

**JICA Biodiversity Finance Impact Tool (Biodiversity-FIT)
Guidance on Biodiversity Mainstreaming**

**Part II
Sector-Specific Guidance for Biodiversity
Mainstreaming**

Disaster Risk Reduction Sector

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1. Importance of Biodiversity in the Disaster Risk Reduction Sector

1.1 Relationship between Ecosystem Services and Disaster Risk Reduction

The disaster risk reduction (DRR) sector is fundamentally dependent on a wide range of ecosystem services provided by the natural environment. Regulating services such as flood mitigation, soil retention, water regulation, and climate regulation play an indispensable role in reducing disaster risks and enhancing the resilience of local communities. For example, wetlands, forests, and riparian green spaces function as natural buffers by attenuating flood peaks, preventing landslides, stabilizing slopes, and improving water quality, thereby minimizing damage during disaster events. Similarly, coastal ecosystems such as mangroves and coral reefs absorb and dissipate the energy of storm surges and tsunamis, providing critical protection for coastal populations and infrastructure.

At the same time, the DRR sector faces a range of challenges and risks arising from ecosystem degradation and change. Urbanization, infrastructure development, land-use change, and excessive resource exploitation have led to the loss of wetlands and forests, habitat fragmentation, water quality deterioration, and soil erosion, all of which undermine the capacity of ecosystems to deliver essential services. For instance, the fragmentation of river basin habitats, the loss of wetlands, and the clearing of mangroves in coastal areas have increased the risks of flooding, storm surges, and landslides, with serious consequences for community resilience and quality of life. Furthermore, climate change through altered precipitation patterns and the increasing frequency and intensity of extreme weather events has further exacerbated and complicated disaster risks.

In this context, the DRR sector increasingly requires a nature-positive approach that maximizes the benefits of ecosystem services while promoting the conservation and restoration of natural capital. Such approaches include the development of integrated disaster risk reduction plans at the river basin or landscape scale, the introduction of green infrastructure that leverages natural buffering functions, the conservation and restoration of wetlands and forests, and disaster risk reduction activities implemented in collaboration with local communities. These efforts not only reduce disaster risks and minimize damage, but also contribute to the maintenance and enhancement of ecosystem services, sustainable local development, and the achievement of international frameworks and commitments such as the Sustainable Development Goals (SDGs), the Paris Agreement, and the Sendai Framework for Disaster Risk Reduction (SFDRR). In this way, the DRR sector represents a key field for addressing complex challenges related to climate change, urbanization, and population growth, while leading the transition toward a nature-positive society.

1.2 Linkages with Local Communities and Culture

Biodiversity in the DRR sector is not limited to its role in reducing disaster risks or its value as part of the natural environment; it is also deeply intertwined with local culture, traditions, and social structures. Natural environments such as forests, rivers, coastlines, and wetlands have long been

integrated with festivals, religious beliefs, traditional land-use practices, and disaster-related knowledge passed down through generations, thereby contributing to the formation of local identity. For example, sacred forests surrounding shrines, tsunami memorial stones, and storytelling practices that convey memories of past disasters are valued as cultural landscapes that reflect the history of coexistence between nature and human societies. These elements serve not only as objects of disaster risk reduction, but also as sources of spiritual and cultural value that underpin local communities.

The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) emphasizes that such cultural ecosystem services and spiritual values constitute essential components of ecosystem services, highlighting the interdependence between disaster risk reduction functions and the preservation of local culture¹. In addition, traditional knowledge and practices developed by communities living in harmony with their natural environment are increasingly recognized as valuable wisdom for sustainable disaster risk reduction. Examples include the design of evacuation routes that take advantage of local topography, the use of vegetation to mitigate landslide risks, and recovery techniques that utilize locally available natural resources. These practices, rooted in local experience, can serve as effective approaches in contemporary DRR initiatives. International organizations such as UNEP and the World Bank also emphasize community-based approaches to disaster risk reduction, promoting resident participation in environmental conservation activities, disaster preparedness education, and the sustainable use of local resources².

In this way, the conservation of biodiversity in the DRR sector forms a foundation for sustaining cultural values and social cohesion within communities, and serves as a key factor in enhancing disaster resilience and the long-term sustainability of local societies. Integrating perspectives on ecosystem services and cultural values into the planning, implementation, and evaluation of DRR projects is therefore essential for achieving truly sustainable community development and effective disaster response.

1.3 Global and Domestic Initiatives toward Nature Positive Approach in the DRR 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. UNEP, IUCN, and the World Bank are promoting policy integration and practical

¹ IPBES (2022). “The Assessment Report on the Diverse Values and Valuation of Nature”.
<https://www.ipbes.net/the-values-assessment>

² UNEP. Disaster Risk Reduction. From risk to resilience: empowering communities, preserving Nature.
<https://www.unep.org/topics/disasters-and-conflicts/disaster-risk-reduction>

World Bank (2020) “Building Resilient Communities: Risk Management and Response to Natural Disasters through Social Funds and Community-Driven Development Operations”.
<https://documents1.worldbank.org/curated/en/844751468148503609/pdf/487230WP0Box331Communities1C%20complete.pdf>

approaches based on Nature-based Solutions (NbS), including ecosystem restoration in coastal areas and river basins, the introduction of green infrastructure, disaster risk reduction through the use of natural purification functions, and the conservation and restoration of forests and wetlands³. In addition, United Nations agencies such as UNDRR and UNEP, the World Bank and the Global Facility for Disaster Reduction and Recovery (GFDRR), are promoting sustainable disaster risk reduction, the strengthening of climate change adaptation measures, and the enhancement of community resilience⁴. Furthermore, the Taskforce on Nature-related Financial Disclosures (TNFD) is encouraging changes in decision-making and financial flows among companies, including those operating in the DRR sector, through the disclosure of nature-related risks and opportunities⁵.

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 Taxonomy⁶”. 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 sectors⁷, including the cross-cutting themes (Renewable Natural Resources Asset Management, Urban Development and Disaster Risk Management, Green Buildings), 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 Guide⁸” 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 “Annual Report on the Environment, the Sound Material-Cycle Society and

³ UNEP, UNDRR (2021). “Nature-based Solutions for Disaster Risk Reduction -Words into Action”. <https://wedocs.unep.org/items/71c20eef-ccc3-4af8-8b03-529505e0552e>

⁴ UNDRR (2022). “Global Assessment Report on Disaster Risk Reduction”. <https://www.undrr.org/gar/gar2022-our-world-risk-gar>

⁵ TNFD (2023). “Taskforce on Nature-related Financial Disclosures (TNFD) Recommendations”. <https://tnfd.global/publication/recommendations-of-the-taskforce-on-nature-related-financial-disclosures/#publication-content>

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>

Biodiversity in Japan (2023)”, formulated by the Ministry of the Environment, Japan, articulates a vision for the simultaneous achievement of net-zero GHG emissions, a circular economy, and a nature-positive. Within this framework, priority is placed on watershed-based conservation, the introduction of green infrastructure, and the strengthening of the DRR sector as a key component of climate change adaptation. Furthermore, the Disaster Management Basic Plan, formulated in 2014, explicitly emphasizes the promotion of international cooperation and technical assistance. Under this policy framework, Ministry of Land, Infrastructure, Transport and Tourism, local governments, private companies, universities, and other stakeholders collaborate to advance disaster risk reduction and enhance disaster management capacities both domestically and internationally, including through technology transfer. Leveraging its world-leading disaster response technologies and extensive experience in community-based disaster risk reduction, Japan has been actively implementing international cooperation initiatives that contribute to strengthening resilience in disaster-prone regions worldwide.

Based on the JICA Global Agenda with 20 Strategies for Global Development, JICA promotes practical disaster risk reduction support aimed at reducing local disaster risks and strengthening community resilience. Through these efforts, JICA contributes to the achievement of the SDGs, particularly Goals 11, 13, and 17. The DRR sector plays a critical role in addressing increasingly complex challenges such as climate change, urbanization, and population growth, while leading the transition toward a nature-positive society through diverse approaches, including ecosystem-based disaster risk reduction (Eco-DRR).

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 Biodiversity⁹, and will also be communicated externally.

2. Main Challenges and Potentials of Biodiversity in the DRR Sector

2.1 Impacts of Ecosystem Services on Disaster Risk Reduction 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,

⁹ 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](https://one.oecd.org/document/DCD/DAC/STAT(2018)26/FINAL/en/pdf)

habitat (supporting) services, and cultural services. In DRR projects, regulating services such as flood mitigation and water flow regulation, the prevention of landslides and sediment-related disasters, and climate regulation, as well as cultural services, including disaster-related knowledge transmission and community cohesion, play particularly important roles. When ecosystem services are degraded, the loss of forests and wetlands, as well as the modification of coastal areas, can lead to more frequent flooding and landslides, increased damage from storm surges, and the fragmentation of local communities, posing significant risks to the realization of sustainable disaster risk reduction¹⁰. Furthermore, ongoing urbanization and infrastructure development can give rise to irreversible challenges, including the weakening of natural disaster mitigation functions, heightened disaster risks, and the loss of traditional knowledge and cultural practices within local communities. In addition, extreme weather events and sea-level rise associated with climate change can result in the failure of evacuation infrastructure and the emergence of new disaster risks¹¹. These impacts manifest as risks to the effectiveness of DRR projects and to the safety and livelihoods of local residents.

Conversely, DRR projects that incorporate the conservation and restoration of natural environments present opportunities to reduce disaster risks and enhance climate change adaptation capacity through the maintenance and strengthening of ecosystem services at the landscape level¹². The introduction of green infrastructure and watershed-based DRR planning can reinforce regulating services, thereby improving disaster response capacity and regional resilience. Moreover, the establishment of local disaster management platforms and participatory community-based activities facilitates consensus building and contributes to the realization of sustainable disaster risk reduction. Community capacity development and the intergenerational transmission of knowledge also offer opportunities to strengthen resilience in the face of population growth and urbanization.

In this way, DRR projects are highly dependent on ecosystem services and inherently encompass both their benefits and vulnerabilities. Therefore, it is essential to appropriately assess both the risks and opportunities arising from ecosystem services and to reflect them in project design and implementation in order to achieve sustainable disaster risk reduction.

2.2 Impacts of DRR Projects on Ecosystems (Impacts)

DRR may exert negative impacts on ecosystem services in cases such as river and coastal

¹⁰ UNEP. Ecosystem-based Disaster Risk Reduction. <https://www.unep.org/topics/disasters-and-conflicts/disaster-risk-reduction/ecosystem-based-disaster-risk-reduction>

¹¹ World Bank (2010). "Building Resilient Communities: Risk Management and Response to Natural Disasters through Social Funds and Community-Driven Development Operations".

¹² IUCN (2017). "Nature-based Solutions to Disasters". https://iucn.org/sites/default/files/2022-07/nbs_to_disasters_issues_brief_final.pdf

modification resulting from levee construction and shoreline protection works, deforestation, wetland reclamation, and excessive land use. These activities can lead to biodiversity loss, degradation of natural disaster mitigation functions, increased soil erosion, and deterioration of water quality, thereby reducing ecosystem services such as flood mitigation and landslide prevention¹³. In addition, urbanization and infrastructure expansion can exacerbate disaster risks and ecosystem degradation by reducing rainwater infiltration and disrupting natural hydrological cycles.

At the same time, there are cases in which DRR projects contribute to the maintenance and enhancement of ecosystem services and lead to nature-positive outcomes. For example, the introduction of green infrastructure that considers the broader natural environment, the restoration of forests and wetlands, and the conservation of coastal vegetation can strengthen regulating services, including flood mitigation, landslide prevention, and climate regulation. Integrated disaster management planning and collaborative regional management involving diverse stakeholders can enable the coexistence of sustainable disaster risk reduction and ecosystem conservation. Furthermore, community capacity building and the promotion of environmental education represent important opportunities to enhance regional resilience and support the recovery of ecosystem services.

Thus, because DRR projects have both negative and positive impacts on ecosystem services, it is crucial to accurately assess risks and opportunities during the planning and implementation stages and to maximize contributions toward a nature-positive society.

3. Mainstreaming Biodiversity in Practice (DRR 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 / Ecosystem Services, and Preliminary Consideration of Response Measures

Project activities in the DRR 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

¹³ UNEP. Ecosystem-based Disaster Risk Reduction.

No.	Sub sector	Activities
	Investment and Measures	Development and Operation of Disaster Prevention Infrastructures (Constructive countermeasures) 【Inland water and riverine floodings】
		Development and Operation of Disaster Prevention Infrastructures (Constructive countermeasures) 【Landslides】
		Development and Operation of Disaster Prevention Infrastructures (Constructive countermeasures) 【Storms, severe winds, and tornados】
		Non-constructive Disaster prevention / mitigation infrastructures (soft infrastructures)
2	Establishment of Disaster Prevention Bodies and their Framework(s)	Governance Capacity Development
		Data Organization
		Stakeholder Collaboration

Source: Prepared by JICA

No.	Disaster Risk Reduction: 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	Pre-Disaster Prevention Investment and Measures	Development and Operation of Disaster Prevention Infrastructures (Constructive countermeasures) 【Tsunami and Coastal floodings】	Improve coastal resilience through the enhancement of mangroves, coral reefs, and beach ecosystems	Regulating / provisioning service (regional disaster mitigation) Habitat and nursery service (habitat and nursery maintenance) Cultural service (creation of recreation and tourism opportunities)	- Reduce wave and tidal energy and prevent coastal erosion by strengthening coastal ecosystems. - Maintain habitats for aquatic and terrestrial species and strengthen ecological networks by conserving mangroves and coral reefs. - Secure tourism resources such as swimming beaches and improve water quality through coral reefs and sandy beaches.
			Tidal wave and erosion mitigation through the restoration and conservation of coastal protective forests	Regulating / provisioning service (regional disaster mitigation, soil quality regulation) Habitat and nursery service (habitat and nursery maintenance)	- Mitigate tsunami and wind damage, prevent sand drift, conserve soil, and maintain land productivity through coastal forests. - Secure habitats for birds, insects, and small mammals and maintain ecological networks through the formation of coastal forests.
			Tidal wave and mitigation through the conservation of mudflats	Regulating / provisioning service (regional disaster mitigation, soil quality regulation) Habitat and nursery service (habitat and nursery maintenance)	- Reduce wave and tidal energy and prevent coastal erosion by strengthening coastal ecosystems. - Maintain habitats for aquatic and terrestrial species and strengthen ecological networks by conserving tidal flats and sand dunes.
		Development and Operation of Disaster Prevention Infrastructures (Constructive countermeasures) 【Inland water and riverine floodings】	Land use management and ecosystem restoration / conservation in high risk area (reduction of exposure risks) Preservation of aquatic ecosystems in integrity surrounding retaining walls, levees, and regulating dams (construction of fish passes and bypass channels)	Regulating / provisioning service (regional disaster mitigation, soil quality regulation) Habitat and nursery service (habitat and nursery maintenance) Regulating / Provisioning Service (regional disaster mitigation) Habitat and nursery service (habitat and nursery maintenance)	- Avoid exposure risks and strengthen disaster-prevention and risk-reduction functions through conservation and land use change for natural environments. - Enhance ecosystem services and generate community co-benefits through conservation and restoration of natural environments. - Protect habitats by reducing fragmentation of fish and amphibian living environments and nurseries.

Source: prepared by JICA

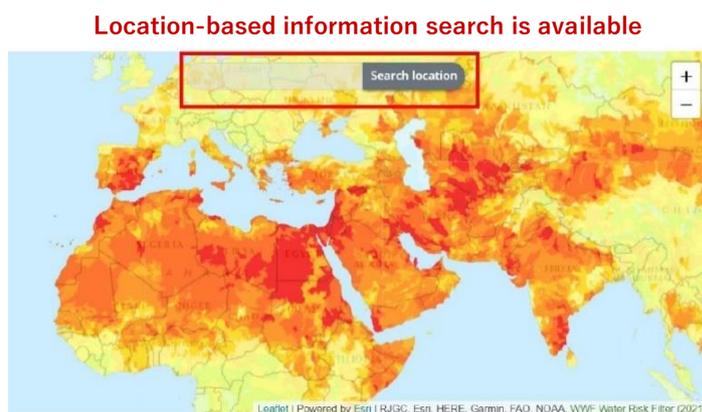
Figure 2 List of Response Measures to Ecosystem Impacts (Illustrative Image)

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

By utilizing external tools such as the Biodiversity Risk Filter (BRF) provided by WWF¹⁵ (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.

¹⁵ 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>

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.



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 : Examination 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 disaster risk reduction 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 DRR 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.

- **Examples:** Status of natural capital loss; surface water flow distribution; hydrological connectivity (functionality of fish passages and wildlife corridors); biodiversity indices (species richness and ecosystem diversity); vegetation cover ratio

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:** Number of disaster-related incidents and amount of damage; flood and storm surge damage losses; recovery status of fisheries resources; number of flood-induced inundation cases and associated economic losses; number of participants in disaster risk reduction and preparedness education programs

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 green space area, biodiversity indices, water quality, and vegetation conditions.
- Participatory monitoring: e.g., community-based recording of species and local environmental activities, as well as monitoring the condition and accessibility of safe evacuation routes.
- 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.