



Food and Agriculture  
Organization of the  
United Nations

BIOECONOMY

# ASPIRATIONAL PRINCIPLES AND CRITERIA FOR A SUSTAINABLE BIOECONOMY

# BACKGROUND AND RATIONALE

**Although bioeconomy addresses global, multidimensional challenges, it is not inherently sustainable.** At the Global Forum for Food and Agriculture in January 2015, 62 ministers of agriculture agreed on the importance of seizing opportunities to implement bioeconomy in a sustainable manner. They recommended that the Food and Agriculture Organization of the United Nations (FAO) coordinates international work on sustainable bioeconomy.

Through the International Sustainable Bioeconomy Working Group (ISBWG), a multistakeholder group established in 2016, FAO provides international support to increase national capacities to develop strategies and policies for sustainability and circularity in the bioeconomy.

The ISBWG adopts a sound approach towards achieving Sustainable Development Goal (SDG) 17, particularly target 17.9 on enhancing international support for implementing national plans. The ISBWG facilitates international dialogue and serves as a platform for sharing knowledge and experiences on sustainable and circular bioeconomy innovations, technologies, practices and policies. It also acts as an advisory body for FAO in the Organization's technical work on sustainable and circular bioeconomy. FAO's vast experience and technical expertise on biomass production, processing and consumption complements activities of other global bioeconomy initiatives, focusing primarily on sustainable agri-food systems transformation.



# PURPOSE

**Given the challenges and opportunities that are involved in making the transition to a sustainable and circular bioeconomy, in 2016, the ISBWG agreed on a set of Aspirational Principles and Criteria for a Sustainable Bioeconomy**

(hereafter referred to simply as the Principles and Criteria). They are complementary as they encompass the social, economic, environmental and governance dimensions of sustainability. As international experts highlighted in a dedicated workshop at the Global Bioeconomy Summit 2020, the Principles and Criteria provide an overview of the role that these different dimensions play in the development and implementation of sustainable bioeconomy at international, national and local levels.

The Principles and Criteria aim to ensure that bioeconomy, when implemented correctly, can benefit individual communities and the global environment in ways that are in line with the SDGs.

In January 2021, amidst the challenges of the COVID-19 pandemic, the Communiqué of the Global Forum for Food and Agriculture highlighted the importance of innovation for sustainable productivity growth in agriculture, encouraging the development and adoption of sustainable solutions in line with, *inter alia*, the principles and criteria of the FAO sustainability framework for bioeconomy.

Bioeconomy strategies are multisectoral and face greater challenges than sustainable development strategies that target a single sector, as the implementation of sustainable and circular bioeconomy involves making trade-offs among different sustainability objectives, on the one hand, and sectors, on the other. With enhanced dialogue among international partners, the ISBWG raises awareness on the potential synergies and trade-offs associated with the implementation of bioeconomy, and the opportunities for sustainability and circularity.



# A VISION AND MISSION FOR A SUSTAINABLE BIOECONOMY

The bioeconomy can be defined as

*the production, utilization, conservation, and regeneration of biological resources, including related knowledge, science, technology, and innovation, to provide sustainable solutions (information, products, processes and services) within and across all economic sectors and enable a transformation to a sustainable economy*

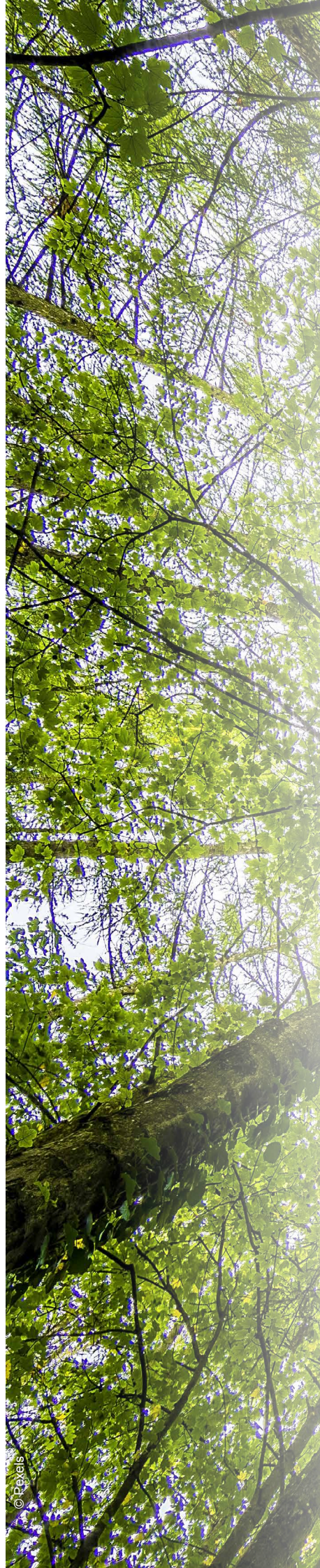
(Global Bioeconomy Summit Communiqué, 2020).

## VISION

Promoting the production, utilization, conservation, and regeneration of biological resources in support of global food and nutrition security and sustainable development requires a holistic vision for a sustainable and circular bioeconomy.

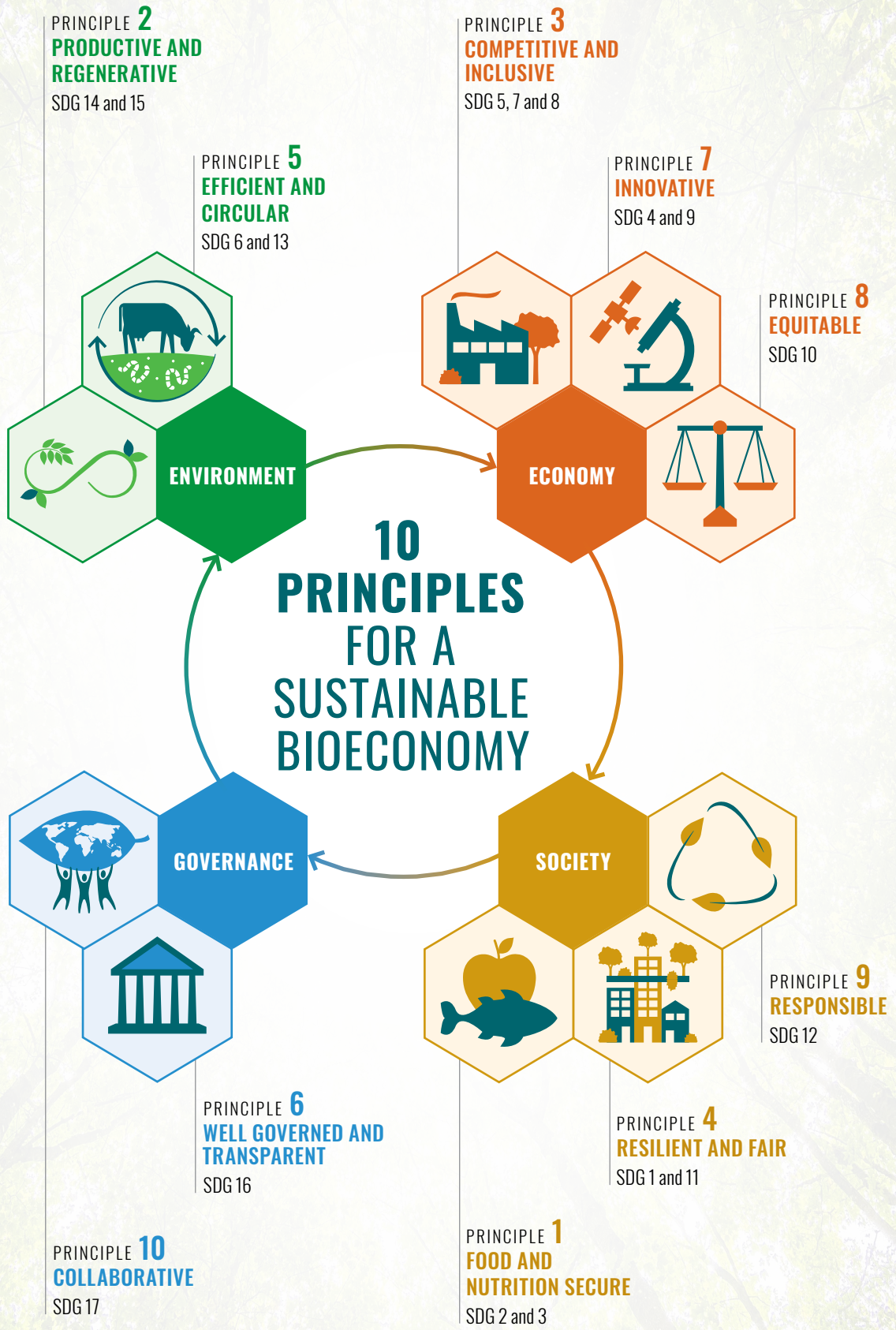
## MISSION

Aware that the production, utilization, conservation, and regeneration of biological resources for food and agriculture are a common concern of all countries, the FAO-led ISBWG aims to mainstream the Principles and Criteria across all economic sectors. The bioeconomy sought is one that unlocks the potential of nature to provide bioresources, bioprocesses and biodiversity and respects the planetary boundaries. The 10 Principles and 24 Criteria define a bioeconomy that is sustainable and contributes to 'leaving no-one behind' in the transition to a greener, fairer and more profitable economy, enabling the achievement of all SDGs.



**FIGURE 1.**

**OVERVIEW OF THE 10 PRINCIPLES FOR A SUSTAINABLE BIOECONOMY**



Source: prepared by M. Gomez San Juan and A. Bogdanski, FAO Office of Climate, Biodiversity and Environment

# OVERVIEW OF THE ASPIRATIONAL PRINCIPLES AND CRITERIA

## PRINCIPLE 1

**SUSTAINABLE BIOECONOMY DEVELOPMENT SHOULD SUPPORT FOOD SECURITY AND NUTRITION AT ALL LEVELS**

**Criterion 1.1**  
Food security and nutrition are supported

**Criterion 1.2**  
Sustainable intensification of biomass production is promoted

**Criterion 1.3**  
Adequate land rights and rights to other natural resources are guaranteed

**Criterion 1.4**  
Food safety, disease prevention and human health are ensured

## PRINCIPLE 2

**SUSTAINABLE BIOECONOMY SHOULD ENSURE THAT NATURAL RESOURCES ARE CONSERVED, PROTECTED AND ENHANCED**

**Criterion 2.1**  
Biodiversity conservation is ensured

**Criterion 2.2**  
Climate change mitigation and adaptation are pursued

**Criterion 2.3**  
Water quality and quantity are maintained, and, as much as possible, enhanced

**Criterion 2.4**  
The degradation of land, soil, forests and marine environments is prevented, stopped or reversed

## PRINCIPLE 3

**SUSTAINABLE BIOECONOMY SHOULD SUPPORT COMPETITIVE AND INCLUSIVE ECONOMIC GROWTH**

**Criterion 3.1**  
Economic development is fostered

**Criterion 3.2**  
Inclusive economic growth is strengthened

**Criterion 3.3**  
Resilience of the rural and urban economy is enhanced

## PRINCIPLE 4

**SUSTAINABLE BIOECONOMY SHOULD MAKE COMMUNITIES HEALTHIER, MORE SUSTAINABLE, AND HARNESS SOCIAL AND ECOSYSTEM RESILIENCE**

**Criterion 4.1**  
The sustainability of urban centres is enhanced

**Criterion 4.2**  
Resilience of biomass producers, rural communities and ecosystems is developed and/or strengthened

## PRINCIPLE 5

**SUSTAINABLE BIOECONOMY SHOULD RELY ON IMPROVED EFFICIENCY IN THE USE OF RESOURCES AND BIOMASS**

**Criterion 5.1**  
Resource use efficiency, waste prevention and waste re-use along the whole bioeconomy value chain are improved

**Criterion 5.2**  
Food loss and waste is minimized and, when unavoidable, its biomass is reused or recycled

## PRINCIPLE 6

**RESPONSIBLE AND EFFECTIVE GOVERNANCE MECHANISMS SHOULD UNDERPIN SUSTAINABLE BIOECONOMY**

**Criterion 6.1**  
Policies, regulations and institutional structures relevant to bioeconomy sectors are adequately harmonized

**Criterion 6.2**  
Inclusive consultation processes and engagement of all relevant sectors of society are adequate and based on transparent sharing of information

**Criterion 6.3**  
Appropriate risk assessment and management, monitoring and accountability systems are put in place and implemented

## PRINCIPLE 7

**SUSTAINABLE BIOECONOMY SHOULD MAKE GOOD USE OF EXISTING RELEVANT KNOWLEDGE AND PROVEN SOUND TECHNOLOGIES AND GOOD PRACTICES AND, WHERE APPROPRIATE, PROMOTE RESEARCH AND INNOVATIONS**

### **Criterion 7.1**

Existing knowledge is adequately valued and proven sound technologies are fostered

### **Criterion 7.2**

Knowledge generation and innovation are promoted

## PRINCIPLE 8

**SUSTAINABLE BIOECONOMY SHOULD USE AND PROMOTE SUSTAINABLE TRADE AND MARKET PRACTICES**

### **Criterion 8.1**

Local economies are not constrained but rather expanded through the trade of raw and processed biomass, and related technologies

## PRINCIPLE 9

**SUSTAINABLE BIOECONOMY SHOULD ADDRESS SOCIETAL NEEDS AND ENCOURAGE SUSTAINABLE CONSUMPTION**

### **Criterion 9.1**

Consumption patterns of bioeconomy goods match sustainable supply levels of biomass

### **Criterion 9.2**

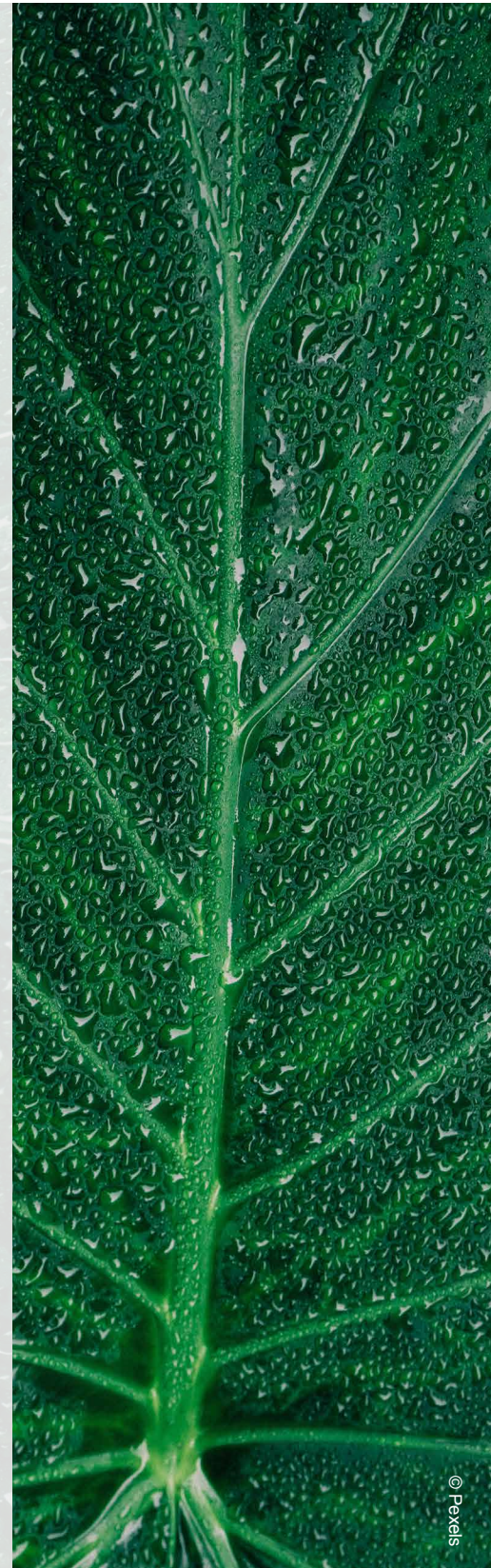
Demand-side and supply-side market mechanisms and policy coherence between supply and demand of food and non-food goods are enhanced

## PRINCIPLE 10

**SUSTAINABLE BIOECONOMY SHOULD PROMOTE COOPERATION, COLLABORATION AND SHARING BETWEEN INTERESTED AND CONCERNED STAKEHOLDERS IN ALL RELEVANT DOMAINS AND AT ALL RELEVANT LEVELS**

### **Criterion 10.1**

Cooperation, collaboration and sharing of resources, skills and technologies are enhanced when and where appropriate



## SCOPE

**The Principles and Criteria create a common ground for discussions on sustainability and circularity in the bioeconomy.**

They can be applied by policy makers and other stakeholders in the development of national and regional bioeconomy strategies. They emphasize aspects that need to be considered when making a shift to a sustainable and circular bioeconomy.

The Principles and Criteria can also be used in monitoring and evaluation frameworks for measuring the sustainability of the bioeconomy or to monitor and evaluate progress in making this shift.

If sustainability and circularity are considered in the design phase of strategy development and in assessments of its implementation, future risks, hidden costs and trade-offs can be avoided right from the outset, which can eliminate the need to implement corrective measures later.

The Principles and Criteria are non-binding, and they should be interpreted in ways that take into account the local social, economic, environmental and governance context.

## INTENDED USERS

**The Principles and Criteria target national and international stakeholders who are involved in the development of strategies, programmes and action plans for promoting a sustainable and circular bioeconomy.** These stakeholders include countries, intergovernmental and regional organizations, financing institutions, research organizations, business enterprises, including farmers and bioproduct manufacturers, civil society organizations, consumer organizations, and other decision makers who want to carry out bioeconomy projects or activities in a sustainable way.

Building on the Principles and Criteria, the FAO Project supports Member states in developing and implementing bioeconomy strategies, through guidance documents on good practices, policies, tools and indicators, as well as work in countries such as Uruguay and Namibia. Another example is the European Commission's monitoring and evaluation system for bioeconomy launched in 2020, which includes FAO's principles and criteria as reference framework.





# THE PRINCIPLES AND CRITERIA

## PRINCIPLE 1

## SOCIETY

### SUSTAINABLE BIOECONOMY DEVELOPMENT SHOULD SUPPORT FOOD SECURITY AND NUTRITION AT ALL LEVELS



#### Criterion 1.1 Food security and nutrition are supported

It is crucial that bioeconomy development does not threaten but strengthens food security and nutrition, which are basic human needs and rights. This involves the simultaneous fulfilment of four dimensions of food security: food availability; food access; food utilization; and the stability of food availability, access and utilization. Stakeholders involved in the development of sustainable bioeconomy should make use of existing food security early warning and monitoring systems to ensure these four dimensions are fulfilled, and apply corrective measures if they are not.

#### Criterion 1.2 Sustainable intensification of biomass production is promoted

Global agricultural production and consumption are projected to double in the next decades, and most of this increase will need to come from increases in yields. Sustainably increasing yields in the production of biological resources such as plant biomass, animals and microorganisms, particularly for food are essential, because the limited availability of land for agricultural production will often be

the primary constraining factor in meeting the global demand for food. Increasing yields for the production of non-food goods is even more urgent.

#### Criterion 1.3 Adequate land rights and rights to other natural resources are guaranteed

Adequate tenure security is crucial for ensuring food security and increasing investments in the production of both food and non-food goods. Therefore, the development of sustainable bioeconomy should not be based on insecure and inequitable rights to land, forests, water and other resources, including traditional and indigenous knowledge systems, but should be used as a motor to clarify and strengthen tenure security.

#### Criterion 1.4 Food safety, disease prevention and human health are ensured

Food safety and healthy nutrition are the cornerstones for the welfare of society. Innovative bioeconomy policies, technologies and tools should be put in place to reduce health risks of unsustainable production systems, diet-related non-communicable diseases, exposure to food-borne hazards and the health consequences of climate change and environmental pollution. These policies, technologies and tools should also contribute to the sustainable management of the entire food system.

## SUSTAINABLE BIOECONOMY SHOULD ENSURE THAT NATURAL RESOURCES ARE CONSERVED, PROTECTED AND ENHANCED



### Criterion 2.1

#### Biodiversity conservation is ensured

The sustainability of the production of food and non-food goods depends on a number of crucial factors, including the conservation and sustainable use of biological diversity of plants, animals and microorganisms, which is fundamental for ensuring resilient bioeconomy systems.

### Criterion 2.2

#### Climate change mitigation and adaptation is pursued

There is global agreement that it is imperative to adapt to and mitigate climate change. Bioeconomy is in a unique position to significantly contribute to climate change mitigation and adaptation through the replacement of fossil fuel-based goods with low-carbon bioproducts and the sustainable and circular management of resources. In that context, bioeconomy plays a crucial role to achieve national and international climate targets.

### Criterion 2.3

#### Water quality and quantity are maintained, and, as much as possible, enhanced

Water is a crucial input at every stage of almost all bioeconomy value chains. However, in several parts of the world, the quantity of water resources is becoming scarce, and water quality is also becoming degraded. Moreover, pressure on water resources is increasing due to greater competition among different users who need it for a range of essential activities, including the production of food and animal feed, the manufacture of bio-industrial goods and the generation of bioenergy. The development of bioeconomy should be done in a way that does not heighten the competition for water but helps guarantee an adequate supply of quality water for all.

### Criterion 2.4

#### The degradation of land, soil, forests and marine environments is prevented, stopped or reversed

Land and soil, forests, and aquatic environments provide the biological resources and ecosystem services that are the main components in biomass and bioproducts production processes. Preserving the quality of these different environments and preventing their degradation is therefore key to a sustainable and circular bioeconomy. A significant proportion of these environments have already been degraded and should be restored and their natural functions enhanced. It is important to keep in mind that, to be successful, actions to protect and restore degraded environments need to be economically viable and socially acceptable.



## SUSTAINABLE BIOECONOMY SHOULD SUPPORT COMPETITIVE AND INCLUSIVE ECONOMIC GROWTH



### Criterion 3.1 Economic development is fostered

A safe and healthy business environment for producers of biomass and bioproducts as well as other investors in bioeconomy is needed because biomass and bioproducts production is a complex activity, and can be an expensive and risky business venture.

### Criterion 3.2 Inclusive economic growth is strengthened

Sustainable bioeconomy should promote equality of opportunity and provide assurances that everyone is able to participate in its development. A special focus should be placed on the working poor and the unemployed to ensure that the development of a sustainable and circular bioeconomy contributes to keeping the pledge UN Member States made in the 2030 Agenda to 'leave nobody behind'. Inclusive growth is also deeply connected with the private sector and other important actors in the bioeconomy, for which public-private partnerships are a key mechanism.

### Criterion 3.3 Resilience of the rural and urban economy is enhanced

Economic crises and fluctuations in the prices of commodities, market goods and food have been shown to increase insecurity in rural areas and are obstacles to long-term investment. The resilience of communities and livelihoods to economic insecurity can be enhanced by strengthening rural-urban linkages. This can be achieved by diversifying rural economies and by promoting the production and processing of food and non-food at the local level. Rural and urban areas should be conceived as part of a single system, not as two competing demographic areas, as they are linked by reciprocal exchanges of products and services that build upon a common infrastructure.



## SUSTAINABLE BIOECONOMY SHOULD MAKE COMMUNITIES HEALTHIER, MORE SUSTAINABLE, AND HARNESS SOCIAL AND ECOSYSTEM RESILIENCE



### Criterion 4.1

#### The sustainability of urban centers is enhanced

Urban areas are home to a great amount of the global population. With urbanization projected to increase over the next decades, the challenges related to securing a sufficient supply of fresh water, food and energy, combatting climate change and maintaining overall healthy livelihoods and healthy environment, especially in low-income and lower-middle-income countries, will become more pressing than ever. Sustainable and circular bioeconomy can offer many solutions and can be an option for collaboration between urban planners and policy makers with the research community, civil society and the private sector.

### Criterion 4.2

#### Resilience of biomass producers, rural communities and ecosystems is developed and/or strengthened

Bioeconomy strategies or programmes that promote technologies, practices and policies that support primary producers and rural communities can build or strengthen the resilience of these communities and the ecosystems, and increase adaptation to climate change, which is crucial for ensuring a stable supply of good quality biomass and sustaining the production of food and other bioproducts.

## SUSTAINABLE BIOECONOMY SHOULD RELY ON IMPROVED EFFICIENCY IN THE USE OF RESOURCES AND BIOMASS



### Criterion 5.1

#### Resource use efficiency, waste prevention and waste re-use along the whole bioeconomy value chain are improved

There is a general agreement that it is critical to 'do more with less' in the production of goods in order to meet the demands of a growing global population in ways that respect environmental planetary boundaries. Efficiency needs to be improved in the use of natural resources as inputs for the production, consumption and conservation of biological resources such as plant biomass, animals and micro-organisms, including in the manufacturing of bioproducts.

The re-use and upgrading of agricultural and industrial residues and by-products would minimize the environmental impact of biomass production, contribute to the recycling of raw materials, reduce greenhouse gas emissions and support the mainstreaming of a circular, inclusive economy. It would also address specific global challenges, such as marine litter and the accumulation of plastic waste.

### Criterion 5.2

#### Food loss and waste is minimized and, when unavoidable, its biomass is reused or recycled

Food loss and food waste in food systems significantly contribute to inefficiency in the use of resources, environmental pollution and greenhouse gas emissions and should be prevented. Especially, unavoidable food losses can be an integral source of biomass for a sustainable bioeconomy.

## RESPONSIBLE AND EFFECTIVE GOVERNANCE MECHANISMS SHOULD UNDERPIN SUSTAINABLE BIOECONOMY



### Criterion 6.1

**Policies, regulations and institutional structures relevant to bioeconomy sectors are adequately harmonized**

Regulatory and institutional harmonization is necessary due to the cross-sectoral nature of bioeconomy and the potential for conflicts with existing legislation related to the different sectors connected to the bioeconomy.

### Criterion 6.2

**Inclusive consultation processes and engagement of all relevant sectors of society are adequate and based on transparent sharing of information**

The design and implementation of bioeconomy should be undertaken with governance mechanisms that include broad social agreement and engagement, linking top-down and bottom-up development approaches. The transition to a sustainable bioeconomy should be transparent and equitable, supported by the application of international standards, and undertaken with an appropriate balance between private, public and civil society initiatives.

### Criterion 6.3

**Appropriate risk assessment and management, monitoring and accountability systems are put in place and implemented**

The implementation of bioeconomy is a very large undertaking that involves many sectors and is carried out at multiple scales. Consequently, it demands cost-effective and inclusive monitoring and evaluation at all levels, as a basis for ensuring proper accountability, transparency and systemic learning, including the monitoring and evaluation of its sustainability.



## PRINCIPLE 7

ECONOMY

**SUSTAINABLE BIOECONOMY SHOULD MAKE GOOD USE OF EXISTING RELEVANT KNOWLEDGE AND PROVEN SOUND TECHNOLOGIES AND GOOD PRACTICES AND, WHERE APPROPRIATE, PROMOTE RESEARCH AND INNOVATIONS**



### Criterion 7.1

**Existing knowledge is adequately valued and proven sound technologies are fostered**

There is already a significant amount of knowledge and technologies to sustainably produce and transform biological resources for both food and non-food goods.

### Criterion 7.2

**Knowledge generation and innovation are promoted**

Research and innovation should support sustainable and circular bioeconomy development to complement existing plant, animal and microbiome science, related knowledge and proven technologies.

## PRINCIPLE 8

ECONOMY

**SUSTAINABLE BIOECONOMY SHOULD USE AND PROMOTE SUSTAINABLE TRADE AND MARKET PRACTICES**



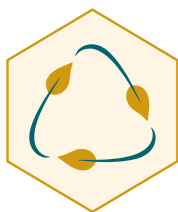
### Criterion 8.1

**Local economies are not constrained but rather expanded through the trade of raw and processed biomass, and related technologies**

The trade of biomass and bioproducts entails both opportunities for local communities and potential risks in relation to food security and other socio-economic issues, in both exporting and importing countries, which should be considered when designing bioeconomy strategies or programmes.



**SUSTAINABLE BIOECONOMY SHOULD ADDRESS SOCIETAL NEEDS AND ENCOURAGE SUSTAINABLE CONSUMPTION**



**Criterion 9.1**

**Consumption patterns of bioeconomy goods match sustainable supply levels of biomass**

A sustainable bioeconomy should contribute to a shift towards sustainable consumption and production. This concerns national and regional consumption trends and their relation to socially equitable and environmentally safe levels of production, use and conservation of biological resources, at global and national levels, and includes finding alternative products or processes that minimize negative impacts of bioeconomy activities from one region or sector to another and reduce sustainability tradeoffs.

**Criterion 9.2**

**Demand-side and supply-side market mechanisms and policy coherence between supply and demand of food and non-food goods are enhanced**

The cross-sectoral nature of bioeconomy calls for market-guarantee mechanisms that are harmonized among the bioeconomy sectors to ensure policy coherence in the production and consumption of food and non-food goods and to enhance synergies in the management of natural resources.

**SUSTAINABLE BIOECONOMY SHOULD PROMOTE COOPERATION, COLLABORATION AND SHARING BETWEEN INTERESTED AND CONCERNED STAKEHOLDERS IN ALL RELEVANT DOMAINS AND AT ALL RELEVANT LEVELS**



**Criterion 10.1**

**Cooperation, collaboration and sharing of resources, skills and technologies are enhanced when and where appropriate**

Around the world, there is currently an uneven distribution of resources, skills and technologies related to bioeconomy, including in the area of research and innovation. This hinders the realization of the global potential for the uptake of bioeconomy. Harnessing effective production, consumption and conservation of biological resources worldwide should be encouraged through mutually beneficial knowledge sharing and capacity building.

## GET INVOLVED

For more information about Sustainable and Circular Bioeconomy:  
[www.fao.org/in-action/sustainable-and-circular-bioeconomy](http://www.fao.org/in-action/sustainable-and-circular-bioeconomy)  
[Bioeconomy@fao.org](mailto:Bioeconomy@fao.org)

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