will be established by the European Commission through delegated acts, while activity-specific baselines will be defined during the design of individual projects.

To determine creditable carbon removals (i.e. removals eligible for certification and credit issuance), it is necessary to quantify not only the baseline but also the **direct and indirect emissions associated with the activity**. This reflects the life-cycle perspective embedded in the CRCF framework. Relevant emission sources may include, for example, soil emissions arising from land-use change, emissions from machinery used during afforestation or forest management, and transport-related emissions. These emissions must be quantified and deducted from gross removals to determine the net creditable amount (Figure 26).

Net carbon removal benefit = Carbon Removals under baseline – total Carbon Removals – GHG associated > 0

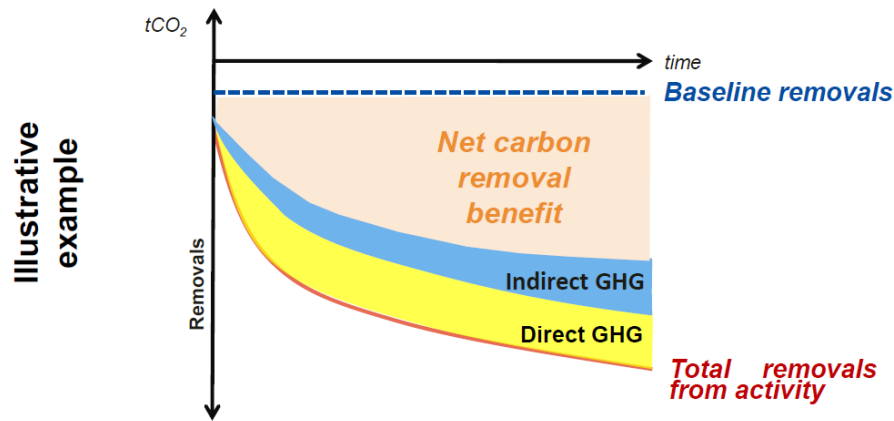


Figure 26: Quantification of creditable carbon removals. (Source: European Commission https://climate.ec.europa.eu/eu-action/carbon-removals-and-carbon-farming_en)

Project design therefore requires substantial data collection and modelling efforts, both to estimate the carbon removal potential of the proposed activity and to quantify the associated direct and indirect emissions.

Following certification and project implementation, a **monitoring phase** is required, during which carbon removals must be verified through field-based measurements and observations. Certified projects generate high-resolution empirical data, as monitoring requirements are considerably more detailed than those applied to conventional land-use activities. Monitoring results are recorded in project certificates, which will become accessible through the EU CRCF registry from 2028 onwards. These data are expected to provide a valuable supplementary information source for national GHG inventory compilation.

It is important to emphasise that intergovernmental emissions trading systems and the voluntary market regulated under the CRCF Regulation operate as parallel and non-fungible systems. Credits generated under the CRCF framework do not constitute compliance units and cannot be transferred into national or international emissions accounting systems under current rules. Accordingly, **CRCF-based transactions do not directly affect the accounting of national emission reduction commitments**, although the data generated may support improved transparency and reporting quality.

9.4.2 Rules for the Certification of Carbon Farming Activities

The range of Carbon Farming activities eligible for certification is illustrated in Figure 27. From the perspective of the forest- and wood-based sector, the most relevant activity types include improved forest management, as well as afforestation and reforestation. Among

agricultural activities, the Regulation also explicitly recognises agroforestry, which offers substantial carbon removal potential in both biomass and soils.

For Carbon Farming projects, the minimum project duration is five years, followed by an additional five-year monitoring period. As a result, the shortest monitoring horizon is ten years, although project duration may be extended following re-certification audits.

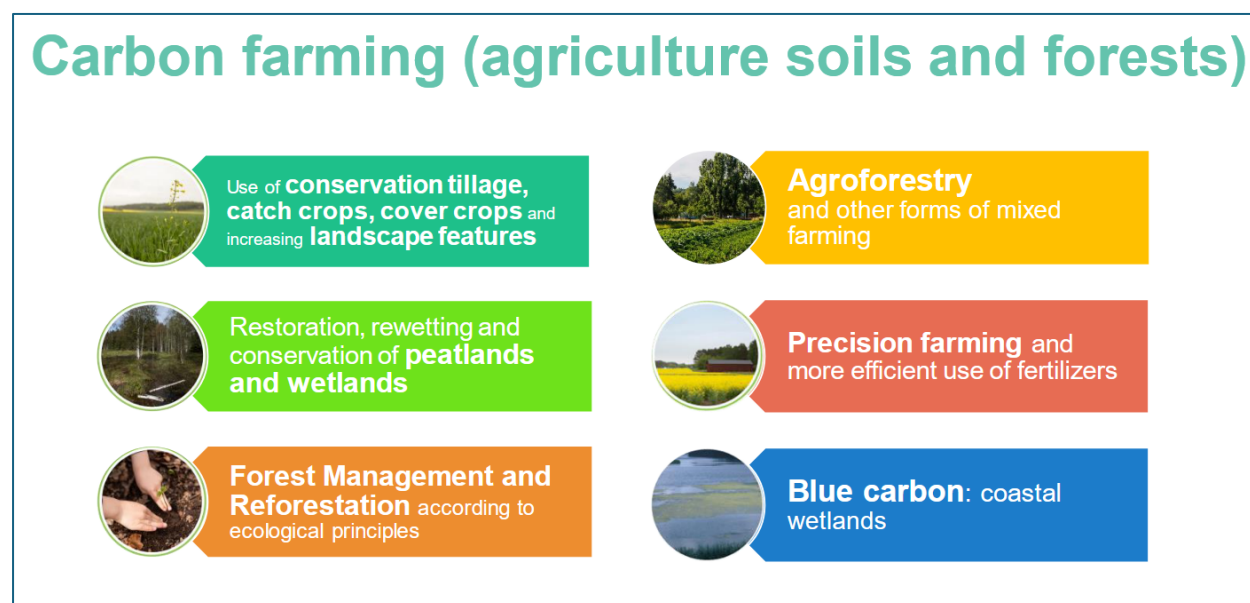


Figure 27: Main types of certifiable Carbon Farming activities. (Source: European Commission https://forest.jrc.ec.europa.eu/media/filer_public/34/66/3466ae62-07f2-462e-a9fd-acbeecd8af8a/711_jurij_krajcic_cc.pdf)

Under the CRCF Regulation, the **relevant carbon pools for Carbon Farming projects are living biomass, soil organic carbon, and dead organic matter** (deadwood and litter). Current indications suggest that the integration of carbon storage in harvested wood products into Carbon Farming methodologies will not be included in the initial version of the methodological guidelines. This creates a methodological limitation, as timber harvesting (e.g. final fellings) would be accounted for as a carbon loss, irrespective of whether the harvested wood continues to store carbon in long-lived products.

Under these conditions, afforestation, climate-adaptive stand conversion, transition to continuous-cover forestry, and extended rotation forestry are likely to represent the most readily certifiable project types in forest management. In addition, agroforestry-based solutions offer further certification opportunities.

Where feasible, **the CRCF Regulation requires the use of standardised baselines established by the European Commission**. Their development is expected to be supported by the Copernicus Earth Observation Programme and the EU Forest Monitoring Regulation. According to the Regulation, standardised baselines will be derived through the combined use of remote sensing, modelling approaches, and field measurements, as illustrated in Figure 28. At present, however, no fully developed and agreed methodologies exist for baseline construction, and baseline values have therefore not yet been defined.

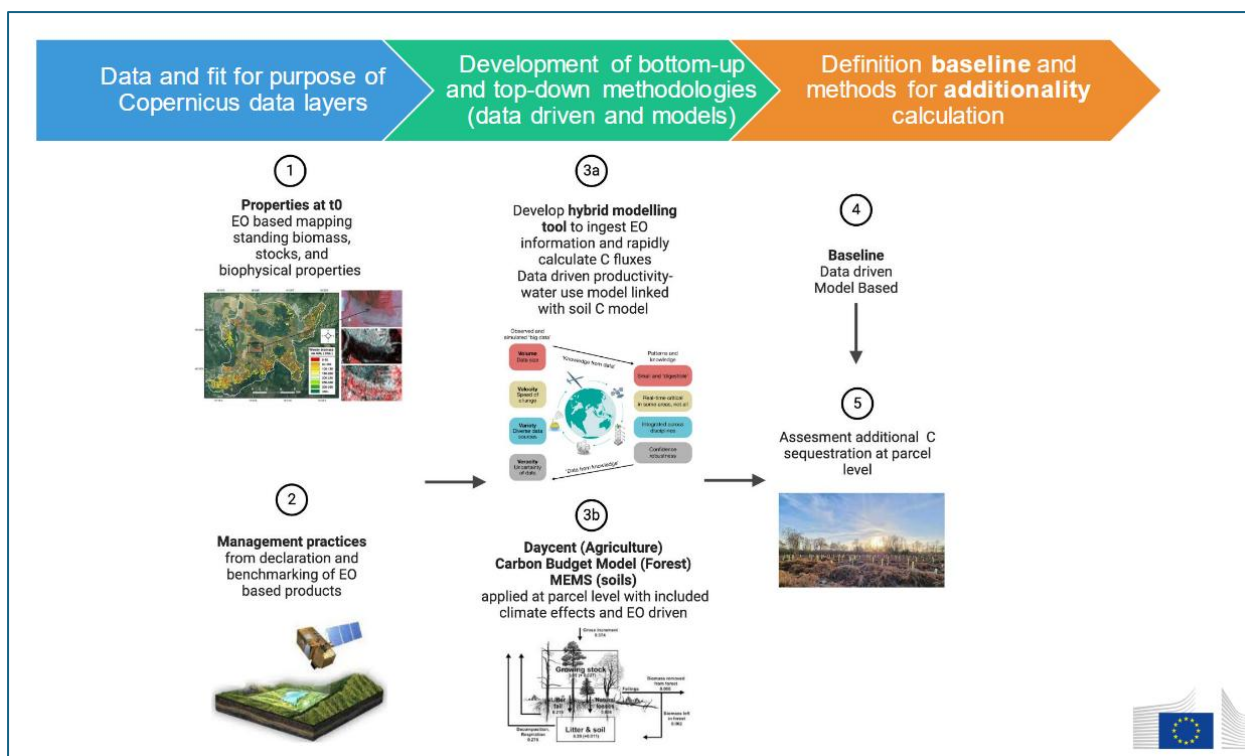


Figure 28: Process for establishing standardised baselines. (Source: https://forest.jrc.ec.europa.eu/media/filer_public/b4/30/b4303691-3ab6-43ed-96ac-2b93d78ee58d/712_lugato_migliavacca_jrc.pdf)

Where standardised baselines cannot be applied, project-specific baselines must be used. In such cases, additional methodological steps are required to demonstrate additionality.

As a general rule, Carbon Farming projects are certifiable only if they are both legally and financially additional, meaning that the carbon removals would not have occurred, or would have occurred at a materially lower level, in the absence of incentives and financing provided under the CRCF framework. In addition, Carbon Farming activities must demonstrate clear co-benefits for biodiversity and soil health to qualify for certification.

9.4.3 Rules for the Certification of Carbon Storage in Harvested Wood Products

Although a wide range of long-lived harvested wood products (HWPs) are already recognized and quantified in national GHG inventories, the CRCF Regulation certifies only a narrow subset of product-based carbon storage. The Regulation stipulates that only carbon storage with a minimum duration of 35 years is eligible, and only where the existence and persistence of storage can be continuously monitored on site.

This stringent definition effectively limits certifiable products to biogenic-based materials permanently incorporated into buildings. Importantly, eligibility is not restricted to wood alone: any long-lived biogenic product that stores carbon and is permanently integrated into buildings may be certified, as illustrated in Figure 29.

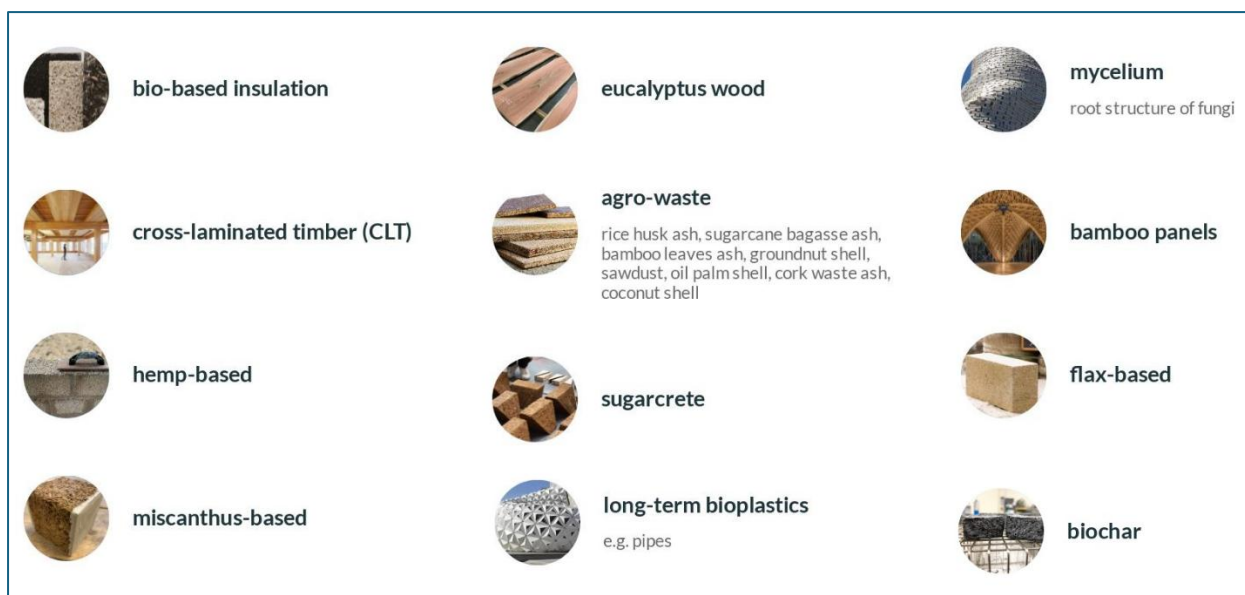


Figure 29: Potential types of long-term integrated biogenic products. (Source: https://climate.ec.europa.eu/document/download/0f796d21-dbe4-4f5a-b0ef-d71247544db1_en?filename=event_20240924_presentation_en.pdf)

Accordingly, the primary focus of product-based carbon storage under the CRCF Regulation is on **structural building components**, for which the legislator considers the minimum 35-year storage duration to be most reliably achievable. The Expert Group on Carbon Removals is currently examining the potential inclusion of **wood-based insulation materials**, given their importance for building renovation, which is a key pathway toward climate-neutral building stock and net-zero emission targets. While insulation materials offer substantial potential for long-term carbon storage, uncertainties remain regarding product lifetimes and monitoring feasibility. Final decisions on eligible product categories are therefore expected upon adoption of the methodological guidance.

The quantification of carbon stored in buildings will be aligned with the **EU Energy Performance of Buildings Directive** and the regulatory framework governing **Environmental Product Declarations (EPDs)**. As with other activity types, baselines will be applied, likely defined at national or regional level and differentiated by building type.

Baselines will reflect the typical amount of wood currently incorporated into buildings, based on assessments of the existing building stock. Only the additional quantity of wood exceeding this baseline will be eligible for certification and credit issuance. As in other activities, direct and indirect emissions associated with construction must be quantified and deducted. In addition, it will be mandatory that **wood used in certified projects originates from sustainable sources, in line with RED III and the EU Taxonomy Regulation**.

For these projects, the project proponent is the building owner, who, following certification, is required to conduct regular monitoring over the full 35-year storage period.

From the perspective of the CRCF-regulated voluntary carbon market, these provisions imply that a key direction for innovation in the wood-based sector will be the development of products with lifetimes exceeding 35 years, alongside the broader deployment of timber-based

construction solutions. In this context, the updating and rationalisation of fire-safety regulations is also of importance, as existing rules often constrain the extensive use of timber structures in larger buildings.

9.5 The Promise and Limits of Carbon Markets in Ecosystem Governance

Carbon pricing internalises part of the climate externality by assigning economic value to emissions, emission reductions, and removals. In the context of nature protection governance, its primary contribution is not the direct preservation of ecosystems through legal command-and-control instruments, but the **alignment of economic incentives** with climate and environmental objectives. When appropriately designed, carbon pricing can mobilise private finance toward conservation, restoration, climate-adaptive land management, and the long-term stewardship of ecosystems that deliver measurable mitigation outcomes alongside broader ecosystem services.

At the same time, carbon pricing instruments operate within **inherent structural constraints**, which are especially pronounced for land-based and ecosystem-based mitigation. Biological carbon stocks are spatially heterogeneous, temporally dynamic, and subject to disturbance risks that cannot be fully controlled through management alone. Measurement uncertainty, non-linearity of ecosystem responses, and the possibility of reversal complicate the conversion of ecological processes into standardised, fungible units suitable for market exchange. These characteristics fundamentally distinguish nature-based mitigation from fossil fuel-based emission reductions and explain why land-use sectors have not been integrated into carbon markets through simple extensions of industrial compliance systems.

As a result, participation of nature-based activities in carbon markets has evolved through **specialised governance arrangements** rather than direct inclusion in conventional emissions trading. Reference levels, baselines, caps, buffers, durability requirements, and sustainability safeguards are not technical add-ons but essential institutional devices designed to manage uncertainty, prevent over-crediting, and protect environmental integrity. These mechanisms reflect an implicit recognition that ecosystem carbon cannot be governed solely as a commodity; it must be governed as a managed stock embedded in complex ecological and social systems.

A central lesson emerging from this analysis is that carbon markets should be understood as **conditional policy instruments**. Their capacity to support nature protection depends critically on the quality of underlying rules and institutions. Robust baselines, high-quality monitoring, reporting, and verification systems, credible management of reversal risks, and the explicit integration of biodiversity and social safeguards are preconditions for positive environmental outcomes. Where these conditions are not met, carbon pricing may produce low-integrity credits, incentivise narrow carbon-focused land-use decisions, or weaken the role of established nature protection frameworks.

Carbon pricing therefore cannot replace environmental regulation, protected area networks, or biodiversity conservation law. Instead, it can function as a **complementary mechanism** that enhances the economic viability of conservation and restoration within a broader governance architecture. In this complementary role, carbon markets can help bridge the gap between public conservation objectives and private investment decisions, provided that ecological limits and legal safeguards remain the foundation of nature protection policy.

From a governance perspective, the challenge is not whether to use carbon pricing in relation to nature protection, but **how and under what conditions** it should be applied. Carefully constrained and transparently governed carbon markets can contribute to **climate mitigation** while supporting **ecosystem resilience and sustainable land management**. Poorly designed or weakly regulated markets, by contrast, risk undermining both climate credibility and biodiversity outcomes. The future role of carbon pricing in nature protection will therefore depend less on market expansion per se, and more on the continued development of robust, precautionary, and ecologically informed governance frameworks that recognise both the potential and the limits of market-based instruments.

Core Concepts and Review Questions – Chapter 9

1. Why is carbon pricing relevant to nature protection policy?

Carbon pricing is relevant to nature protection policy because it partially internalises climate-related environmental externalities by assigning an explicit economic value to greenhouse gas emissions, emission reductions, and carbon removals. By influencing relative prices, it can redirect private investment and land-use decisions toward activities that reduce emissions or enhance carbon sequestration, including ecosystem conservation and restoration. From a nature-protection perspective, its relevance lies not in replacing biodiversity law, but in mobilising financial incentives that can support conservation objectives when embedded within robust regulatory and ecological safeguards.

2. What is the primary governance function of carbon pricing from a nature-protection perspective?

From a nature-protection perspective, the primary governance function of carbon pricing is to align private economic incentives with collective climate and environmental objectives. By making emissions more costly and mitigation more valuable, carbon pricing encourages actors to consider environmental impacts that would otherwise remain external to market decision-making. However, this function remains indirect and conditional: carbon pricing shapes behaviour through incentives rather than legal prohibitions and therefore depends on complementary regulation to ensure biodiversity protection and ecological integrity.

3. Which distinction best differentiates carbon taxes from emissions trading systems (ETS)?

The key distinction between carbon taxes and emissions trading systems lies in the type of certainty they provide. Carbon taxes deliver price certainty by fixing the cost per tonne of emissions, while emissions outcomes remain uncertain. In contrast, ETS provide quantity certainty by setting a binding emissions cap, while allowance prices fluctuate according to market conditions. This distinction has important governance implications, particularly where ecological targets require predictable environmental outcomes rather than predictable prices.

4. Why are carbon taxes rarely applied directly to land-use and forestry sectors?

Carbon taxes are rarely applied directly to land-use and forestry sectors because measurement, reporting, and verification of emissions and removals are complex and uncertain in biological systems. Forest carbon stocks vary spatially and temporally and are affected by natural disturbances such as storms, drought, and pests. These characteristics make it difficult to define taxable emission flows in a stable and administratively feasible manner, unlike fossil fuel combustion, where emissions can be measured with high precision.

5. What is the defining feature of an emissions trading system (cap-and-trade)?

The defining feature of an emissions trading system is the establishment of a quantitative cap on total emissions, combined with tradable emission allowances. The cap ensures that

aggregate emissions do not exceed a predefined environmental limit, while trading allows regulated entities to comply cost-effectively by reallocating mitigation efforts across participants. This structure links environmental effectiveness to economic efficiency within a regulated market framework.

6. Why have traditional ETS generally excluded land-use and forestry sectors?

Traditional emissions trading systems have generally excluded land-use and forestry sectors because biological carbon is subject to permanence risks, reversibility, and complex accounting rules. Unlike fossil emissions, ecosystem carbon stocks can be lost due to natural disturbances or management changes. These risks raise concerns about environmental integrity and make it difficult to integrate land-use activities into compliance markets designed for stable, controllable emission sources.

7. What is an emission allowance in a compliance carbon market?

An emission allowance is a regulatory unit issued by public authorities that authorises the emission of one tonne of carbon dioxide equivalent within a defined compliance period. Allowances are not mitigation outcomes themselves; rather, they allocate limited emission rights under an overall cap. Their scarcity, enforced through regulation, is what gives them economic value and drives mitigation behaviour in cap-and-trade systems.

8. What distinguishes carbon credits from emission allowances?

Carbon credits differ from emission allowances in that they represent verified emission reductions or carbon removals achieved relative to a defined baseline, typically through specific projects or activities. Allowances allocate emission rights within a capped system, while credits certify mitigation outcomes. This distinction is particularly important for nature-based mitigation, which is generally credit-based rather than allowance-based.

9. Why are carbon credits particularly relevant for nature protection?

Carbon credits are particularly relevant for nature protection because they can be generated through ecosystem-based activities, such as forest conservation, afforestation, agroforestry, soil carbon enhancement, and long-term carbon storage in biomass or products. These activities can deliver climate mitigation alongside biodiversity and ecosystem-service co-benefits. When properly governed, carbon credits create financial incentives that can support conservation and restoration beyond what regulation alone may achieve.

10. Which risk is most specific to ecosystem-based carbon capture and storage?

The most specific risk associated with ecosystem-based carbon capture and storage is reversibility, meaning that stored carbon can be released back into the atmosphere due to disturbances such as fire, drought, pests, or land-use change. This risk distinguishes biological carbon from fossil emission reductions and necessitates buffers, durability rules, and long-term monitoring in carbon market design.

11. Why does the UNFCCC not establish a global carbon price?

The UNFCCC does not establish a global carbon price because it functions as a framework convention that sets principles, reporting rules, and institutional arrangements, while leaving policy instrument choice to individual Parties. This approach reflects differences in national circumstances, development levels, and governance capacities, allowing countries to adopt carbon taxes, emissions trading, or other instruments consistent with their domestic contexts.

12. What is the key architectural shift from the Kyoto Protocol to the Paris Agreement?

The key architectural shift from the Kyoto Protocol to the Paris Agreement is the move from top-down, internationally negotiated emission targets to nationally determined contributions (NDCs). Under the Paris Agreement, all Parties define their own mitigation objectives within a common transparency and accountability framework, fundamentally changing the role of carbon markets and cooperative mechanisms.

13. What is the primary purpose of Article 6 of the Paris Agreement?

Article 6 provides a legal basis for voluntary cooperation among Parties, allowing them to transfer mitigation outcomes and collaborate on emission reductions and removals. Its purpose is to enhance cost-effectiveness and ambition while maintaining environmental integrity through accounting rules and transparency requirements.

14. What are Internationally Transferred Mitigation Outcomes (ITMOs)?

ITMOs are quantified mitigation outcomes transferred between countries under Article 6 and used toward achieving national climate targets. They may represent emission reductions or removals and are subject to corresponding adjustments to ensure accounting consistency.

15. Why does Article 6 require corresponding adjustments?

Corresponding adjustments are required to prevent double counting of mitigation outcomes by ensuring that a transferred unit is subtracted from the transferring country's balance and added to the acquiring country's balance. This maintains the environmental integrity of international cooperation.

16. How are nature-based solutions treated under the Paris Agreement?

Nature-based solutions are fully integrated through the LULUCF sector and can contribute to national mitigation targets and international cooperation under Article 6. Their inclusion reflects recognition of land-use and ecosystem management as legitimate mitigation pathways, subject to robust accounting and safeguards.

17. Why are voluntary carbon markets considered complementary to compliance markets?

Voluntary carbon markets are considered complementary to compliance markets because they mobilise climate-mitigation finance outside mandatory regulatory systems, particularly for sectors, activities, or actors that are not covered by emissions trading systems or carbon taxes. They provide an additional channel for directing private investment toward emission reductions

and carbon removals, including nature-based solutions such as forestry and soil carbon projects. Voluntary markets also allow for greater experimentation and innovation in project design and methodologies. However, their complementary role depends on credible governance frameworks, as they are not substitutes for compliance obligations or legally binding climate targets.

18. What is a major integrity concern in voluntary carbon markets?

A major integrity concern in voluntary carbon markets is the fragmentation of standards and variability in credit quality, which can undermine trust and environmental effectiveness. With multiple certification schemes applying different rules for additionality, permanence, and monitoring, credits may not represent equivalent mitigation outcomes. This heterogeneity increases the risk of over-crediting and greenwashing, where credits are marketed as climate-beneficial without delivering real or durable emission reductions or removals. Without harmonised methodologies and public oversight, voluntary markets may weaken rather than strengthen climate and nature governance.

19. What is the main innovation of the EU Carbon Removal and Carbon Farming (CRCF) Regulation?

The main innovation of the CRCF Regulation is the establishment of the first EU-wide, publicly regulated framework for the voluntary certification of carbon removals and carbon farming activities. Unlike earlier purely private schemes, the CRCF introduces harmonised methodologies, legally defined quality criteria, biodiversity and sustainability safeguards, accredited certification bodies, and public oversight at EU and Member State levels. This represents a structural shift from fragmented voluntary markets toward a regulated voluntary carbon market, aimed at improving credibility, comparability, and environmental integrity while supporting climate and nature objectives.

20. Which activity type is eligible under the CRCF Regulation?

The CRCF Regulation allows certification of three broad categories of activities: carbon farming practices in agriculture and forestry, permanent carbon removal technologies such as geological storage, and long-term carbon storage in products, particularly in buildings. Eligibility is conditional on strict requirements for quantification, additionality, durability, monitoring, and sustainability. Activities must deliver measurable climate benefits beyond business-as-usual scenarios and comply with biodiversity and environmental safeguards, ensuring that certified mitigation does not undermine other EU sustainability objectives.

21. Why does the CRCF Regulation distinguish between permanent and temporary credits?

The distinction between permanent and temporary credits reflects fundamental differences in durability and reversal risk. Ecosystem-based carbon sequestration and product-based storage are inherently time-bound and exposed to disturbances, decay, or changes in land use, requiring periodic monitoring and re-certification. By contrast, permanent removals—such as geological storage—are intended to last for centuries with minimal reversal risk. Differentiating credit

types allows the governance framework to align credit validity, monitoring obligations, and risk management with the physical characteristics of different removal pathways.

22. What is the minimum storage duration for certifiable product-based carbon storage under CRCF?

Under the CRCF Regulation, certifiable product-based carbon storage must have a minimum storage duration of 35 years. This threshold reflects the need for long-term, verifiable carbon storage and is designed to ensure meaningful climate mitigation rather than short-lived carbon retention. In practice, this requirement limits certification primarily to structural applications in buildings, where storage duration and on-site monitoring can be credibly demonstrated over multiple decades.

23. Why are most harvested wood products excluded from CRCF product-based certification?

Most harvested wood products are excluded from CRCF product-based certification because their storage duration is too short or too uncertain to meet the Regulation’s durability and monitoring requirements. Products such as paper, packaging, or short-lived furnishings typically release stored carbon within a relatively brief period, and tracking their fate over decades is not feasible. As a result, these products cannot provide the long-term, monitorable storage needed to ensure environmental integrity under the CRCF framework.

24. What does “additionality” mean in the CRCF framework?

In the CRCF framework, additionality means that certified carbon removals or storage must go beyond what would occur under business-as-usual conditions and must depend materially on revenues from carbon certification. Activities that are already legally required, economically attractive without carbon finance, or part of standard practice are not eligible. Additionality thus ensures that carbon credits represent genuine, incremental mitigation outcomes and that public and private finance is not used to reward actions that would have happened anyway.

25. Why are biodiversity and sustainability safeguards included in CRCF certification?

Biodiversity and sustainability safeguards are included to prevent carbon-focused mitigation activities from causing harm to other environmental objectives, such as biodiversity conservation, soil health, water resources, and climate adaptation. These safeguards ensure coherence with EU environmental law and reflect the recognition that climate mitigation should not come at the expense of ecosystem integrity. By embedding “do no significant harm” principles into certification, the CRCF framework aims to align carbon markets with broader nature-protection and sustainability goals.

26. Why are CRCF credits not fungible with EU ETS allowances?

CRCF credits are not fungible with EU ETS allowances because they are voluntary, non-compliance units and do not form part of the EU’s capped emissions trading system. Allowing their use for ETS compliance could weaken the environmental integrity of the cap and blur the distinction between emission reductions and removals. Maintaining this separation preserves

the credibility of the EU ETS while allowing voluntary markets to function as a complementary, but distinct, climate-mitigation instrument.

27. What is the main role of baselines in carbon farming certification?

Baselines define the business-as-usual scenario against which additional carbon removals or storage are measured, ensuring that only mitigation outcomes exceeding expected trends or standard practices are credited. They provide the counterfactual needed to assess additionality and prevent over-crediting of natural growth or existing management. Robust baselines are therefore central to environmental integrity, transparency, and comparability across projects, and they ensure that carbon finance rewards genuine climate benefits rather than artefacts of accounting.

28. Why is monitoring more demanding in CRCF projects than in national greenhouse gas inventories?

Monitoring in CRCF projects is more demanding because certification operates at the project level and requires high-resolution, empirical data on carbon stocks, fluxes, and management practices. Unlike national greenhouse gas inventories, which rely on aggregated statistics and modelling, CRCF projects must demonstrate site-specific performance through detailed measurements, repeated verification, and documented management actions. This higher monitoring burden is necessary to support credible credit issuance and prevent over- or mis-crediting.

29. What is a central limitation of carbon markets in ecosystem governance?

A central limitation of carbon markets is their difficulty in fully capturing ecological complexity, uncertainty, non-linearity, and reversal risk. Ecosystems are dynamic and disturbance-prone, and their responses to management and climate change cannot be perfectly predicted or standardised. As a result, carbon markets require buffers, baselines, and safeguards and cannot operate as standalone governance tools. These limitations highlight the need for complementary regulatory, conservation, and land-use planning instruments.

30. How should carbon markets relate to nature protection law?

Carbon markets should function as complementary instruments embedded within robust legal and ecological frameworks, not as substitutes for nature protection law. While carbon pricing can help align economic incentives with conservation and restoration goals, legal protection, protected areas, and biodiversity regulation remain the foundation of ecosystem governance. Properly designed carbon markets can enhance the economic viability of nature-based solutions, but only when grounded in strong environmental regulation and precautionary safeguards.

Glossary

A

Adaptation (climate): Adjustment of natural or human systems to actual or expected climate change and its impacts, reducing vulnerability and increasing resilience.

Additionality: Additionality refers to the requirement that an environmental or climate benefit is causally attributable to a specific policy, project, or incentive and would not have occurred in its absence. In other words, the outcome must go beyond what would have happened under business-as-usual conditions, existing regulations, or prevailing market trends.

Agenda-setting: The phase of the policy cycle in which issues gain political attention and are prioritized for public action.

Allowance: A legally issued right to emit a specified amount of greenhouse gases, used in compliance emissions trading systems.

Anthropogenic: Originating from human activity.

Atmospheric pollution: Contamination of the atmosphere by harmful substances such as particulate matter, ozone, and greenhouse gases.

B

Baseline: Reference scenario describing expected developments in the absence of a policy or intervention.

Biodiversity: Diversity of life at genetic, species, and ecosystem levels.

Bioeconomy: Economic system based on the sustainable use of biological resources for food, materials, chemicals, and energy.

Biogenic carbon: Carbon stored and cycled in biological systems such as forests, soils, crops, and biomass-based products.

Birds Directive: EU legislation (Directive 2009/147/EC) providing legal protection for wild bird species, their habitats, nests, and eggs, and establishing Special Protection Areas (SPAs).

Buffer (integrity / risk buffer): Reserve mechanism used to manage uncertainty and reversal risks, especially in carbon accounting.

C

Carbon accounting: Systematic quantification of greenhouse gas emissions and removals using standardized rules.

Carbon farming: Land-management practices that enhance carbon sequestration in soils and biomass while delivering co-benefits.

Carbon leakage: Displacement of emissions to other regions or sectors due to policy intervention.

Carbon pricing: A policy approach that assigns a price to greenhouse gas emissions or removals to internalize climate externalities and incentivize mitigation.

Carbon removal: Extraction of CO₂ from the atmosphere with durable storage.

Carbon sink: System that absorbs more carbon than it emits over a given period.

Carbon stock: Quantity of carbon stored in a reservoir at a given time.

Carrying capacity: Maximum level of population or activity an ecosystem can sustain without degradation.

Certification: Independent verification that activities meet defined environmental or sustainability standards.

Circular economy: Economic model minimizing waste and resource use by maintaining materials in circulation.

Climate change: Long-term alteration of climate patterns, primarily driven today by anthropogenic greenhouse gas emissions.

Climate mitigation: Actions aimed at reducing emissions or enhancing sinks to limit climate change.

Co-benefits: Additional positive outcomes beyond a policy's primary objective.

Compliance market: Legally mandated market system requiring participation and compliance (e.g. EU ETS).

Conservation: Sustainable management and protection of natural resources to maintain ecological integrity.

Credit: A tradable unit representing a verified emission reduction or carbon removal, typically equivalent to one tonne of CO₂ equivalent.

D

Decarbonization: Reduction of carbon intensity and fossil-fuel dependence in economic systems.

Deforestation: Permanent conversion of forest land to non-forest uses.

Delegated act: A non-legislative act of general application adopted by the European Commission under Article 290 of the Treaty on the Functioning of the European Union (TFEU), which supplements or amends non-essential elements of a legislative act, and is subject to ex post control by the European Parliament and the Council, which may revoke the delegation or object to the act.

Desertification: Land degradation in drylands caused by climatic variability and human activities.

Double materiality: A sustainability reporting concept requiring organizations to assess and disclose (1) how environmental and social issues affect their financial performance (financial materiality) and (2) how their activities impact the environment and society (impact materiality).

E

Ecological economics: Economic paradigm viewing the economy as embedded within ecological systems and biophysical limits.

Ecosystem approach: Integrated management of land, water, and living resources promoting conservation and sustainable use.

Ecosystem integrity: Ability of an ecosystem to maintain structure, composition, and function.

Ecosystem services: Benefits humans obtain from ecosystems: provisioning, regulating, cultural, and supporting services.

Environmental externality: Environmental cost or benefit not reflected in market prices.

Environmental governance: Processes and institutions through which societies manage environmental resources and impacts.

Environmental liability: Legal responsibility for preventing or remedying environmental damage.

Evidence-based policymaking: Use of scientific knowledge and data to inform public decisions.

F

Fitness check: EU evaluation assessing whether legislation is effective, efficient, coherent, relevant, and proportionate.

Fragmentation (habitat / policy): Division of ecosystems or governance systems into disconnected units.

G

Global environmental problem: Environmental issue whose causes or impacts transcend national borders and require international cooperation.

Governance: Structures and processes through which collective decisions are made and implemented.

Governance layer: Functional level within the EU nature protection framework grouping instruments by role.

Green Deal: EU strategic framework integrating climate, biodiversity, energy, and economic transformation.

Green claims: Environmental statements made by companies regarding products or services.

Green labeling: Voluntary or regulated schemes signaling environmental performance to consumers.

Greenwashing: Misleading portrayal of products or activities as environmentally beneficial.

H

Habitats Directive: EU legislation (Directive 92/43/EEC) aimed at conserving natural habitats and wild species, forming the legal basis of the Natura 2000 network through Special Areas of Conservation (SACs).

Harvested Wood Products (HWP): Wood products storing carbon after harvest and accounted for in climate reporting.

Hybrid governance: Combination of binding regulation, market instruments, and voluntary standards.

I

Impact assessment (IA): Ex-ante evaluation of economic, social, and environmental impacts of proposed policies.

Implementation gap: Difference between policy objectives and actual outcomes.

Institutional capacity: Ability of institutions to design, implement, and enforce policies.

Intergenerational equity: Principle that present actions should not compromise future generations' needs.

Invasive alien species: Non-native species whose introduction or spread threatens biodiversity, ecosystem services, or human well-being, subject to prevention and control measures under EU law.

L

Land-use change: Conversion of land from one use to another with ecological and climate implications.

Leakage: Displacement of harmful activities outside regulated areas.

LULUCF (Land Use, Land-Use Change and Forestry): UNFCCC and EU accounting sector covering emissions and removals from land and forests.

LULUCF Regulation: EU regulation setting binding accounting rules and targets for land-based carbon sinks.

M

Market-based instrument: Policy tool using price signals or tradable rights to influence behavior.

Material substitution: Emission reductions from replacing carbon-intensive materials with lower-carbon alternatives.

Mitigation hierarchy: Order of preference: avoid → minimize → restore → compensate environmental harm.

Monitoring, Reporting and Verification (MRV): Systems ensuring accurate measurement and credibility of environmental outcomes.

N

Nature-based solutions (NbS): Actions using ecosystems to address societal challenges.

Nature Restoration Regulation: EU regulation establishing binding ecosystem restoration targets.

Natural capital: Stock of natural assets generating ecosystem services.

Net sink: System where removals exceed emissions over an accounting period.

P

Permanence: Durability of environmental benefits over time.

Policy coherence: Consistency between policies across sectors and governance levels.

Policy cycle: Conceptual model of policymaking: agenda-setting, formulation, adoption, implementation, evaluation.

Precautionary principle: Principle that lack of full scientific certainty should not delay protective action.

Protected area: Geographically defined area managed for long-term conservation.

R

Reference level: Benchmark against which environmental performance is measured.

Regulatory instrument: Legally binding rule such as a directive or regulation.

Resilience: Capacity of systems to absorb disturbance while maintaining function.

Reversal risk: Risk that previously achieved environmental benefits are lost.

S

Safeguards: Rules preventing negative environmental or social impacts.

Sectoral policy: Government-led framework regulating a specific domain (e.g. forestry, energy).

Soft law: Non-binding instruments shaping behavior and policy direction.

Stakeholder: Actor affected by or capable of influencing policy.

Strategic Environmental Assessment (SEA): Assessment of environmental impacts of plans and programs.

Sustainable development: Sustainable development balances environmental integrity, economic prosperity, and social justice to secure well-being now and in the future. Development meeting present needs without compromising future generations.

Sustainable Development Goals (SDGs): 17 global goals guiding sustainability action to 2030.

T

Technological lock-in: Long-term dependence on harmful technologies due to infrastructure and institutions.

Trade-off: Situation where achieving one objective limits another.

Transformative governance: Governance aiming at systemic change rather than incremental adjustment.

U

Universality (SDGs): Principle that sustainability goals apply to all countries.

V

Voluntary carbon market (VCM): A non-compliance market in which organisations or individuals voluntarily purchase carbon credits to compensate for part of their greenhouse-gas emissions. Credits represent verified emission reductions or carbon removals generated by projects such as renewable energy, forest and land-use activities, or engineered removals, and are issued under private or hybrid certification standards rather than mandated by law..

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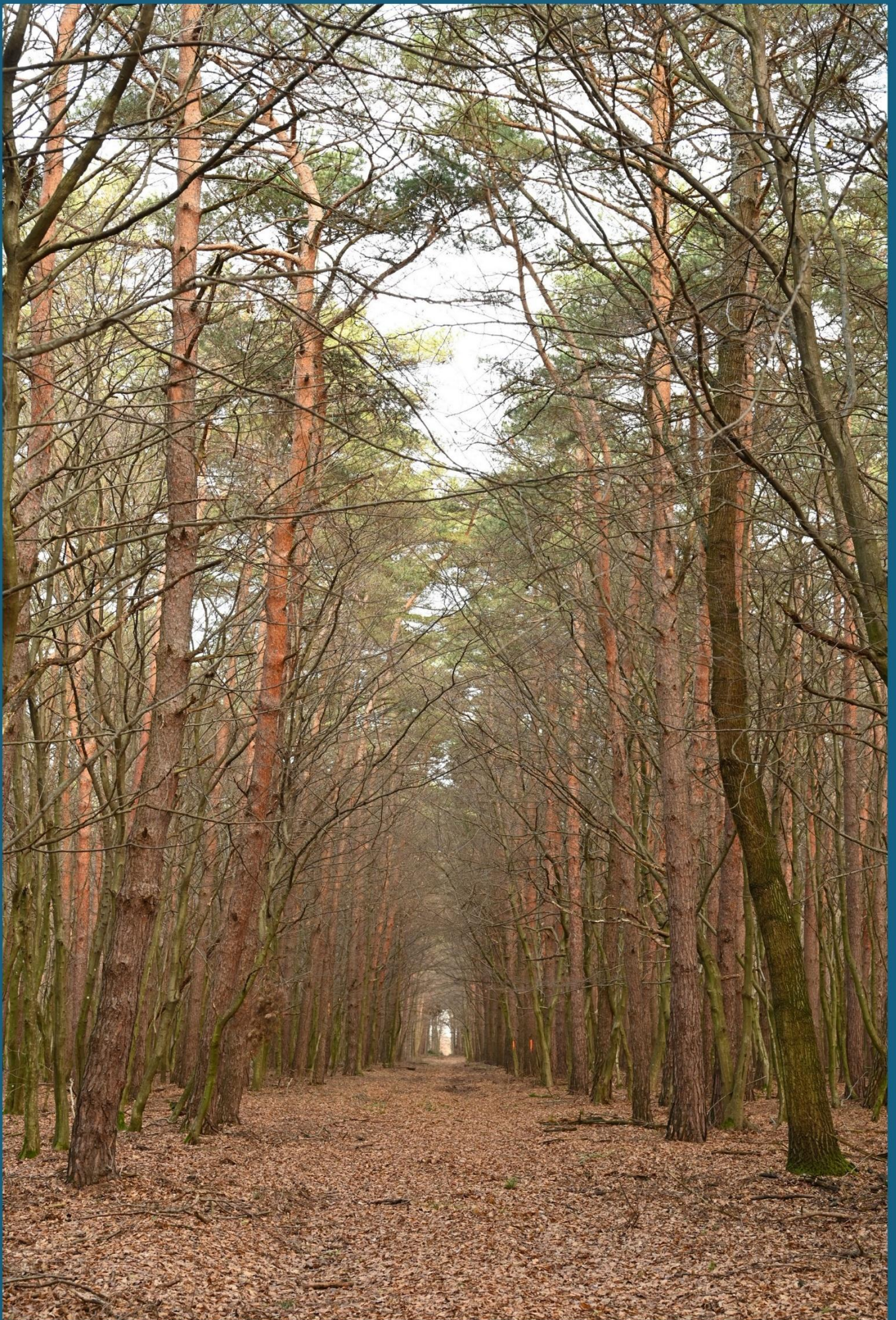
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