JICA Biodiversity Finance Impact Tool (Biodiversity-FIT)

Guidance on Biodiversity Mainstreaming

Part II
Sector-Specific Guidance for Biodiversity Mainstreaming

Agriculture and Rural Development Sector

January 2026

Table of Contents

1. Importance of Biodiversity in the Agriculture and Rural Development Sector

1.1 Relationship between Ecosystem Services and Agriculture

Agriculture fundamentally depends on a wide range of “ecosystem services” provided by the natural environment, including crop pollination, soil formation and nutrient cycling, water purification, pest and disease control, and climate regulation. These ecosystem functions form the basis of agricultural productivity while also underpinning the quality of life and food security of local communities. For example, pollinators such as bees and butterflies directly influence the yield and quality of fruit and vegetable crops. Forests, wetlands, and other natural habitats play a critical role in recharging water sources and mitigating floods, thereby reducing disaster risks in rural areas.

However, recent agricultural development practices, such as large-scale monocultures, excessive use of chemical fertilizers and pesticides, deforestation, and wetland reclamation, have accelerated biodiversity loss. As reported in various cases, this has led to declining crop yields due to reduced pollinator populations and soil degradation, accompanied by a weakening capacity of ecosystems to provide essential services, all of which threaten the long-term sustainability of agriculture. Moreover, agriculture can contribute to multiple environmental pressures, including the runoff of agrochemicals into surrounding water bodies, overexploitation of freshwater resources, and greenhouse gas emissions associated with soil degradation.

In response, “regenerative agriculture[1]” and similar ecosystem-based approaches are increasingly being reviewed and repositioned as strategies that enable agricultural production while maximizing the benefits of ecosystem services. Practices such as no-tillage, non-fertilization, and pesticide-free cultivation, when applied as part of these approaches, help maintain habitats for soil fauna, microorganisms, fungi, and bacteria. By promoting diverse vegetation both above and below ground, these practices enhance biodiversity, while plant cover protects soil and improves water retention. These approaches contribute to both climate change adaptation by enhancing the resilience of agricultural systems and mitigation by conserving and retaining carbon in soils and ecosystems. Given that agriculture can exert both negative and positive influences on ecosystems, the transition toward nature-positive agricultural practices is increasingly positioned as a strategic investment to enhance agricultural productivity and resilience over the long term.

1.2 Linkages with Local Communities and Culture

Biodiversity in agricultural and rural areas represents not only an ecological resource but also a foundation of local culture, traditions, and social structures. In many regions, indigenous crop varieties and livestock breeds have been passed down through generations, playing an essential

[1] Regenerative agriculture is an approach based on core principles such as no-tillage, non-fertilization, and pesticide-free cultivation, aimed at enhancing the diversity of soil ecosystems

role in local food culture, festivals, and traditional farming practices. These native genetic resources are often well adapted to local climatic and soil conditions and, in many cases, exhibit higher resilience to environmental changes compared to introduced species.

Traditional customs and indigenous knowledge systems developed through centuries of coexistence between people and nature are now being re-evaluated as valuable wisdom for sustainable resource management. For instance, traditional techniques such as the water management of terraced rice fields, intercropping and crop rotation practices, and agricultural calendars aligned with natural cycles exemplify production methods that sustain biodiversity. Rural environments comprise a mosaic of ecosystem elements, including farmlands, satoyama[2], rivers, and irrigation ponds, providing multiple ecosystem services such as food production, water retention, pollination, pest control, and landscape formation. These ecosystems, often referred to as agro-ecosystems, are semi-artificial systems traditionally shaped and maintained through human cultivation activities including paddy fields, dry fields, orchards, pastures, and shifting cultivation sites.

The conservation of biodiversity thus underpins the cultural values and social cohesion of local communities. Active community participation in environmental conservation in rural areas can strengthen local identity and contribute to regional revitalization, such as through tourism and the development of local specialty products. Furthermore, the active participation of women and youth in biodiversity-related initiatives can promote gender equality and intergenerational collaboration.

In this way, biodiversity serves not only as the foundation of agricultural production but also as a multifaceted driver of sustainable rural development. Recognizing its significance and integrating biodiversity perspectives into project planning, implementation, and evaluation are essential steps toward achieving truly sustainable development in the agricultural and rural development sector.

1.3 Global and Domestic Initiatives toward Nature Positive Approach in the Agricultural Sector

In the Kunming–Montreal Global Biodiversity Framework (GBF) adopted in 2022, achieving nature-positive outcomes defined as halting and reversing biodiversity loss by 2030 was set as a global objective. Against this backdrop, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) has recommended addressing multiple challenges simultaneously through the transformation of agricultural practices and the enhanced use of ecosystem services[3]. International organizations such as UNEP, IUCN, and the World Bank are promoting policy

[2] Satoyama refers to mountains and forests surrounding rural settlements and farmlands, characterized as secondary natural environments that have been formed and maintained through long-term human use and management. (Ministry of Environment Japan (2022) “Satoyama in Japan -For Nature-based Solutions-)
[3] IPBES (2019). “Global Assessment Report on Biodiversity and Ecosystem Services”. https://ipbes.net/global-assessment

integration and practical approaches based on Nature-based Solutions (NbS), such as agroforestry, wetland restoration, and soil-conserving agricultural practices[4]. In addition, the Taskforce on Nature-related Financial Disclosures (TNFD) is driving changes in corporate decision-making and financial flows including those involving agricultural businesses through the disclosure of nature-related risks and opportunities[5].

In response to these initiatives, multilateral development banks (MDBs) revised the Common Principles for Tracking Nature Finance in November 2025 and introduced a new "Common Nature Finance Taxonomy[6]". This taxonomy classifies investments and projects that contribute to nature-positive outcomes into four categories: (a) restoration and conservation of biodiversity or ecosystem services; (b) reduction of the direct drivers of biodiversity or ecosystem services loss; (c) integration of nature-based solutions across economic sectors; and; and (d) design and implementation of policy, tools or other sectoral instruments enabling (a) to (c). The taxonomy standardizes eligible activities across seven sectors[7], including the Forestry, agriculture, fisheries, and aquaculture sector (such as forestry, crops, livestock, fisheries and aquaculture), and is positioned as a framework to enhance the consistency and transparency of nature finance. Furthermore, the International Capital Market Association (ICMA) published "Sustainable Bonds for Nature: A Practitioner's Guide[8]" in June 2025, providing practical guidance for the issuance of sustainable bonds targeting projects that contribute to biodiversity and natural capital. These initiatives reflect the expanding scale of nature-related investment in international capital markets, including investments in urban and regional development.

Domestically, the conservation of agricultural lands and satoyama landscapes is positioned as a key pillar for achieving the 30by30 target in the "National Biodiversity Strategy and Action Plan of Japan 2023–2030, the sixth edition (2023)" formulated by the Ministry of the Environment, Japan. Furthermore, the "Annual Report on the Environment, the Sound Material-Cycle Society and Biodiversity in Japan (2023)" articulates a vision for simultaneously achieving net-zero GHG

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[4] IUCN (2020). "Guidance for using the IUCN Global Standard for Nature-based Solutions". https://iucn.org/resources/publication/iucn-global-standard-nature-based-solutions-first-edition
FAO (2021). "Nature-based Solutions in Agriculture, Sustainable Management and Conservation of Land, Water and Biodiversity". https://openknowledge.fao.org/server/api/core/bitstreams/c9aa3745-ab2b-41bd-a3ba-c8ea3ef4582b/content

[5] TNFD. Additional Sector Guidance: Food and agriculture (2024). https://tnfd.global/wp-content/uploads/2024/06/Additional-Sector-Guidance-Food-and-Agri.pdf?v=1719526279

[6] World Bank (2025). "MDB Common Nature Finance Taxonomy".
https://www.worldbank.org/en/topic/environment/publication/mdb-common-nature-finance-taxonomy

[7] 1. Forestry, agriculture, fisheries, and aquaculture, 2. Mining and energy, 3. Transportation, 4. Waste management, water, and sanitation, 5. Industry, trade, and services, 6. Financial sector, and 7. Cross-cutting themes (Renewable Natural Resources Asset Management, Urban Development and Disaster Risk Management, Green Buildings)

[8] International Capital Market Association (2025). "Sustainable Bond for Nature: A Practitioner's Guide".
https://www.icmagroup.org/assets/documents/Sustainable-finance/2025-updates/Sustainable-Bonds-for-Nature-A-Practitioners-Guide-June-2025.pdf

emissions, a circular economy, and nature-positive, and positions sustainable agriculture, circular agricultural practices, biodiversity conservation, and decarbonization as key pillars of this approach. In addition, the Ministry of Agriculture, Forestry and Fisheries, Japan is promoting organic agriculture, the creation of "Nationally Certified Sustainably Managed Natural Sites"[9], and the reduction of environmental pressures through the utilization of local resources, through "the Biodiversity Strategy of the Ministry of Agriculture, Forestry and Fisheries (revised in 2023)" and "MIDORI Strategy for Sustainable Food Systems (2024)". Collectively, these policies constitute an institutional foundation supporting the transition toward a nature-positive economy in the agricultural sector.

Based on the JICA Global Agenda with 20 Strategies for Global Development, JICA is advancing integrated project design in the agriculture and rural development sector that combines climate change mitigation and adaptation measures with biodiversity conservation, thereby contributing to the achievement of the SDGs, in particular Goals 2, 13, and 15. The agricultural and rural development sector thus represents a key field for leading the transition toward an economy and society that coexist in harmony with nature.

Furthermore, projects for which biodiversity mainstreaming in development operations has been examined using this guidance and for which contributions to biodiversity are confirmed will be reported to the OECD-DAC under the Rio Marker for Biodiversity[10], and will also be communicated externally.

2. Main Challenges and Potentials of Biodiversity in the Agricultural and Rural Development Sector

2.1 Biodiversity-Related Challenges by Type of Agro-Ecosystem

Agro-ecosystems are composed of crops and livestock *(as producers and consumers)*, pests and beneficial insects, birds and mammals, wild plants such as weeds, soil microorganisms and aquatic

[9] Nationally Certified Sustainably Managed Natural Sites refer to areas certified by the Ministry of the Environment, Japan where biodiversity conservation is achieved through private-sector initiatives, including company-managed forests, satoyama landscapes, and urban green spaces. These sites form part of Japan's efforts to achieve the 30by30 target—to conserve at least 30 percent of land and sea areas by 2030—and are registered internationally as Other Effective Area-based Conservation Measures (OECMs), which contribute to biodiversity conservation outside formally designated protected areas.

[10] Since 2002, projects that contribute to at least one of the three objectives of the Convention on Biological Diversity (CBD)—namely, (i) the conservation of biological diversity, (ii) the sustainable use of its components (ecosystems, species, or genetic resources), and/or (iii) the fair and equitable sharing of the benefits arising from the utilization of genetic resources—have been reported as the Rio Marker for Biodiversity in the OECD-DAC Creditor Reporting System (CRS) statistics.
The criteria for assigning the Rio Marker "Biodiversity" under the OECD-DAC are set out in the following official guidance documents:
https://one.oecd.org/document/DCD/DAC/STAT(2018)26/FINAL/en/pdf

organisms *(as decomposers)*, as well as abiotic components including water, soil, and climate. In recent years, concerns have been raised about the decline of biodiversity and the degradation of local environments in rural areas due to factors such as increasing urbanization associated with development and the outmigration of rural populations. These challenges affect not only the conservation of the natural environment and biodiversity, but also have direct impacts on agricultural productivity and the livelihoods of local communities. Furthermore, the characteristics of biodiversity and the challenges arising from biodiversity loss differ among types of agro-ecosystems, and therefore, the development of measures tailored to the specific conditions and characteristics of each agro-ecosystem is required.

Table 1 Characteristics by Type of Agro-ecosystems

Category	Characteristics of Agro-ecosystems
Rice cultivation / Paddy fields	Wetland environments where unique ecosystems are formed through interactions between water and soil. Seasonal environmental changes occur depending on water management practices. A wide range of aquatic and semi-aquatic organisms coexist, including dragonflies, frogs, aquatic insects and waterbirds.
Upland cropping / Dry fields	Environments where crops and weeds tend to intermingle and are frequently disturbed by tillage. These are relatively dry and open environments utilized by insects and birds. Biodiversity varies depending on crop type, with many grassland insects and ground-dwelling small animals. Weeds and surrounding vegetation serve as important habitats for wildlife.
Shifting cultivation / Slash-and-burn agriculture	Traditional agricultural practice in which forests are cleared and burned for temporary cultivation, followed by fallow periods that allow land to regenerate. This system is characterized by secondary succession, where biodiversity dynamically changes over time—from grassland species in the early stages to forest species in later stages.
Orchards / Tree crop cultivation	Tree presence creates vertically structured environments. Long-term cultivation is common, and distinctive plant and animal communities develop beneath tree canopies. Many birds, arboreal insects, and small mammals inhabit these systems, while ground-layer vegetation also provides important habitats.
Livestock production / Pasturelands	Semi-natural grasslands maintained through grazing and mowing. Herbaceous plants dominate with few shrubs or trees. These areas provide important habitats for insects (e.g., grasshoppers, butterflies), grassland birds, and ground-dwelling organisms. Grazing intensity and trampling significantly influence biodiversity patterns.

Source: prepared by JICA

2.2 Impacts of Ecosystem Services on Agricultural and Rural Development Projects (Dependencies)

The Millennium Ecosystem Assessment (MA) and the Economics of Ecosystems and Biodiversity (TEEB) classify ecosystem services into four categories: provisioning services, regulating services, habitat (supporting) services, and cultural services. In agriculture and rural development projects, provisioning services (such as the supply of water resources and biomass, and the provision of genetic resources), regulating services (including climate regulation, water cycles, soil erosion control and soil fertility maintenance, and pollination), and habitat services (such as the provision of habitats and the maintenance of genetic diversity) play particularly important roles in ensuring

the sustainability and productivity of projects.

When ecosystem services are degraded, agricultural and rural development projects can be subject to a wide range of negative impacts. Examples include the depletion of water resources due to the loss of forests and wetlands, declines in soil fertility, the loss of ecosystem functions such as pollination and natural pest and disease control, and a reduced capacity for climate regulation. These impacts can lead to decreased agricultural productivity, increased variability and instability in yields, heightened disaster risks, and the weakening of the livelihood foundations of local communities. Furthermore, environmental degradation can have serious consequences for community resilience and long-term sustainable development.

Conversely, when ecosystem services are maintained or enhanced, agricultural productivity and stability can be improved, enabling the sustainable use of soil and water resources. For example, healthy forests and wetlands contribute to water retention and flood mitigation, while diverse biological communities provide natural pest control and pollination services. As a result, the sustainability of agricultural operations is strengthened, and both community resilience and harmonious coexistence with nature are promoted. By maximizing the benefits derived from ecosystem services, agricultural and rural development projects can achieve long-term stability and sustainable growth.

As outlined above, agricultural and rural development projects are highly dependent on ecosystem services. Therefore, promoting project design and implementation based on a balanced consideration of both the risks and opportunities associated with ecosystem services is essential for achieving sustainable agricultural and rural development.

2.3 Impacts of Agricultural and Rural Development Projects on Ecosystems (Impacts)

JICA's agriculture and rural development projects contribute to local economic development and improved food security; however, if adequate consideration is not given, they may also generate negative impacts on biodiversity. In particular, projects involving infrastructure development, such as irrigation facilities, roads, and reservoirs, or the expansion of agricultural land may inevitably entail the modification of natural ecosystems. Moreover, when biodiversity impact assessments are insufficient at the project design stage, unforeseen environmental problems may arise during or after implementation. For example, cases have been reported in which the conversion of wetlands into agricultural land has resulted in the loss of habitats for waterbirds or a decline in groundwater levels, leading to the depletion of local water resources.

At the same time, agriculture and rural development projects can also generate positive impacts by enhancing ecosystem services and fostering nature-positive outcomes. For instance, the introduction of diversified cropping systems, such as crop rotation and intercropping, contributes to

the maintenance of soil fertility and biodiversity, while increasing resilience to climate change and pest and disease pressures. The promotion of reduced-pesticide and organic farming practices improves water quality and soil conditions and supports the provision of safe food at the local level. The conservation and restoration of terraced rice fields and wetlands strengthen regulating services such as water retention and flood mitigation, thereby reducing disaster-related damage and enabling more stable agricultural production. In addition, the development of agricultural waterways and ecological networks can restore habitats for flora and fauna and enhance ecosystem services across the landscape. Through the sustainable use of natural capital, these initiatives also contribute to improved disaster preparedness and the stabilization of livelihoods in rural areas, ultimately strengthening overall community resilience.

Because agriculture and rural development projects can generate both negative and positive impacts on ecosystem services, it is essential to accurately assess associated risks and opportunities during the planning and implementation stages, and to maximize contributions toward a nature-positive society.

3. Mainstreaming Biodiversity in Practice (Agriculture and Rural Development Sector)

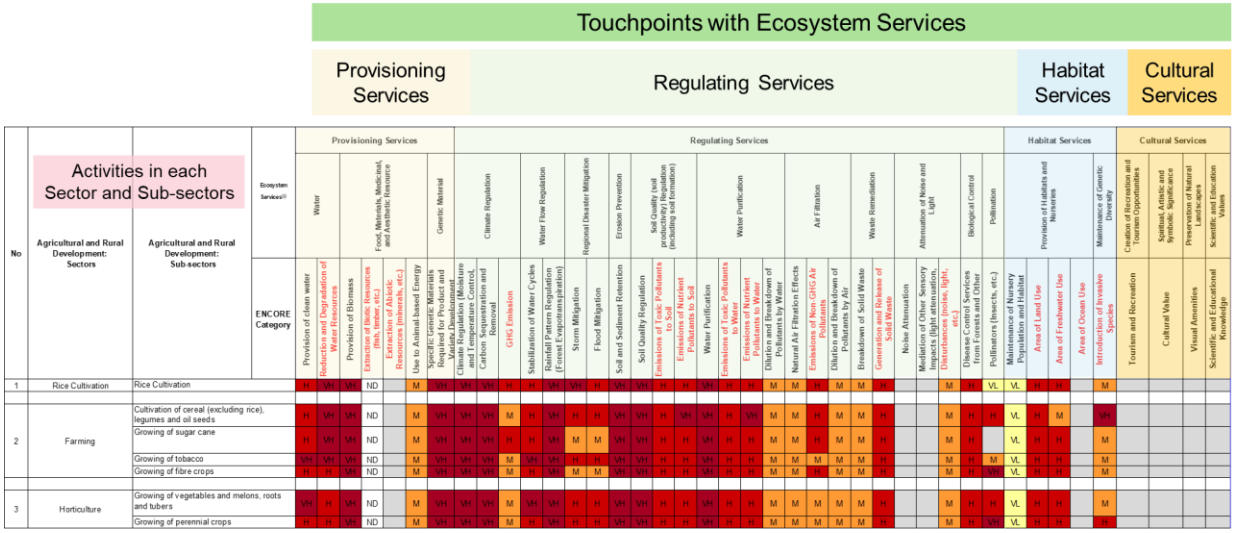
Biodiversity mainstreaming in development projects refers to the integration and practical application of perspectives on natural capital and biodiversity throughout all stages of a project, including planning, implementation, monitoring, and evaluation. This chapter introduces a practical approach to biodiversity mainstreaming in the agriculture and rural development sector through the following five steps. An overview of the entire process is provided in Part I, “5. Mainstreaming Biodiversity in Practice (Overview).”

3.1 Step 1: Identification of Interfaces between Project Activities and Natural Capital and Ecosystem Services, and Preliminary Consideration of Response Measures

Project activities in the agriculture and rural development sector benefit from a wide range of ecosystem services derived from natural capital, while at the same time exerting various impacts on natural capital and ecosystems. These dependencies and impacts are closely linked to the biodiversity of the project area and therefore require appropriate understanding and responses.

In this first step, the project identifies how the planned project activities depend on ecosystem services and how they affect natural capital and ecosystems (i.e., the project’s interfaces with ecosystem services). To this end, the department responsible for the project uses the Sector-specific Ecosystem Impact Matrix to examine the degree of dependency on and impact on

ecosystem services associated with the project. This matrix is developed with reference to assessments under ENCORE (Exploring Natural Capital Opportunities, Risks and Exposure)[11] and evaluates the degree of interaction between project activities and ecosystem services, provisioning services, regulating services, habitat (supporting) services, and cultural services, using a five-level scale (see Figure 1). In addition, by referring to the List of Response Measures to Ecosystem Impacts (see Figure 2), an initial examination is conducted of potential response measures that may be considered based on the identified points of interaction.



Source: Prepared by JICA based on data provided by ENCORE

Figure 1 Sector-specific Ecosystem Impact Matrix (Illustrative Image)

In the List of Response Measures, the main response measures to the anticipated ecosystem impacts are organized for each activity in the agriculture and rural development sector shown in Table 1, and are summarized in the areas highlighted by the red boxes in Figure 2.

Table 1 List of Activities Organizing Response Measures to Ecosystem Impacts in the Agriculture and Rural Development Sector

NO.	Sub Sector	Activities
1	Rice Cultivation	Water Resource Management in Paddies
		Guidance on cultivation techniques and farm operations (seeding, fertilization, pest and disease control, water management, etc.)
		Production of high-quality seeds
		Mechanization
		Food Value Chain (harvesting, milling, storage, logistics)

[11] ENCORE is a natural capital assessment tool jointly developed by UNEP and other partners (https://encore.naturalcapital.finance). As ENCORE is based on industry classifications designed primarily for corporate and economic activities, it should be noted that the specific activities of JICA projects may not be fully covered.

NO.	Sub Sector	Activities
		Common approaches among activities
2	Farming (excluding horticulture)	Land use planning
		Guidance on cultivation techniques and farm operations (seeding, fertilization, pest and disease control, water management, etc.)
		Production of high-quality seeds
		Food Value Chain (harvesting, milling, storage, logistics)
		Common approaches among activities
3	Horticulture	Land use planning
		Guidance on cultivation techniques and farm operations (seeding, fertilization, pest and disease control, water management, etc.)
		Production of high-quality seeds
		Food Value Chain (harvesting, milling, storage, logistics)
		Common approaches among activities
4	Livestock industry	Development of livestock industries
		Livestock hygene improvement and desease prevention
		Food Value Chain (harvesting, milling, storage, logistics)
		Common approaches among activities
5	Infrastructure (irrigation)	Civil constructions: irrigation regulating dams, headworks, and intake structures.
		Civil constructions: irrigation systems, waterways, reservoirs, wells, etc.
		Field improvement
6	Infrastructure (non-irrigation)	Civil constructions: development of agricultural instrastructures (farm paths, etc.)
		Civil constructions: storage, processes, and testing facilities.

Source: Prepared by JICA

No.	Agricultural and Rural Development: Sub-sectors	Activity Group	Activities and Countermeasures	Affected ecosystem services (Based on TEEB)	Effects of activities and countermeasures (Risk avoidance / response, and opportunity enhancement)
1	Rice cultivation	1. Water Resource Management in Paddies	Water-risk assessment and effective use of water resource: - Water-efficient irrigation (drip irrigation) - Water-efficient irrigation (AWD and other intermittent irrigation) - Rainwater reclamation system - Participatory irrigation management	Provisional service (water supply). Regulating service (climate regulation, water flow regulation, regional disaster mitigation)	- Reduce drought risk through sustainable water resource management. - Prevent social conflicts by mitigating competition for water resources (between residents and industry). - Suppress of methane emission (which contributes to greenhouse gas reduction)
			Preservation of ecosystems in farmland and surrounding areas: - Ecosystem-conscious land use planning and zoning - Water management leveraging topography and vegetation - Conservation and restoration of forests and wetlands	Habitat and nursery service (habitat and nursery maintenance). Regulating service (climate regulation, water flow regulation, water purification)	- Preserve biodiversity and habitats around farmlands (maintain and secure habitats for birds, insects, amphibians, etc.). - Reduce soil erosion and wind damage risk through the improvement of watersides and hedgerows. - Protect water quality by reducing the runoff of nutrients and pesticides using riparian buffers
		2. Guidance on cultivation techniques and farm operation (seeding, fertilization, pest and disease control, water management, etc.)	Promotion of regenerative agriculture and conservation farming (crop rotation, low-tillage farming, etc.)	Regulating service (climate regulation, water flow regulation, soil quality regulation)	- Improve soil fertility through enhancing microbial diversity, water retention, and nutrient holding capacity. - Prevent topsoil loss and land degradation risk through reduced tillage. - Improve the resilience of agroecosystems through the accumulation of soil organic carbon
			Promotion of organic and natural farming methods (integrated rice-duck farming, application of biochar, etc.)	Regulating service (climate regulation, soil quality regulation)	- Improve soil fertility and stabilize crop production through organic inputs and enhanced microbial activities. - Secure a healthy crop growth environment by improving water holding capacity and aeration. - Reduce ecosystem stress and enhance natural pest control functions.
			Integrated Pest Management (IPM)	Regulating service (soil quality regulation, water purification). Habitat and nursery service (habitat and nursery maintenance)	- Reduce soil and water pollution risks and conserve aquatic/soil biota. - Maintain and enhance habitats for pollinators and pest predators. . - Reduce impacts on non-target organisms (birds, amphibians, beneficial insects, etc.). - Stabilize pest and disease management and improving crop yield and quality by curbing the emergence of chemical resistance. - Protect public health and downstream environments by reducing pesticide runoff risk
			Promotion of climate-adaptive agriculture through regional climate-risk assessment and adaptation planning (e.g., variety selection, adjustment of planting schedules)	Regulating service (climate regulation, water flow regulation)	- Address unstable temperature and precipitation patterns, heat stress, and extreme weather by selecting drought and pest-resistant indigenous and diverse varieties
		3. Production of high-quality seeds	Cultivation and breeding of climate-adaptive crop varieties	Provisional service (food, material, medical, and amenity resources). Regulating service (climate regulation, water flow regulation). Habitat and nursery service (maintain genetic diversity)	- Address unstable temperature and precipitation patterns, heat stress, and extreme weather by selecting drought and pest-resistant indigenous and diverse varieties
			Conservation and utilization of indigenous species and seed-saving activities	Provisional service (food, material, medical, and amenity resources). Regulating service (climate regulation). Habitat and nursery service (maintain genetic diversity)	- Enhance food security and climate adaptability by adding value to local crops, avoiding genetic resource loss, and maintaining genetic diversity.

Source: prepared by JICA

Figure 2　List of Response Measures to Ecosystem Impacts (Illustrative Image)

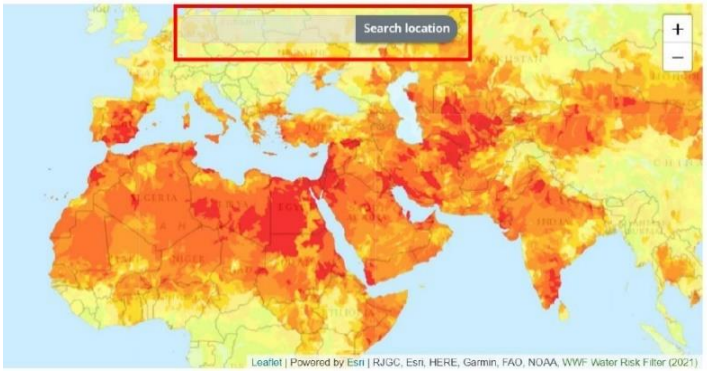
3.2　Step 2 : Identification of Ecosystem Impacts (Dependencies and Impacts)

By utilizing external tools such as the Biodiversity Risk Filter (BRF) provided by WWF[12] (see Figure 3), this step geographically assesses the degree of dependency on and impact on ecosystem services identified in Step 1 at their points of interaction. This step is conducted during the implementation stage of the preparatory survey or the detailed planning survey.

The BRF is a tool that builds on sector-level dependency and impact assessments developed under ENCORE, while integrating region-specific biodiversity conditions, such as the distribution of protected areas, tree cover loss, and the habitats of threatened species, based on 33 indicators. Through this approach, the BRF enables a spatial understanding of biodiversity risks associated with project sites and target areas, thereby allowing for more refined risk assessments and the consideration of appropriate response measures.

[12] WWF Biodiversity Risk Filter is an online tool provided by WWF that spatially visualizes biodiversity risks in a given area. https://riskfilter.org/biodiversity/home

Location-based information search is available



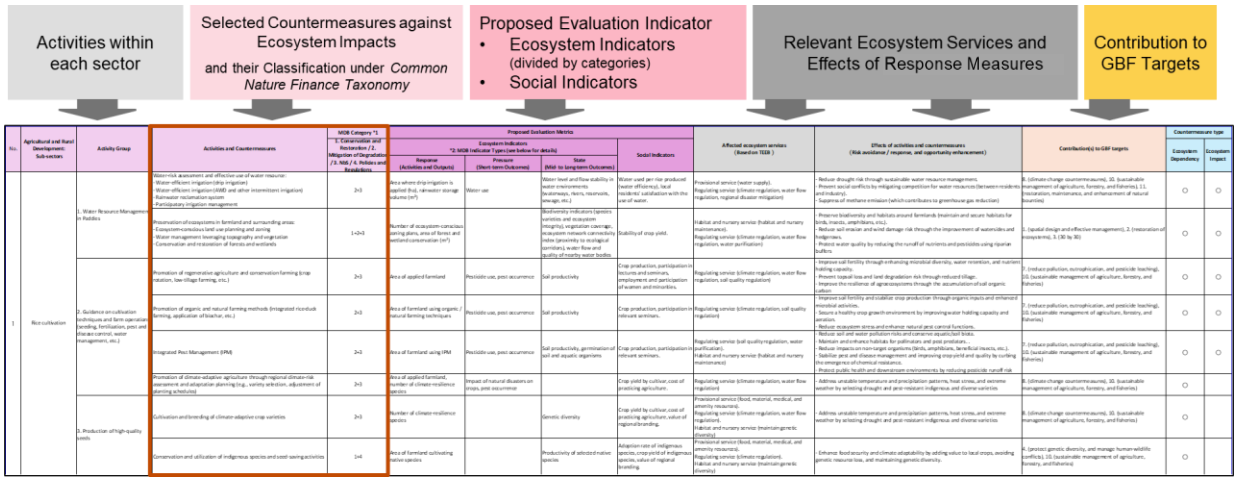
Source: WWF Biodiversity Risk Filter（WWF）

Figure 3　Example of an Ecosystem Risk Heat Map Generated by the WWF Biodiversity Risk Filter

3.3　Step 3 : Identification of Response Measures to Ecosystem Impacts

During the implementation stages of the preparatory survey and the detailed planning survey, it is expected that appropriate response measures will be identified based on the points of interaction (dependencies and impacts) between project activities and ecosystem services, with the aim of minimizing risks while also converting them into opportunities. As described above, the agriculture and rural development sector is highly dependent on ecosystems and, at the same time, has the potential to exert significant impacts on them; therefore, the identification of response measures represents a critical step that directly influences the sustainability of projects.

Response measures should not only mitigate risks, but also incorporate a nature-positive perspective by generating benefits for ecosystem restoration and local communities. In considering response measures, reference should be made to the annexed “List of Response Measures to Ecosystem Impacts,” from which activities that are both highly feasible and expected to deliver tangible effects should be selected. The list provides illustrative examples of response measures, organized by types of activities in the agriculture and rural development sector, aimed at reducing ecosystem-related risks and enhancing opportunities. An illustrative image of the list is shown in the figure below, where the areas highlighted by red boxes indicate examples of response measures to ecosystem impacts.



Source: prepared by JICA

Figure 4 List of Response Measures to Ecosystem Impacts and Related Information (Illustrative Image)

3.4 Step 4 : Setting Effects Indicators

During the implementation stage of the preparatory survey or the detailed planning survey, and following the examination of response measures in Step 3, effects indicators are considered in parallel in order to understand what results the proposed measures will deliver in terms of ecosystem conservation and restoration, as well as risk reduction. Two types of indicators are examined: “ecosystem indicators”, which measure the effectiveness of response measures from the perspective of the health and sustainability of the natural environment and ecosystem services; and “socioeconomic indicators”, which measure outcomes from the perspective of local communities’ quality of life, culture, social inclusion, and resilience.

In considering these indicators, it is recommended to refer to the indicator examples compiled for each response measure in the accompanying reference material, “List of Response Measures to Ecosystem Impacts,” while selecting indicators for which data collection is feasible, taking into account the specific characteristics of the project, as well as the local natural, social, cultural, and regional contexts. The list presents illustrative examples of “ecosystem indicators” [13] and “socioeconomic indicators” that have been organized with reference to the MDB Guidance.

Ecosystem Indicators

- **Characteristics:** Indicators that measure the health and sustainability of natural capital and ecosystem services, based on international frameworks such as IPBES and TNFD
- **Examples:** Water use volume; biodiversity indices; soil organic matter content; pollinator population size; methane emissions; changes in wetland area; soil erosion rates; pesticide and

[13] The MDB Guidance refers to “Financing Nature: A Practitioner’s Guide to Results Metrics Selection (Inter-American Development Bank, November 2025)”, which classifies and defines indicators into three categories: Response, Pressure, and State.

fertilizer use; greenhouse gas (GHG) emissions; green space area

Socioeconomic Indicators

- **Characteristics:** Indicators that measure local communities' quality of life, well-being, inclusiveness, and resilience, from the perspectives of JICA's concept of Human Security and the Sustainable Development Goals (SDGs).
- **Examples**: Rate of income increase among farming households; access rate to safe drinking water; incidence rate of health impacts; proportion of employment and participation of women and vulnerable groups; food self-sufficiency ratio; nutrition improvement indicators; participation rate in education and training; increase in cash income; incidence rate of livestock-borne infectious diseases; community access rate to irrigation infrastructure; continuity rate of water supply during disasters; number of jobs created locally; status of evacuation and recovery preparedness systems

These indicators not only enable the quantitative demonstration of project outcomes, but also serve as an evidence base for internationally reporting progress toward nature-positive outcomes.

3.5 Step 5 : Examination of Monitoring Methods

During the preparatory survey or detailed planning survey stage, a monitoring framework should be developed based on the effect indicators established in Step 4. This framework enables the continuous tracking and evaluation of changes in ecosystems and local communities that occur following project implementation.

Examples of major monitoring methods:

- Fixed-point observation: e.g., regular measurement of soil, water quality, and vegetation.
- Participatory monitoring: e.g., community-based recording of native species or wildlife by farmers, and the use of traditional knowledge.
- Use of remote sensing and GIS: e.g., tracking changes in forest cover or land use.
- Regular review meetings: e.g., progress confirmation and issue-sharing among local governments, community members, and JICA stakeholders.

Examples of implementation arrangements:

- The project formulation department develops the monitoring plan and implements it in collaboration with local governments, research institutions, and NGOs.
- The project formulation department encourages active participation of local residents and farmers to establish a community-based monitoring framework.
- Monitoring results are expected to be utilized for project evaluation, feedback into subsequent planning, and international reporting on nature-positive initiatives through the Sustainability Promotion Office.