Action Plan for Promoting Nature-Positive through Chemicals Management

Ver.1.0

(Provisional English Translation)

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Ministry of the Environment, Japan

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(This is an English translation of the Japanese original. In case of any discrepancy, the Japanese text shall prevail.)

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Summary

This Action Plan organizes the current situation, key challenges, and possible directions for future responses with a view to contributing, through chemicals management, to the realization of Nature-Positive, halting and reversing biodiversity loss and putting nature on a path to recovery.

In recent years, biodiversity loss, climate change, and pollution have increasingly been recognized as interrelated global challenges, and the importance of policy responses that address them in an integrated manner has been growing internationally. Pollution from chemicals, in particular, is one of the major drivers of biodiversity loss, and chemicals management therefore has an important role to play in the conservation and restoration of ecosystems and biodiversity.

At the same time, chemicals management in Japan has historically been developed and implemented primarily from the perspectives of protecting human health and preventing environmental pollution. As a result, efforts to systematically organize impacts on biodiversity and ecosystem functions under the overarching objective of realizing Nature-Positive outcomes cannot yet be regarded as fully sufficient. In addition, as awareness grows that the degradation of natural capital can also affect socio-economic activities—through such channels as instability in raw material procurement and heightened business continuity risks—the transition to Nature-Positive is increasingly being positioned not as an additional burden for environmental protection, but as an important initiative for ensuring the sustainability of socio-economic activities.

Based on this understanding, this Action Plan seeks to reposition chemicals management not merely as a regulatory effort to reduce negative impacts on nature, but as a strategic means of appropriately managing risks throughout the life cycle of chemicals while simultaneously realizing biodiversity recovery and enhancing the sustainability of socio-economic activities.

Specifically, from the perspective of promoting biodiversity conservation through chemicals management, the Action Plan broadly organizes and analyzes Japan's current situation and key challenges and systematically sets out possible response options from the perspectives of research and studies, monitoring, risk assessment, institutional

operation, and collaboration among relevant actors. It also identifies the roles to be played by a wide range of stakeholders—including the national government, local governments, businesses, research institutions, NPOs/NGOs, and citizens—as well as the overall direction of future actions [1]. Furthermore, the Action Plan positions chemicals management not only as a matter of legal compliance, but also as an initiative that can contribute to enhancing corporate value and business continuity through risk management and information disclosure across the entire value chain, from raw material procurement to product use and disposal.

This Action Plan has thus been compiled mainly around policies within the remit of the Ministry of the Environment, based on discussions informed by the knowledge currently available. It is, however, intended to be reviewed and refined on an ongoing basis in light of domestic and international developments, the accumulation of scientific knowledge, and progress in related initiatives. In doing so, the Ministry will continue to consult and coordinate with relevant ministries and agencies while promoting ongoing information-sharing and dialogue with relevant stakeholders, with a view to further refining the Action Plan and improving its practical feasibility.

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[1] This Action Plan, Version 1.0, is intended to provide a foundation for relevant stakeholders to further develop and specify their action plans by setting out the direction of future efforts.

Chapter 1. Introduction

Domestic and International Trends in Chemicals Management and Biodiversity Conservation[2]

1.1 What is Nature-Positive?

In recent years, biodiversity loss has accelerated on a global scale, and ecosystem degradation is increasingly threatening the foundations of socio-economic systems. In response to this crisis, a new shared goal concept— "Nature-Positive"—has been gaining traction both in Japan and internationally. Nature-Positive means halting and reversing biodiversity loss in order to put nature on a path to recovery[3]. In the Kunming-Montreal Global Biodiversity Framework (hereinafter "GBF"), adopted in 2022, this concept is reflected in the 2030 mission, and has helped shape an international trend toward the integrated promotion of biodiversity conservation, climate action and pollution control[4].

1.2 International Efforts on Biodiversity Conservation and Chemicals Management

The drivers of biodiversity loss include changes in land use, climate change, invasive alien species, direct exploitation, and pollution from chemicals and waste[5]. The United Nations Environment Programme (UNEP) identifies pollution, alongside climate change and biodiversity loss, as one of the three major environmental crises and calls for stronger chemicals management that takes account of impacts on ecosystems[6]. Against this backdrop, the international community has been moving beyond responses confined to individual sectors and is increasingly promoting synergies among multilateral environmental agreements and policy frameworks. At the sixth session of the United Nations Environment Assembly (UNEA-6), held in 2024, a resolution on synergies (UNEP/EA.6/Res.4) was adopted, encouraging stronger coordination, cooperation and synergies in the national implementation of multilateral environmental agreements and other relevant environmental instruments, while respecting the mandates and objectives of each agreement. The resolution points to a broader international shift toward more integrated responses to major environmental challenges, including

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[2] Note: In this Action Plan, "chemicals" refers mainly to man-made synthetic chemicals, including substances contained in industrial, household and agricultural products, as well as substances used in their manufacture, including pesticides, pharmaceutical ingredients, cosmetic ingredients and additives.

[3] Ministry of the Environment, Japan. (2023). *The National Biodiversity Strategy and Action Plan (NBSAP) of Japan 2023-2030*. https://www.env.go.jp/en/nature/biodiv/nsj/index.html

[4] CBD Secretariat. (2022). *Kunming-Montreal Global Biodiversity Framework*. https://www.cbd.int/doc/decisions/cop-15/cop-15-dec-04-en.pdf

[5] IPBES. (2019). *Global Assessment Report on Biodiversity and Ecosystem Services*. https://ipbes.net/global-assessment

[6] UNEP. (2021). *Making Peace with Nature*. https://www.unep.org/resources/making-peace-nature

biodiversity loss, climate change and pollution[7]. In 2025, UNEA-7 adopted a follow-up resolution (UNEP/EA.7/Res.5), further encouraging Member States to explore additional approaches to achieving synergies at the national and local levels through cooperation with stakeholders and partners[8]. Chemicals and waste management can be understood as one of the key means of operationalizing action on pollution. Reducing pollution is also closely related to the Sustainable Development Goals (SDGs), including Goal 12, as well as Goals 3, 6, 14 and 15.

In response to these developments, coordination between international agreements has been accelerating in order to promote chemicals management and biodiversity conservation in an integrated manner. For example, analytical work has been carried out on linkages between the four chemicals-related conventions[9] and the Convention on Biological Diversity (CBD)[10], and the resulting report concluded that the sound management of chemicals and waste can bring significant benefits for biodiversity conservation and the maintenance of ecosystem services[11].

The GBF also highlights that the sound management of chemicals and waste is indispensable for the conservation and restoration of biodiversity. It has been noted that, of the 23 GBF targets, as many as 19 are dependent in some way on the safe and sustainable management of chemicals and waste[12]. For example, Target 7 calls for reducing pollution risks and the negative impacts of pollution from all sources by 2030, to levels that are not harmful to biodiversity and ecosystem functions and services,

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[7] UNEP. (2024). *Resolution adopted by the United Nations Environment Assembly on 1 March 2024, 6/4. Promoting synergies, cooperation or collaboration for national implementation of multilateral environmental agreements and other relevant environmental instruments.* https://docs.un.org/en/UNEP/EA.6/RES.4

[8] UNEP. (2025). *Resolution adopted by the United Nations Environment Assembly on 12 December 2025, 7/5. Promoting synergies, cooperation or collaboration for national implementation of multilateral environmental agreements and other relevant environmental instruments.* https://docs.un.org/en/UNEP/EA.7/Res.5

[9] The four chemicals-related conventions are: (i) the Stockholm Convention on Persistent Organic Pollutants; (ii) the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal; (iii) the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade; and (iv) the Minamata Convention on Mercury.

[10] UNEP. *Convention on Biological Diversity.* https://www.cbd.int/convention/text

[11] Secretariats of the Basel, Rotterdam and Stockholm Conventions (BRS), and the Minamata Convention on Mercury (MC). (2021). *Interlinkages between the chemicals and waste multilateral environmental agreements and biodiversity: Key Insights.* https://minamataconvention.org/sites/default/files/documents/2021-07/Biodiversity_Interlinkages_Key_Insights.pdf

[12] UNEP. *Biodiversity: Interlinkages between the framework and biodiversity protection goals.* https://www.unep.org/global-framework-chemicals/implementation/biodiversity

considering cumulative effects, including by reducing excess nutrients lost to the environment by at least half, including through more efficient nutrient cycling and use, by reducing the overall risk from pesticides and highly hazardous chemicals by at least half, including through integrated pest management, based on science, take into account food security and livelihoods, and by preventing, reducing and working toward eliminating plastic pollution. This illustrates that many biodiversity-related policy measures—such as reducing emissions of pesticides, chemicals and nutrients[13], and improving water quality—are inseparable from chemicals management.

In the chemicals and waste field as well, shared targets for 2030 (and in some cases 2035) have been established under the Global Framework on Chemicals (GFC)[14]. In particular, Target E6 calls for identifying and strengthening synergies and linkages between the management of chemicals and waste and other environmental policy areas, including biodiversity conservation. In addition, from the perspective of strengthening the science-policy interface, the Intergovernmental Science-Policy Panel on Chemicals, Waste and Pollution (ISP-CWP) was established in 2025, drawing in part on the model of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)[15][16]. These developments demonstrate that international efforts on biodiversity conservation and chemicals management have evolved in ways that increasingly reinforce one another.

1.3 The Current Status of Chemicals Management in Other Countries with Consideration for Ecosystems and Biodiversity

The European Union (EU) has been advancing more sophisticated chemicals management as a central element of its environmental policies, including ecosystem conservation. The European Commission's 2020 Chemicals Strategy for Sustainability, "Towards a Toxic-Free Environment,"[17][18]

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[13] Nutrients: Although nutrient loading and organic pollution also have major impacts on biodiversity, this Action Plan deals primarily with anthropogenic chemicals.

[14] UNEP. (2024). *Global Framework on Chemicals – For a Planet Free of Harm from Chemicals and Waste*. https://wedocs.unep.org/rest/api/core/bitstreams/8c50e52e-1f39-495f-85e1-6f970f7562dd/content

[15] Ministry of the Environment, Japan. *Integration of Science and Policy (IPBES).* https://www.env.go.jp/nature/biodiversity/ipbes.html

[16] UNEP. *Intergovernmental Science-Policy Panel on Chemicals, Waste and Pollution.* https://www.unep.org/isp-cwp

[17] European Commission. (2020). *Chemicals Strategy for Sustainability.* https://ec.europa.eu/environment/strategy/chemicals-strategy_en

[18] European Commission. (2020). *Chemicals Strategy for Sustainability: Towards a Toxic-Free Environment.* https://ec.europa.eu/commission/presscorner/api/files/attachment/866620/Chemicals%20Strategy%20EN.pdf

sets out to better protect human health and the environment from hazardous chemicals, promote innovation for safe and sustainable chemicals, and enable the transition to chemicals that are safe and sustainable by design. It presents a comprehensive approach encompassing both stronger regulation and voluntary efforts by industry. In addition, the European Commission is promoting the concept of Safe and Sustainable-by-Design (SSbD), which seeks to minimize environmental burdens from the product design stage onward[19]. The "essential use" concept has also been defined in an official communication of the European Commission in terms of criteria and principles, and is being considered as a policy framework for possible future incorporation into EU chemicals legislation[20].

The European Environment Agency (EEA), drawing on scientific findings including those of the Stockholm Resilience Centre, has pointed out that chemical pollution may already have exceeded planetary boundaries. It has also indicated that, with the increasing volume and diversity of chemicals, conventional risk assessment and management approaches that focus on individual substances may no longer be sufficient to adequately assess and manage the associated risks[21]. Against this scientific backdrop, Europe has been developing chemicals management approaches that also take ecosystem services and biodiversity conservation into account[22]. These initiatives should be seen not merely as stricter chemical regulation, but as strategic measures that simultaneously pursue long-term societal goals such as the sustainable transformation of the chemicals industry and the protection of human health and the environment[17].

In the United States, efforts have been made to take ecosystems and biodiversity into account in the assessment and registration of pesticides in light of the Endangered Species Act (ESA). The ESA aims to conserve endangered and threatened species and their critical habitats, and requires that actions by federal agencies not adversely affect them. Under the pesticide registration system established pursuant to the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), the U.S. Environmental Protection Agency (EPA) has developed mechanisms to assess the effects of pesticide use on

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[19] European Commission. *Safe and sustainable by design*. https://research-and-innovation.ec.europa.eu/research-area/industrial-research-and-innovation/chemicals-and-advanced-materials/safe-and-sustainable-design_en

[20] European Commission. (2024). *Guiding criteria and principles for the essential use concept in EU legislation dealing with chemicals*. https://environment.ec.europa.eu/document/download/fb27e67a-c275-4c47-b570-b3c07f0135e0_en?filename=C_2024_1995_F1_COMMUNICATION_FROM_COMMISSION_EN_V4_P1_3329609.PDF

[21] European Environment Agency. (2023). *Managing the systemic use of chemicals in Europe*. https://www.eea.europa.eu/en/analysis/publications/managing-the-systemic-use-of-chemicals

[22] European Commission, Joint Research Centre. (2025). *Protection of biodiversity as the ultimate goal of environmental safety assessment: how does chemical pollution affect biodiversity?* https://publications.jrc.ec.europa.eu/repository/bitstream/JRC140133/JRC140133_01.pdf

endangered species and critical habitats[23]. In ecological risk assessments for pesticides, the EPA analyzes impacts on ecosystems, including non-target organisms, and, where necessary, reflects restrictions on use conditions and mitigation measures in pesticide labels and other regulatory instruments in order to protect species. For new pesticides and certain active ingredients, frameworks are also in place for consultation with the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS), depending on the results of the assessment. In recent years, the EPA has also formulated biodiversity-related mitigation strategies such as the Herbicide Strategy, under which mitigation measures may be introduced even before a full assessment is completed in order to reduce potential impacts on endangered species[24].

1.4 Chemicals Management Systems and Biodiversity Conservation in Japan

As an overarching direction of Japan's environmental policy, the Sixth Basic Environment Plan, approved by the Cabinet in May 2024, identifies climate change, biodiversity loss and pollution as the "triple global crisis," on the environment and emphasizes the need to address them in an integrated manner. The Plan presents a basic approach that seeks to achieve the simultaneous resolution of environmental, economic and social challenges through environmental policy, while interlinking the realization of net-zero, the transition to a circular economy and the promotion of Nature-Positive outcomes. It places particular emphasis on cross-sectoral policy coordination and synergies[25].

In Japan, frameworks for the management of chemicals have been established at each stage of manufacture, use and release under a range of laws, including the Chemical Substances Control Law (CSCL), the Act on the Assessment of Releases of Specified Chemical Substances in the Environment and the Promotion of Management Improvement (the PRTR system), the Agricultural Chemicals Regulation Act, the Water Pollution Control Act and the Air Pollution Control Act, although the substances covered and the approaches taken differ from one system to another. These systems have produced certain results and have formed the foundation of chemicals management in Japan. Traditionally, these systems were developed primarily with a focus on the protection of human health; however, consideration for flora and fauna in the environment has also been incorporated step by step, including through the introduction in 2003 of a review and regulatory system under the CSCL that focuses on effects on plants and animals in the environment.

In addition, the National Biodiversity Strategy and Action Plan (NBSAP) of Japan 2023-2030,

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[23] U.S. EPA. *About the Endangered Species Protection Program*. https://www.epa.gov/endangered-species/about-endangered-species-protection-program

[24] U.S. EPA. *Implementing EPA's Workplan to Protect Endangered and Threatened Species from Pesticides*. https://www.epa.gov/endangered-species/implementing-epas-workplan-protect-endangered-and-threatened-species-pesticides

[25] Ministry of the Environment, Japan. (2024). *The Sixth Basic Environment Plan*. https://www.env.go.jp/en/policy/

approved by the Cabinet in March 2023[3], sets out the realization of Nature-Positive by 2030 as a national goal for 2030 and includes a range of related policy measures. Chemicals management is also incorporated into the Strategy. More specifically, under Action Target 1-3, "Reduction of Pollution," the Strategy calls for the promotion and expansion of risk assessment and appropriate risk management, including proper use, with regard to chemicals, pesticides and other substances[3].

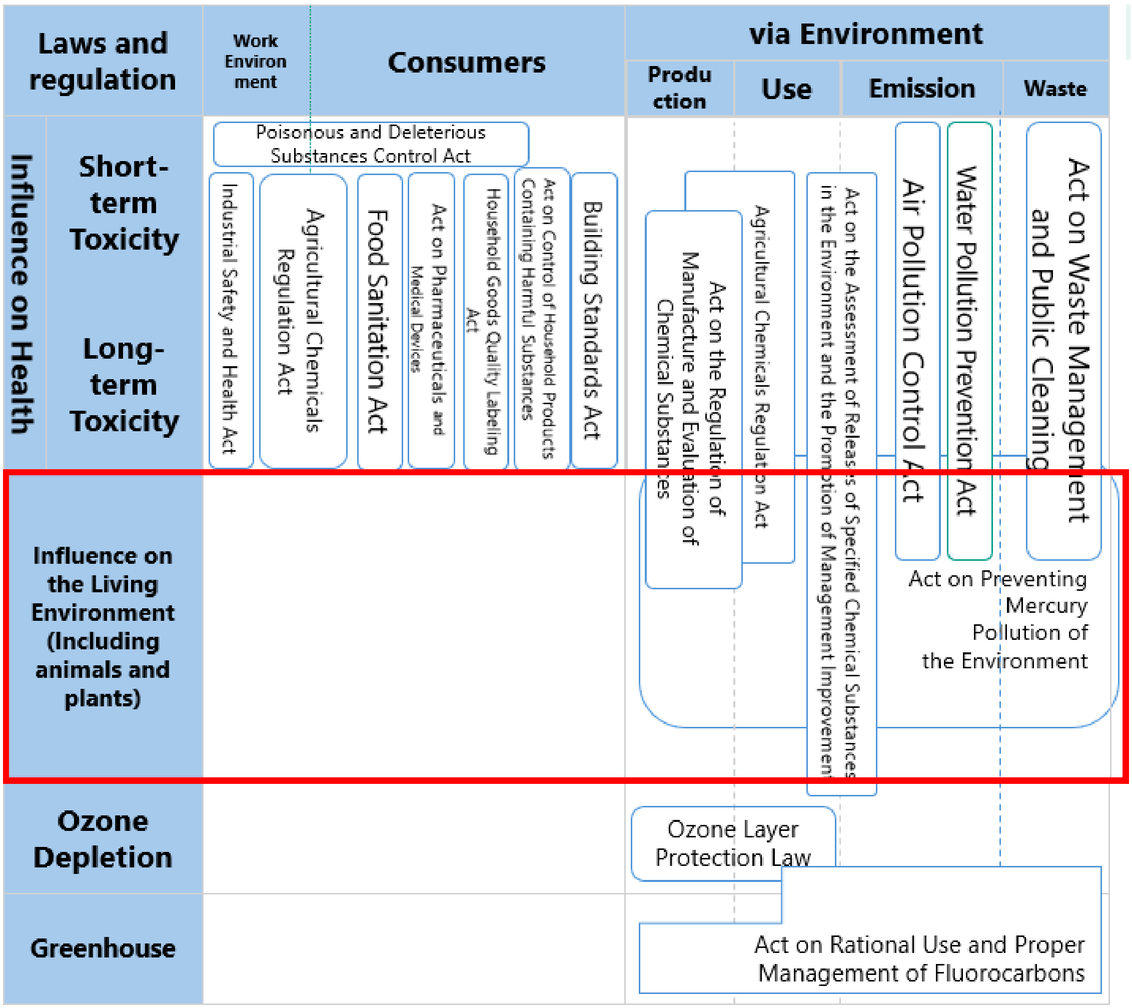

Figure 1.. Japan's Framework for Chemicals Management (Reproduced from the National Plan of Action for the Implementation of the GFC)[26]

As a domestic plan on chemicals management, Japan's National Plan of Action for the Implementation of the GFC, formulated in 2025, also includes, as a measure corresponding to GFC Target E6 mentioned above, the organization of a study group consisting of experts on chemicals

[26] Wastewater discharges from resource extraction and primary industries (such as livestock farming and fisheries) are regulated under the Water Pollution Control Act, while occupational exposure to heavy metals at mines and similar sites is regulated under the Industrial Safety and Health Act.

management and biodiversity in Japan to examine measures for promoting chemicals management that contributes to Nature-Positive outcomes[27].

1.5 The Need to Promote Nature-Positive through Chemicals Management

Taking into account the international trends and domestic policy developments outlined above—particularly the direction toward integrated responses to the three major environmental crises and the significant contribution that chemicals management can make to biodiversity conservation—it is necessary to reorganize and analyze the current situation and challenges of the assessment and management of ecological impacts of chemicals, which have thus far been addressed separately under individual laws and systems, under the overarching theme of "promoting Nature-Positive through chemicals management." It is also necessary to set out actions indicating how the various actors involved in chemicals management should cooperate and respond in an integrated manner.

Based on this recognition, the Ministry of the Environment launched the Study Group on Promoting Nature-Positive through Chemicals Management in September 2025, comprising relevant experts, and prepared this Action Plan with the benefit of their advice.

2. Purpose, Scope and Vision of this Action Plan

2.1 Purpose of this Action Plan

This Action Plan, taking into account the international trends and domestic policy developments described in Section 1 above, and incorporating the discussions and observations of the Study Group on Promoting Nature-Positive through Chemicals Management established in response to the measures set out in the above-mentioned National Plan of Action for the Implementation of the GFC, is issued as Version 1.0 in order to indicate initial policy directions for advancing chemicals management toward Nature-Positive outcomes.

In recent years, the degradation of natural capital has increasingly come to be recognized as an issue that can affect corporate activities and the economic system itself through instability in raw material procurement, greater business continuity risks, and declining public trust. In this context, the transition to Nature-Positive—putting nature on a path to recovery—is no longer seen merely as an additional burden for environmental protection, but rather as an initiative that can restore the soundness of the natural capital on which businesses depend and thereby help maintain and enhance their medium- to long-term business foundations and corporate value.

Against this backdrop, this Action Plan aims to reposition chemicals management not merely as a regulatory tool for reducing negative impacts on nature, but as a strategic means of managing risks

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[27] Ministry of the Environment, Japan. (2025). *the National Plan of Action for the Implementation of the GFC*. https://www.env.go.jp/en/press_04884.html

throughout the life cycle of chemicals while supporting biodiversity recovery and the sustainability of socio-economic activities.

More specifically, from the perspective of promoting biodiversity conservation through chemicals management, this Action Plan organizes and analyzes Japan's current situation and challenges from a broad range of perspectives, and also outlines response options that may be taken to address them. Based on this information, the Action Plan is intended to serve as a basis for defining, including through a roadmap, the roles to be played by relevant actors such as the national government, local governments, businesses, research institutions, NPOs/NGOs and citizens, and for identifying future actions.

In addition, this Action Plan is intended to reframe chemicals management not as a passive undertaking centered solely on legal compliance, but as part of risk management across the entire value chain—from raw material procurement to product use and disposal. As recognition grows that nature-related risks and dependencies can affect business continuity and corporate value, chemicals management is increasingly becoming an important management issue that is closely linked to risk reduction in supply chains, information disclosure, and evaluations by investors and business partners. Taking account of these developments, this Action Plan is also intended to serve as a basis for helping businesses understand and manage the relationship between their activities and biodiversity, and for encouraging them to take proactive action.

2.2 Scope of this Action Plan

The impacts of chemicals on ecosystems are often not limited to a single act of use or a single source of release. In many cases, they appear cumulatively as a result of releases and movements occurring across multiple stages—manufacture, use, collection and treatment, and disposal—as well as persistence and transformation in the environment. In light of these characteristics, effective assessment and management of impacts on biodiversity require a comprehensive view of the full life cycle of chemicals, including how they are manufactured, at what stages they are used, and how they are collected, treated and released after use, as well as a systematic understanding of the issues and management tools that arise at each stage.

The GFC also defines its scope as covering the full life cycle of chemicals, including chemicals in products and waste. Likewise, this Action Plan covers environmental impacts across the entire life cycle of chemicals, including the waste stage. Reducing the negative impacts of chemicals on biodiversity and ecosystems is indispensable, and in some cases such reduction may itself contribute to recovery. At the same time, it is expected that combining such efforts with initiatives that help support conservation and recovery—for example, the appropriate utilization of the functional value of chemicals—can more reliably move society toward Nature-Positive outcomes.

Furthermore, as illustrated in Figure 1, chemicals management is based not only on institutional measures under laws and regulations, but also on the basic principle that producers, users and releasers each bear social responsibility corresponding to their actions at each stage of the life cycle of chemicals. In addition, as emphasized in the GFC, it is indispensable that diverse sectors (including environment, health, agriculture, labour and industry) and diverse actors (including national and local governments, businesses, NPOs/NGOs and citizens) advance their efforts while complementing one another's roles. Accordingly, this Action Plan takes into view not only government action, but also cross-sectoral and multi-stakeholder approaches.

2.3 Vision of this Action Plan

Based on the scientific knowledge currently available and the discussions of the Study Group, this Action Plan presents directions for promoting Nature-Positive through chemicals management, while also organizing a phased vision of the future with a view to the further refinement of the conceptual framework over time.

The vision pursued by this Action Plan is as follows:
"By advancing the assessment of impacts of chemicals on ecosystems, and progressively reflecting the resulting knowledge in the operation of systems and cooperation among actors, society minimizes the negative impacts of chemicals on biodiversity. On that basis, it gives priority to management that does not undermine nature's resilience, and makes complementary use of chemicals only within the range that contributes to preventing and mitigating biodiversity loss, thereby creating a society that not only halts biodiversity loss but also restores it."

Such a vision of society is not intended solely for environmental protection. Through the restoration of natural capital, it is expected to bring medium- to long-term positive effects for businesses and economic activities as well, including greater stability in resource procurement, reduced environmental and social risks associated with business activities, and enhanced credibility with local communities and markets.

Nor is the Action Plan aiming at a society that simply reduces the quantity of chemicals used. Rather, it envisages a dynamic and collaborative process characterized by: (i) the incorporation into assessment of ecosystem characteristics, including region-specific conditions; (ii) collaboration among relevant actors based on the results of those assessments; and (iii) the reconciliation of the functional value of chemicals with ecosystem conservation. In other words, the vision of society pursued by this Action Plan is one in which a scientific basis for making impacts on ecosystems visible, institutional frameworks that enable government, businesses and local stakeholders to make rational decisions—based on such information—regarding the risks that should be reduced as a priority, acceptable trade-offs, and available alternatives, and social understanding and consensus-building together make it possible to use chemicals safely and sustainably in support of the realization of Nature-Positive outcomes.

Chapter 2. Situation Analysis

In Chapter 1, this Action Plan reviewed domestic and international trends in chemicals management and biodiversity conservation, set out the need to formulate the Action Plan, and clarified its scope, vision, overall structure, and the process leading to its development.

In Chapter 2, based on domestic and international literature, existing survey and assessment results, and the organization of relevant institutional frameworks, and reflecting the expert knowledge shared in the Study Group, the Action Plan examines cases where environmental releases of chemicals and their impacts on ecosystems are of concern, as well as issues related to existing assessment and management frameworks and their operation. Because it is often difficult to clearly separate releases from impacts, these issues are discussed together in this chapter.

1. Cases of Concern Regarding Environmental Releases of Chemicals and Their Impacts on Ecosystems

1.1 Cases of Ecosystem Impacts Associated with the Use of Various Chemicals

In recent years, concern has been increasing that a wide range of chemicals are affecting ecosystems. As the uses of chemicals continue to expand and the modes of use and pathways of release diversify, impacts on ecosystems are increasingly manifesting themselves in complex ways. In order to realize Nature-Positive outcomes, it is therefore important not only to deepen knowledge of the environmental fate of different chemicals and of ecotoxicity at the level of individuals and species in light of actual conditions, but also to improve understanding of impacts on community structure and ecosystem functions, including interspecies interactions.

The following section focuses on impacts that may act directly on biodiversity through the use or release of chemicals and that may not be fully assessed or managed under the current chemicals management framework. From the perspectives of the intended use of chemicals, the forms of release, and whether they are used for the control or management of specific organisms, representative cases of impacts on ecosystems are organized into two categories.

(1) Potential Impact of Pesticides on Non-Target Organisms

It may be possible that these impacts arise at the ecosystem level beyond the scope of the currently intended uses or assessment endpoints for pesticides and similar substances, and may not be adequately captured under existing frameworks for risk assessment and use management.

Pesticides are indispensable for the management of pests and weeds within agricultural land, but concerns have been raised that, after application, they may run off from farmland through rainfall and drainage and affect non-target organisms[28]. In Japan as well, it has been suggested that inflows of neonicotinoid pesticides may be associated with declines in populations of aquatic insects and fish[29], prompting debate on the relationship between pesticide use and changes in aquatic ecosystems. Outside farmland, chemicals other than agricultural pesticides are also widely used, including mosquito and fly control agents, pest control agents for home gardening, and herbicides used in the management of roadside trees[30]. While such products contribute to improved hygiene and convenience in living environments, they may also affect non-target organisms.

A number of cases have also been reported in which chemical control methods have been adopted to manage alien species against adverse effects to ecosystem and other aspects, and such methods have often proved highly effective. For example, in the control of red imported fire ants, bait formulations containing pyriproxyfen or fipronil as active ingredients are used[31]. Similarly, for invasive alien plants such as *Alternanthera philoxeroides*, which have serious impacts on aquatic and wetland ecosystems and agricultural production, efforts are underway to develop and implement effective management techniques combining multiple control methods, including chemical control[32]. At the same time, when such chemicals are used—particularly in areas of high importance for biodiversity conservation—careful consideration must be given to impacts on surrounding environments. For example, in the Ogasawara Islands, a World Natural Heritage site, the aerial application of rodenticides to eradicate invasive rats was intended to protect rare and endemic species, but potential impacts on ecosystems, including endemic species, became an important issue for consideration, and the importance of examining methods of use, measures to reduce impacts, and monitoring has been pointed out[33]. One

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[28] Wan, N. F., *et al.* (2025). Pesticides have negative effects on non-target organisms. *Nature Communications*, 16(1), 1360. https://www.nature.com/articles/s41467-025-56732-x

[29] Yamamuro, M., *et al.* (2019). Neonicotinoids disrupt aquatic food webs and decrease fishery yields. *Science*, 366(6465), 620–623. https://www.science.org/doi/10.1126/science.aax3442

[30] Ministry of the Environment, Japan. (2015). *FY2014 Survey Report on the Actual Situation of Consumer Products Such as Insecticides* [in Japanese]. https://www.env.go.jp/chemi/chemi/bicidesurvey/%E5%B9%B3%E6%88%9026%E5%B9%B4%E5%BA%A6%E6%AE%BA%E8%99%AB%E5%89%A4%E7%AD%89%E3%81%AE%E5%AE%9F%E6%85%8B%E8%AA%BF%E6%9F%BB%E5%A0%B1%E5%91%8A%E6%9B%B8.pdf

[31] Ministry of the Environment, Japan. (2022). *Outline of the Act Partially Amending the Act on the Prevention of Adverse Ecological Impacts Caused by Designated Invasive Alien Species* [in Japanese] . https://www.env.go.jp/content/000038130.pdf

[32] Ministry of Agriculture, Forestry and Fisheries and Ministry of the Environment, Japan. (2025). *Development of Eradication Technologies for Invasive Alien Species Threatening Biodiversity and Agricultural Production, BRIDGE Program FY2025 Research and Development Plan* [in Japanese]. https://www8.cao.go.jp/cstp/bridge/keikaku/r6-09_bridge_r7.pdf

[33] Kanto Regional Environmental Office, Ministry of the Environment, Japan. (2016). *Summary of the FY2016 Anijima Terrestrial Snail Conservation Project Implementation Plan* [in Japanese].

obstacle in such efforts is that current chemicals-related legislation in Japan does not directly cover the use of chemicals in the field for the control of wild organisms.

In addition, chemical spraying is sometimes carried out during disasters as a hygiene pest control measure and to prevent the spread of infectious diseases. When large amounts are applied within a short period of time, this may pose problems for local biota. For example, in dengue fever control, rapid control of vector mosquitoes is essential[34], but non-target organisms may also be exposed at the same time.

(2) Potential Impacts on Ecosystems from Chemicals Used or Released for Purposes Other than the Control or Management of Specific Organisms

In addition to the impacts of pesticides and similar substances on non-target organisms described above, chemicals used or released for purposes other than the control or management of specific organisms may also have measurable impacts on ecosystems. Although such chemicals vary widely in terms of sources of release and substance characteristics, many share a common challenge: knowledge of their behavior in the environment and ecotoxicity remains insufficient, and regulatory and assessment frameworks premised on intentional uses are often ill-suited to addressing them.

A concrete example is the case reported in the State of Washington in the United States, where 6-PPDQ, a transformation product formed by the degradation of the tire additive 6-PPD, was found to exhibit species-specific toxicity to coho salmon[35]. This case shows that unregulated chemicals entering the environment via urban runoff can have unexpected impacts on ecosystems and suggests that addressing risks not adequately captured by traditional chemicals management frameworks is an important issue.

Another important group is PFAS[36],which includes environmentally persistent substances. PFAS comprise more than 10,000 substances, including substances that are characterized by resistance to degradation, long-term persistence in the environment, and the capacity for long-range transport. Certain PFAS, such as PFOS, PFOA, and PFHxS, have been found to accumulate in ecosystems and in the human body and are subject to international regulation[37]. At the same time, research on the ecological effects and environmental behavior of PFAS not yet subject to regulation[38] has been

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https://kanto.env.go.jp/content/900157688.pdf

[34] Japan Institute for Health Security (JIHS). (2019). Emergency Response Manual for Dengue Fever, Chikungunya Fever and Other Mosquito-Borne Infectious Diseases: For Local Governments [in Japanese] . https://www.niid.jihs.go.jp/content2/research_department/ent/20250404185949.html

[35] Tian, Z., *et al.* (2021). A ubiquitous tire rubber–derived chemical induces acute mortality in coho salmon. *Science*, 371(6525), 185–189. https://www.science.org/doi/full/10.1126/science.abd6951

[36] General term for per- and polyfluoroalkyl substances.

[37] Ministry of the Environment, Japan. (2025). *PFAS Handbook*. https://www.env.go.jp/content/000368188.pdf

[38] Ankley, G. T., *et al.* (2021). Assessing the ecological risks of per- and polyfluoroalkyl substances: Current

accumulating in recent years; however, because the number of such substances is very large, the expansion of knowledge remains a continuing challenge.

Antimicrobials are another relevant example. In response to antimicrobial resistance (AMR), the proper use of such substances and reductions in their use are being called for in the medical and agricultural sectors. In addition, from a One Health perspective, measures against AMR in the environment require the monitoring of antimicrobial concentrations in environmental media.

Examples of chemicals derived from daily life include pharmaceuticals and personal care products (PPCPs). These chemicals may not be completely removed through wastewater treatment, may remain in the environment, and have raised concerns regarding impacts on ecosystems. Surveys by the Ministry of the Environment have also detected certain PPCPs in river water. Although the concentrations detected are considered unlikely to cause acute effects, caution is warranted in relation to chronic effects and combined exposure[39]. There are also reports that ultraviolet filters contained in sunscreens and similar products may flow into marine environments and affect corals, algae, and invertebrates[40].

In addition, micro- and nanoplastics (MNPs) have emerged as factors that may affect ecosystems in relation to chemicals. It has been pointed out that the rapid global increase in plastic production and inadequate waste management are increasing plastic leakage into the environment, including the oceans, and that such plastic fragments into MNPs. MNPs may affect organisms not only through ingestion and the physical effects of polymer particles, but also through the leaching of additives such as plasticizers and flame retardants contained in the particles and through chemicals adsorbed from the environment[41].

Another issue that has emerged in recent years is the growing use of firefighting agents in response to the increasing occurrence of large-scale wildland fires. The IPCC Sixth Assessment Report has found that increases in regional temperatures, drying, and changes in drought conditions are contributing to increases in the frequency and intensity of fires[42]. In light of these growing risks, and

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state of the science and a proposed path forward. *Environmental Toxicology and Chemistry*, 40(3), 564–605. https://academic.oup.com/etc/article/40/3/564/7734567

[39] Ministry of the Environment, Japan. (2022). *Progress under "Future Responses to Endocrine Disrupting Effects of Chemicals (EXTEND2016)"* [in Japanese]. https://www.env.go.jp/chemi/end/extend2016/seminar2022/mat03.pdf

[40] Hodge, A. A., *et al.* (2025). Ecotoxicological effects of sunscreen-derived organic and inorganic UV filters on marine organisms: A critical review. *Marine Pollution Bulletin*, 213, 117627. https://www.sciencedirect.com/science/article/pii/S0025326X2500102X

[41] GESAMP. (2016). *Sources, Fate and Effects of Microplastics in the Marine Environment (Part 2).* http://www.gesamp.org/publications/microplastics-in-the-marine-environment-part-2

[42] IPCC. (2022). *Sixth Assessment Report. Technical Summary. TS.B Observed Impacts.* https://www.ipcc.ch/report/ar6/wg2/chapter/technical-summary/

taking into account the use of firefighting agents in wildland fires in countries such as the United States, the use of various firefighting agents containing surfactants is also being considered in Japan[43]. However, in order to promote the use of firefighting agents in wildland fire response, it will be necessary to examine methods for assessing the effectiveness of individual agents against fire as well as their impacts on human health and the environment. Minimizing impacts on surrounding ecosystems while making use of firefighting agents as a means to prevent the spread of wildland fires constitutes an issue that should be addressed as part of adaptation to climate change.

1.2 Socio-Economic Factors Behind Impacts of Chemical Pollution on Biodiversity

As described above, the use of chemicals and their release into the environment can potentially have negative impacts on biodiversity and ecosystems. At the same time, depending on the purposes for which chemicals are used and the way they are managed, chemicals may also serve as part of efforts that support the conservation and restoration of ecosystems and the sustainable use of biodiversity.

Production and consumption activities are linked to the use and release of chemicals through a series of processes, including resource extraction, manufacturing, distribution, use, and disposal. These activities generate "direct drivers" of biodiversity impacts, such as emissions of chemicals and exposure in specific locations. At the same time, behind these drivers lie socio-economic factors such as patterns of consumption, international trade, supply chains, technological choices, and institutional and policy settings.

IPBES distinguishes pressures that act directly on biodiversity, such as pollution, as "direct drivers," while the socio-economic and institutional background that gives rise to them is treated as "indirect drivers."[44] Based on this IPBES framing, this section organizes economic activity, consumption structures, and supply-chain arrangements as indirect drivers that give rise to chemical-related impacts on biodiversity.

In recent years, environmental due diligence has been spreading internationally as a way of addressing such indirect drivers of biodiversity impacts. Environmental due diligence refers to a framework under which businesses identify, prevent, mitigate, and explain how they are addressing adverse environmental impacts (including potential impacts) that may arise through business activities or transactions. In the context of chemical pollution, management across the full supply chain is increasingly expected. For example, at the sixth meeting of the Conference of the Parties to the Minamata Convention on Mercury, held in 2025, a resolution was adopted that calls on Parties to adopt

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[43] Review Committee on Firefighting and Disaster Prevention Measures in Light of the Ofunato City Wildland Fire. (2025). *Report of the Review Committee on Firefighting and Disaster Prevention Measures in Light of the Ofunato City Wildland Fire* [in Japanese]. https://www.fdma.go.jp/singi_kento/kento/items/post-167/06/houkokusyo.pdf

[44] IPBES Secretariat. *Glossary: drivers of change.* https://www.ipbes.net/node/41006

and strengthen environmentally sustainable management of gold supply chains and to encourage buyers and intermediaries to take more responsible action throughout the supply chain in order to prevent mercury pollution associated with gold mining[45]. This is an example of addressing pollution problems in specific locations by linking them to international economic and trade structures. In the sphere of consumption as well, the importance of mechanisms—such as certification schemes—that allow consumers to choose environmentally responsible products (including so-called ethical jewelry) has been noted[46]. Such efforts can be positioned as important means of reducing chemical pollution and, as a result, restraining negative impacts on biodiversity by acting on the indirect drivers associated with economic and consumption activities that involve chemicals.

1.3 Efforts that Support Conservation and Restoration by Leveraging the Functional Value of Chemicals

It is also possible to use the functional value of chemicals to contribute to biodiversity conservation. For example, as noted above, chemical control in invasive alien species management and the early suppression of large-scale forest fires through the use of surfactant-containing firefighting agents may, in some cases, contribute directly to biodiversity conservation by preventing the spread of invasive species or severe ecosystem damage caused by fire. It is therefore important not only to focus on the negative side of chemicals, but also to pay attention to their role in supporting conservation and restoration and, while taking due account of secondary impacts on surrounding environments[47][48], to consider the appropriate application of the functional value of chemicals in diverse contexts under proper conditions of use and management.

2. Issues Concerning Existing Risk Assessment, Ecotoxicity Test Methods, and Management Systems

2.1 Linking Monitoring of Chemicals and Biota

Existing biological monitoring has, in some cases, undergone changes over time in survey methods and target taxa, and care must therefore be taken when making strict comparisons of long-term trends.

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45 Ministry of the Environment, Japan. (2025). *Results of the Sixth Meeting of the Conference of the Parties to the Minamata Convention on Mercury* [in Japanese]. https://www.env.go.jp/press/press_01704.html

46 UNEP. *Consumer Information, Ecolabels and Certification Schemes.* https://www.unep.org/topics/finance-and-economic-transformations/scp-and-circularity/consumer-information

47 U.S. EPA. *Pesticide Emergency Exemptions.* https://www.epa.gov/pesticide-registration/pesticide-emergency-exemptions

48 USDA. *Nationwide Aerial Application of Fire Retardant on National Forest System Lands.* https://thenarwhal.ca/wp-content/uploads/2025/08/AerialFireRetardant-FinalSEIS-1.pdf

In addition, it has been pointed out that, in setting targets for Nature-Positive outcomes, it is important to consider how reference conditions (baselines) should be established for each region, including by making use of historical data.

Although methods for assessing species distributions and stress conditions using tools such as environmental DNA (eDNA)[49] and environmental RNA (eRNA)[50] have emerged, the methodologies, data infrastructure, and institutional arrangements needed to connect these tools to integrated assessment of chemical monitoring, exposure analysis, and biological responses are still in the process of development.

In addition, in chemical monitoring, there is a need for exposure assessment that can lead to the evaluation of impacts on biodiversity and ecosystems, taking into account sources of exposure, pathways of release, and bioaccumulation. For example, frameworks have been proposed that link losses of ecosystem services caused by chemicals in the environment through a chain from toxic effects at the individual and species levels, to impacts on functions and communities, and ultimately to ecosystem services[51]. This indicates the need to move beyond monitoring of chemicals and biota in isolation and to incorporate perspectives on biological functional impairment and ecosystem degradation. It has also been pointed out that interactions between climate change, extreme weather, and chemical exposure need to be taken into account[52].

2.2 Understanding Environmental Releases and Outflows of Chemicals

Under the PRTR system based on the Act on the Assessment of Releases of Specified Chemical Substances in the Environment and the Promotion of Management Improvement, releases and transfers of PRTR-listed chemicals from establishments above a certain scale are tracked. At the same time, for sources not covered by the system—for example, releases from establishments below the regulatory threshold, emissions from mobile sources such as motor vehicles, and off-site runoff of pesticides used on farmland through rainfall, irrigation drainage, and infiltration into groundwater—

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[49] Ministry of the Environment, Japan. *Environmental DNA Survey.* https://www.biodic.go.jp/edna/edna_top.html

[50] Hiki, K., and Jo, T. S. (2025). Comprehensive Sequencing of Environmental RNA from Japanese medaka at various size fractions and comparison with skin swab RNA. *Environmental DNA*, 7(3), e70137. https://onlinelibrary.wiley.com/doi/full/10.1002/edn3.70137

[51] EFSA Panel on Plant Protection Products and their Residues (PPR). (2010). Scientific Opinion on the development of specific protection goal options for environmental risk assessment of pesticides, in particular in relation to the revision of the Guidance Documents on Aquatic and Terrestrial Ecotoxicology (SANCO/3268/2001 and SANCO/10329/2002). *EFSA Journal*, 8(10), 1821. https://efsa.onlinelibrary.wiley.com/doi/10.2903/j.efsa.2010.1821

[52] Liu, Y., *et al.* (2025). Beyond linear thinking: redefining chemical pollution impacts on biodiversity. *Environmental Science and Ecotechnology*. https://www.sciencedirect.com/science/article/pii/S2666498425000675?via%3Dihub

the national government produces supplementary estimates of emissions[53]. However, issues remain, including limitations in the display of estimated emissions on mesh maps and in the precision of such estimates.

2.3 Management that Takes Account of the Life Cycle of Chemicals

In recent years, the need for management across the full life cycle of chemicals has been emphasized internationally. The GFC explicitly covers the management of chemicals throughout their full life cycle, from production and use to waste, and Target D2 calls for the promotion of safer alternatives and sustainable solutions throughout product value chains[54]. The UNEP/SETAC Life Cycle Initiative, established in April 2002, has presented guidance and practical examples for the use of life-cycle assessment (LCA) in policymaking and supports the understanding of environmental impacts across the entire life cycle of products and services[55]. For environmental releases and ecological impacts of chemicals, the USEtox model, developed by UNEP/SETAC as a method for quantifying human health and ecotoxicological impacts[56], has been incorporated as a standard feature in major LCA software.

At the same time, a number of issues remain, including insufficient understanding of the toxicity of metabolites and degradation products, environmental releases during recycling and recovery phases after chemical use, and impacts on ecosystems at the downstream end of supply chains, such as in waste management and recycling markets.

2.4 Insufficiency of Methods for Assessing Impacts on Ecosystems as a Whole

Traditional ecological risk assessment of chemicals has relied mainly on ecotoxicity tests using fish, crustaceans, algae, and similar organisms. However, there are limits to directly evaluating impacts on communities and ecosystem levels, and ultimately on higher-order ecological functions such as biodiversity and ecosystem services, on the basis of findings obtained only at the individual level. In Europe, it has been pointed out that many ecotoxicological studies focus on the individual level and are poorly aligned with studies that use biodiversity—such as species richness and community structure—as indicators[22]. Against this backdrop, a number of approaches have recently been examined as research-oriented means of complementing understanding of impacts on ecosystems as a whole, while not immediately replacing conventional assessment methods. These include the

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[53] Ministry of the Environment, Japan. *PRTR Information Plaza.* https://www.env.go.jp/en/chemi/prtr/prtr.html

[54] Ministry of the Environment, Japan. *Global Framework on Chemicals – For a Planet Free of Harm from Chemicals and Waste* (provisional translation by the Ministry of the Environment based on the document adopted at the International Conference on Chemicals Management). https://www.env.go.jp/content/000224759.pdf

[55] UNEP. *Life Cycle Initiative.* https://www.lifecycleinitiative.org/

[56] USEtox. https://usetox.org/

following:

- **Combined testing using mesocosms (semi-natural outdoor model ecosystems).**
  Such approaches can be useful in understanding community responses under particular environmental conditions, but they have limitations in reproducibility and generalizability, and it is difficult to directly apply the results obtained to general chemicals management.
- **Prediction of community responses using species sensitivity distributions (SSD) and statistical modeling.**
  These approaches are applicable only to substances for which a relatively large body of reliable toxicity data has been accumulated, and formalistic application without proper assessment of data quality and representativeness may fail to produce appropriate predictions of community responses.
- **The use of new approach methods (NAMs), including in vitro tests that do not rely on animal testing.**
  These methods are mainly intended to elucidate mechanisms of action at the individual or cellular level, and substantial uncertainty remains in linking them directly to assessment of impacts on ecosystems as a whole. At the same time, research efforts are underway to integrate such information with other knowledge and bridge it to ecological impact assessment.
- **Consideration of combined impacts from degradation products, metabolites, and mixtures of chemicals, as well as impacts on non-target organisms, rare species, and regionally endemic species.**
  These are important perspectives for reflecting real-world environmental conditions, but the standardization of target-setting and interpretation of results has not yet been sufficiently established.
- **Linking to declines in ecosystem services.**

In addition, the need has been pointed out to consider environmental changes—such as climate change, changes in water temperature, changes in rainfall patterns, and extreme weather events—as modifying factors in chemical impacts. In light of these perspectives, a major challenge in chemicals management is to develop an assessment framework that can systematically organize impacts on the structure and functions of species, communities, and ecosystems from temporal, spatial, and combined perspectives, and clarify how those impacts appear as changes in ecosystem services[57].

[57] Forbes, V. E., *et al.* (2017). A framework for predicting impacts on ecosystem services from (sub)organismal responses to chemicals. *Environmental Toxicology and Chemistry*, 36(4), 845–859. https://pmc.ncbi.nlm.nih.gov/articles/PMC6147012/

2.5 Introduction of the Concepts of Biodiversity and Regional Specificity

From the standpoint of biodiversity conservation, it is important to focus not merely on whether organisms exist, but also on species-level composition and diversity, including endemic and rare species. It is also important to consider the functions that sustain ecosystem services and the resilience of ecosystems. At the same time, conventional risk assessment in chemicals management has been designed to identify general hazard characteristics of substances and to enable management that can be applied broadly across many environments. As a result, elements such as regional specificity, rare species, and the vulnerability of particular ecosystems have, from the standpoint of simplifying assessment and ensuring fairness, tended to be intentionally excluded from detailed consideration.

It has been pointed out that, even where impacts of chemicals are not readily apparent in the standard species used in ecotoxicity testing, serious impacts may arise for endemic species or vulnerable components of ecosystems, and that current risk assessment methods and management systems do not adequately reflect differences in sensitivity among species or the vulnerability of ecosystem components[58]. For example, in lakes, wetlands, coastal zones, and island areas where local biota differ, highly sensitive endemic species may be present, yet assessments are often based on representative species such as fish, crustaceans, and algae, and may not sufficiently reflect the perspective of conserving rare species and endemic ecosystems.

In light of these issues, questions arise as to how such matters as the organization of sensitivity profiles for regional ecosystems, the use of knowledge regarding the sensitivities of endemic species, and assessment approaches that take account of ecosystem resilience and vulnerability should be positioned and used complementarily from a broader environmental management perspective, rather than being incorporated immediately into the conventional framework of chemical risk assessment itself. In this regard, concepts used in environmental impact assessment—such as the superior, typical, and unique characteristics of ecosystems[59]—may provide useful points of reference for perspectives that reflect regional characteristics. At the same time, when considering the application of such concepts to chemicals management, careful examination is necessary in light of differences in the purposes of assessment and in institutional premises.

2.6 Operational Issues in Chemicals Management Systems

As shown in Figure 1 of Chapter 1, Japan's chemicals management systems are addressed through

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[58] Rattner, B. A., *et al.* (2024). Wildlife ecological risk assessment in the 21st century: Promising technologies to assess toxicological effects. *Integrated Environmental Assessment and Management*, 20(3), 725–748. https://onlinelibrary.wiley.com/doi/pdf/10.1002/ieam.4806

[59] Japan Environmental Assessment Association. (2017). *Technical Guide to Environmental Assessment: Biodiversity and Human Interaction with Nature* [in Japanese]. https://assess.env.go.jp/files/0_db/seika/0066_01/20170620_1.pdf

separate laws according to their respective purposes, and it has been pointed out that mechanisms remain insufficient for responding in a cross-cutting and integrated manner to chemical issues that span a wide range of fields. In the chemical control of invasive alien species discussed above as well, one obstacle is that current chemicals-related legislation in Japan does not directly cover the use of chemicals in the field for the control of wild organisms. Furthermore, addressing the issues described thus far requires the integration of knowledge from multiple domains, including biodiversity, ecosystem services, chemical monitoring, data analysis, and computational modeling, and there is also a challenge in training and sustainably securing expert personnel capable of such integration. In addition, it has been pointed out that Japan's national chemicals management systems do not sufficiently reflect on-the-ground realities and region-specific ecosystem conditions involving local governments, citizens, and businesses, thereby creating a gap between institutional systems and actual conservation activities.

3. Issues Related to Education, Awareness-Raising, and Partnerships Among Relevant Actors

Chemicals management that contributes to Nature-Positive outcomes requires the understanding and collaboration of diverse actors, including governments, businesses, research institutions, and local residents. However, there are challenges in education, awareness-raising, and partnership-building because perceptions of chemical risks differ among actors and because there is still limited shared understanding of what biodiversity conservation should look like in concrete terms.

3.1 Risk Communications

In chemicals management, not only risk assessment based on scientific knowledge, but also the way in which the results are shared with stakeholders such as local residents and how relationships of trust are built, are important factors that influence the acceptability and effectiveness of policies. For example, in the aerial application of rodenticides implemented as part of invasive species countermeasures in the Ogasawara Islands, local risk communication was undertaken in a manner attentive to the community, including by carefully identifying the anxieties and concerns of island residents and by conducting information-sharing and exchanges of views with public participation, drawing on past experience in which residents had felt uneasy about earlier initiatives[33]. This case shows that, in making decisions on and implementing the use of chemicals, it is important to build in not only the presentation of scientific knowledge but also processes of information-sharing and dialogue that take into account local living environments and concerns.

Moreover, in chemicals management aimed at biodiversity conservation, multiple interests are often intertwined, including pest control, invasive alien species measures, and stable food production. As a result, judgments must be made with due regard to both the risks and the benefits of chemical use[32].

For this reason, it is essential to enhance education and information provision and to build communication frameworks that allow risks and benefits to be appropriately compared and enable the joint examination of the best options under different circumstances.

There is a need for continuing processes in which governments, businesses, local residents, and other stakeholders engage in dialogue and build consensus toward the shared goal of minimizing the impacts of chemicals on biodiversity, while taking realistic constraints and social conditions into account.

3.2 Biodiversity Conservation Reflecting Regional Circumstances

Biodiversity has been shaped in each region by differing historical backgrounds, climates, topographies, and human activities, and the impacts of chemicals and ecological vulnerabilities likewise differ greatly depending on regional characteristics. As a result, uniform chemicals management across the country may not always be sufficiently effective, and approaches that take account of regional ecological characteristics, land use, and cultural values are important. In some regions, particular species or the use of natural resources may be emphasized from the standpoint of cultural value or regional revitalization, while the introduction of alien species (including domestic alien species) may also affect ecosystems. For this reason, rather than uniformly prioritizing either cultural value or biodiversity conservation, it is important to establish frameworks in which purposes, impacts, alternatives, and irreversibility are shared and choices are made through local consensus-building.

In addition, in biodiversity conservation, it may be difficult to quantitatively analyze and assess the values inherent in biodiversity, the factors causing its loss, and the outcomes of conservation efforts. As a result, it is not uncommon for local residents to lack a sufficiently shared understanding of concrete goals and priorities. In particular, if there is no common understanding of which species or ecosystems should be protected, or which chemical impacts matter most for a given region, it becomes difficult to advance conservation activities or chemicals management measures on the basis of local consensus.

For this reason, it is necessary to create forums for discussion that help specify the ecological value of a region and, after clarifying objects that can be shared locally—such as species and ecosystems to be protected and natural resources to be passed on—promote chemicals management and conservation measures accordingly[60]. In order to support conservation activities reflecting regional characteristics, it is also important to establish collaborative frameworks among governments, research institutions, businesses, and local residents so that regions themselves can proactively determine directions for conservation. Administrative plans such as local biodiversity strategies play an important role as frameworks for sharing local priorities and conservation objectives. By linking perspectives from

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[60] Kitamura, K., *et al.* (2018). Formation of a community of practice in the watershed scale, with integrated local environmental knowledge. *Sustainability*, 10(2), 404. https://www.mdpi.com/2071-1050/10/2/404

chemicals management—such as sources of exposure, ecosystems affected, and regionally endemic species—to such plans, it becomes easier to proceed with the selection of measures, monitoring, and the allocation of roles among relevant actors on the basis of local agreement. It has also been pointed out that the setting of regional conservation objectives should be based not only on current distribution data but also on a long-term perspective, including geology and historical materials—that is, a perspective of historical ecology.

4. Issues Concerning Biodiversity Impact Assessment Indicators for Chemicals

To realize chemicals management that contributes to Nature-Positive outcomes, it is essential to develop outcome indicators that make it possible to measure whether policies relating to chemicals have led to improvements in biodiversity. This requires the development not only of indicators relating to environmental concentrations and toxicity of chemicals, but also of indicators capable of capturing changes in biological communities and ecosystem functions.

At the international level, with regard to Target 7 (reduction of pollution) of the GBF, one example of an area in which consideration has advanced relatively far is the direction of using pesticide risk indicators such as "Pesticide environmental concentration" and/or "aggregated total applied toxicity (ATAT/TAT)," highlighting the need for indicators that integrate biodiversity conservation and chemicals management[61] [62]. Under the GFC, a "measurability structure" has been established to promote the development of indicator systems for assessing impacts of chemicals and waste on the environment and human health and for measuring progress, and consideration is under way regarding high-level indicators for tracking progress[63]. At the same time, for excessive nutrients (nitrogen and phosphorus), plastics, and similar pollutants, although their impacts on biodiversity are recognized internationally, the development of unified impact assessment indicators that directly capture changes in ecosystem status and recovery remains incomplete. Thus, the state of progress in indicator development varies considerably depending on the pollutants or stressors in question, and a major challenge for the future is to examine assessment indicators capable of appropriately capturing relationships with biodiversity in fields beyond pesticides.

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[61] UNEP. (2025). *Monitoring framework for the Kunming-Montreal Global Biodiversity Framework, Conference of the Parties to the Convention on Biological Diversity, Sixteenth meeting, second resumed session.* https://www.cbd.int/doc/c/1e13/f20d/81cd8447744640bbd21e008f/cop-16-l-26-rev1-en.pdf

[62] UNEP-WCMC. (2024). *Metadata Factsheet, 7.2 Aggregated Total Applied Toxicity (ATAT). Indicators for the Kunming-Montreal Global Biodiversity Framework.* https://www.gbf-indicators.org/metadata/headline/7-2

[63] UNEP. *Seventh meeting of the open-ended ad hoc group on measurability and indicators.* https://www.unep.org/events/conference/seventh-meeting-open-ended-ad-hoc-group-measurability-and-indicators

At the same time, it has also been pointed out that no single indicator can adequately represent the complexity of ecosystems, and that there is no all-purpose indicator capable of satisfying all needs. Moreover, because evaluation perspectives differ by region, there remain challenges such as establishing systems for selecting indicator organisms and indicator sets that reflect regional specificity in aquatic and terrestrial environments.

Chapter 3. Response Options and the Action Plan

In Chapter 2, this Action Plan reviewed cases in which environmental releases of chemicals and their impacts on ecosystems are of concern, as well as issues relating to existing assessment and management frameworks and their operation. In Chapter 3, based on existing policies and plans, the Action Plan organizes possible response options, clarifies the implementation framework and the roles of relevant actors, and sets out concrete actions together with directions for communicating outcomes to related domestic and international frameworks.

Impacts of chemicals on biodiversity and ecosystems are influenced not only by factors attributable to chemicals themselves, such as releases and exposure, but also by surrounding conditions that affect how such impacts appear, including environmental conditions and socio-economic activities.

In particular, it has been pointed out that chemical impacts may be modified by environmental changes such as climate change, changes in water temperature, changes in rainfall patterns, and the increasing frequency of extreme weather events. Such environmental changes may alter the environmental fate of chemicals (including transport and degradation) and the sensitivity and resilience of organisms, thereby influencing impacts on biodiversity and ecosystems. For this reason, future chemicals management may need to consider approaches to assessment and management that explicitly take such environmental variability into account, rather than relying solely on assessments under single sets of conditions.

In addition to such environmental conditions, socio-economic background factors—including structures of chemical production and consumption, supply chains, and patterns of consumer behavior—are also important as factors that contribute to impacts on biodiversity. IPBES distinguishes pressures that act directly on biodiversity as “direct drivers,” while the socio-economic and institutional background that gives rise to them is treated as “indirect drivers.” Chemical pollution can also be understood within such a structure of drivers.

The response options presented in this chapter are organized with these considerations in mind. Environmental change is positioned as a cross-cutting perspective, while, for the time being, priority is placed on addressing direct drivers such as releases and exposure through surveys and research, risk assessment, and institutional consideration. At the same time, indirect drivers such as structures of production and consumption involving chemicals are also positioned as issues for gradual consideration through voluntary efforts by businesses, information disclosure, and cooperation among relevant actors.

1. Response Options to Address the Issues

Based on the issues identified in Chapter 2, this section organizes possible response options—primarily those proposed by members of the Study Group—from six perspectives: “implementation and expansion of surveys, research and monitoring,” “advancement of risk assessment methodologies,” “review and revision of chemicals management systems,” “actions and strengthened collaboration by relevant actors,” “development and implementation of biodiversity impact assessment indicators,” and “input to international frameworks and domestic plans.” The “response options” presented in this chapter are intended to prospectively organize a range of possible directions and approaches that may be considered at the present stage and to broaden the range of choices available for future consideration and institutional design.

1.1 Implementation and Expansion of Surveys, Research, and Monitoring

This section sets out directions for implementing and expanding surveys, research, and monitoring aimed at understanding chemicals, organisms, and their impacts on ecosystems, based on the situation analysis presented in Chapter 2.

(1) Surveys and Research

It may be important to expand surveys and research on the environmental fate, toxicokinetics, and impact assessment of PFAS and other chemicals of concern, as well as microplastics and related substances. For example, in order to undertake risk assessment of microplastics (or MNPs), various challenges remain at each stage, including the need to understand exposure data such as the presence, concentration, and behavior of particles and associated chemicals, and to evaluate the reliability of hazard data for organisms. It may be expected that future surveys and research will help overcome such challenges and support the development of methods for assessing combined impacts.

At the National Institute for Environmental Studies (NIES), the “Comprehensive Environmental Risk Research Programme” is pursuing the development of comprehensive health and ecological risk indicators that take into account difficult-to-quantify toxic effects, vulnerability, the environmental fate of mixtures and degradation products, and the assessment of groups of similar substances[64]. By bridging such research outcomes to chemicals management systems and assessment frameworks relevant to Nature-Positive outcomes, it may become possible to move beyond simple risk assessment on a substance-by-substance basis toward approaches that take ecosystems as a whole and combined exposure into account.

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64 National Institute for Environmental Studies. *Comprehensive Environmental Risk Research Programme* [in Japanese]. https://www.nies.go.jp/risk_health/program2023/pg_pj5.html

It may also be important to develop the basis for organizing and visualizing differences in sensitivity among regional ecosystems and sensitivity characteristics of biological groups including endemic and rare species, in order to reflect perspectives of biodiversity and regional specificity in chemicals management. It may be possible to proceed step by step, using existing biological monitoring data, the Environmental Survey and Monitoring of Chemicals, and research outcomes from NIES and other institutions, to identify representative ecosystems and indicator organisms for different regions and to conduct surveys and research toward constructing sensitivity profiles for chemical exposure.

From the funding perspective, the Environmental Research and Technology Development Fund may be positioned as a competitive research funding scheme covering a broad range of themes, including environmental risk management and living in harmony with nature, and may serve to promote policy-relevant research through calls based on administrative needs[65]. In addition, the BRIDGE program, which works in coordination with the Cross-ministerial Strategic Innovation Promotion Program (SIP), supports research and development with an eye toward social implementation, including the building of circular plastic value chains and the development of indicators and disclosure schemes for the transition to a Nature-Positive economy[66][67]. There are also frameworks such as SATREPS (Science and Technology Research Partnership for Sustainable Development), jointly implemented by JST and JICA, which promote international collaborative research with developing countries on global-scale issues such as the environment, energy, disaster prevention, and infectious diseases[68].

Making effective use of such competitive funding and related mechanisms, and strengthening arrangements under which long-term, interdisciplinary surveys and research can be more readily evaluated and supported, may constitute an important response option for promoting Nature-Positive through chemicals management.

(2) Monitoring

As a foundation for chemicals management that contributes to Nature-Positive outcomes, it may be important to establish a national scheme that strategically links biological monitoring and chemical monitoring. In Japan, the Environmental Survey and Monitoring of Chemicals (the so-called Kurohon survey) has been conducted continuously since FY1974 to understand the residual status of chemicals

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[65] Environmental Restoration and Conservation Agency. *Environmental Research and Technology Development Fund* [in Japanese]. https://www.erca.go.jp/suishinhi/

[66] Cabinet Office. *Cross-ministerial Strategic Innovation Promotion Program (SIP)* [in Japanese]. https://www8.cao.go.jp/cstp/gaiyo/sip/sipgaiyou.pdf

[67] Cabinet Office. *Program for Bridging the Gap between R&D and Society 5.0 (BRIDGE)* [in Japanese]. https://www8.cao.go.jp/cstp/bridge/index.html

[68] Japan Science and Technology Agency. *Science and Technology Research Partnership for Sustainable Development (SATREPS)* [in Japanese]. https://www.jst.go.jp/global/about/about.html

in the general environment, and the results have been compiled in the annual report Chemicals in the Environment[69]. By integrating such chemical monitoring frameworks with information on long-term changes in biota and on sensitive indicator species obtained through Monitoring Sites 1000, it may become possible to understand, at higher resolution, the relationships between chemical burdens and the status of biodiversity.

For the advancement of monitoring, the use of indicators based on effects—such as biomarker measurements in wildlife, bioassays[70], and effect-directed analysis (EDA)[71]—may be considered. Non-invasive sampling methods that do not require culling, such as the collection of feathers, feces, or tissue fragments, may make it possible to track ecosystem-level burden trends continuously while reducing stress on rare species.

In addition, technologies using environmental DNA (eDNA) and environmental RNA are rapidly developing as means of comprehensively identifying the biological communities inhabiting or using environmental media such as water, soil, and air. In Japan, fish fauna surveys using eDNA are already being applied in practice, and linking such data with chemical concentration data may help build the basis for analyzing which chemical compositions are associated with which kinds of community change.

With regard to plastics, although the existing data concern particles rather than chemicals per se, the Ministry of the Environment has taken the lead in preparing and publishing the Harmonized Monitoring Guidelines for Floating Marine Microplastics, including a revised version covering surveys using small vessels, with the aim of promoting internationally comparable data and monitoring frameworks across countries, including in Southeast Asia. At present, because net-based collection remains the principal method, methods and data collection for nano-sized particles remain underdeveloped. Looking ahead, it may also become possible to analyze relationships between such particle data on microplastics and associated adsorbed or additive chemicals (for the use of such data, see also (1) Surveys and Research).

Connections with international data-sharing arrangements may also be important. Under the Stockholm Convention, the Global Monitoring Plan (GMP) for persistent organic pollutants (POPs) has been implemented in order to understand regional changes in POP concentrations and analyze

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[69] Ministry of the Environment, Japan. *Residual Status of Chemicals in the Environment* [in Japanese]. https://www.env.go.jp/chemi/kurohon.html

[70] Ministry of the Environment, Japan. *On the Use of Effluent Management Methods Utilizing Biological Responses* [in Japanese]. https://www.env.go.jp/content/900524715.pdf

[71] Brack, W., et al. (2016). Effect-directed analysis supporting monitoring of aquatic environments—an in-depth overview. *Science of the Total Environment*, 544, 1073–1118. https://www.sciencedirect.com/science/article/abs/pii/S0048969715310834

transport pathways[72]. In addition, under frameworks such as those of the OECD and UNECE, international data centers that compile PRTR data from different countries and case collections on the use of PRTR data have been developed, presenting tools for linking information on chemical releases to environmental and ecological indicators[73].

In coordination with such domestic and international frameworks, and with stable budgetary support for monitoring, the construction of long-term observation networks that can integrate chemical concentrations, biological responses, and biodiversity indicators may serve as important infrastructure for Nature-Positive outcomes. It may also be useful to consider how long-term monitoring results can be utilized and organized in order to understand changes in the behavior of chemicals and biological responses under climate change and extreme weather conditions.

1.2 Advancement of Risk Assessment Methodologies

Current risk assessment of chemicals has been designed and operated in accordance with the purposes and applications of individual regulatory systems and on the basis of international agreement and scientific knowledge. Against that background, this section organizes possible directions for the advancement and supplementation of assessment, as well as new perspectives that have begun to be considered on a trial basis, while taking into account issues that have recently been pointed out and new scientific knowledge. It is not intended to call for an immediate revision of the overall current framework.

To realize Nature-Positive outcomes, more comprehensive risk assessment is required that, while grounded in toxicity assessment of individual chemicals, also takes into account the health of ecosystems as a whole and impacts on biodiversity. In doing so, it may be important, before creating an entirely new risk assessment system, to advance those efforts that can improve or enhance the current framework. Specifically, it may be effective to gradually incorporate into existing risk assessment such perspectives as Weight of Evidence (WoE), which integrates multiple test results and lines of knowledge, and approaches to combined effects assessment that take simultaneous exposure to multiple chemicals into account.

The Ministry of the Environment's Initial Environmental Risk Assessment of Chemicals has served a useful role as a screening exercise that provides an overview of a wide range of substances. At the same time, in order to connect assessment results to specific regulatory systems and measures, it may be necessary to clarify the process for moving to the next stage of detailed assessment and management

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[72] Secretariat of the Stockholm Convention. *Stockholm Convention on Persistent Organic Pollutants (POPs): Global Monitoring Plan.* https://chm.pops.int/Implementation/GlobalMonitoringPlan/Overview/tabid/83/Default.aspx

[73] OECD. *Monitoring and Preventing Industrial Pollution.* https://www.oecd.org/en/topics/monitoring-and-preventing-industrial-pollution.html

measures[74]. Assessment on a single-substance/single-species basis remains important as a foundation, but from the perspective of Nature-Positive outcomes, it may be desirable to complement such assessment with information at the community and ecosystem levels in order to take combined exposure and impacts on ecosystem functions into account. In addition, in considering assessment methodologies, it may be desirable to incorporate perspectives that take account of the modifying effects of changes in environmental conditions—such as those driven by climate change—on exposure levels and the manifestation of impacts. Organizing how assessment can be advanced or supplemented while reflecting these issues may therefore be important.

(1) Assessment Taking Account of the Life Cycle of Chemicals

Current risk assessment tends to focus on particular environmental media (water, soil, air) or releases at the use stage. From the perspective of Nature-Positive outcomes, however, it may also be useful to adopt a broader view across the full life cycle of chemicals—from raw material procurement, manufacturing, and distribution to use, disposal, and recycling—in order to organize how environmental burdens appear as supplementary information complementing existing assessment results. By making use of PRTR data and environmental concentration data, and by applying life-cycle perspectives not as a substitute for current risk assessment but as an auxiliary means of identifying substances and release stages that should be examined as priorities, it may become possible to support consideration of measures contributing to Nature-Positive outcomes.

(2) Exploring the Applicability of Ecosystem-Level Risk Assessment Approaches

I. Simulated ecosystem tests using mesocosms and related approaches

Microcosm and mesocosm tests are being examined as research-oriented approaches for understanding the impacts of chemicals under conditions closer to real-world ecosystems by using ecosystem models composed of multiple species. While such simulated ecosystem tests can evaluate impacts of chemicals under near-natural conditions, issues have been identified concerning test-system design, endpoint selection, costs, and related matters[75], and they cannot immediately be applied to current risk assessment in practice. For this reason, rather than assuming their direct introduction into regulatory practice, it may be important to organize their applicability and limitations as information complementing understanding of chemical impacts on ecosystems.

II. Assessment using community models and ecosystem function indicators

Species community models and network models may be positioned as conceptual and research-oriented approaches for exploratory examination of possible changes in community structure and

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[74] Ministry of the Environment, Japan. *Initial Environmental Risk Assessment of Chemicals* [in Japanese]. https://www.env.go.jp/chemi/risk/index.html

[75] Goka, K., and Hayasaka, D. (2013). *Can Ecological Risk Assessment of Pesticides Protect Biodiversity? Through Mesocosm Testing as a Higher-tier Risk Assessment Method* [in Japanese]. *Japanese Journal of Environmental Toxicology*, 16(2), 21–28. https://www.jstage.jst.go.jp/article/jset/16/2/16_21/_pdf

declines in function (including primary production, decomposition, and nutrient cycling) resulting from chemical exposure by mathematically reproducing interspecies interactions and food-web structures in ecosystems. While such methods can provide useful insights into the propagation of chemical impacts that are difficult to capture at the single-species level, their predictive results remain highly dependent on assumptions and are subject to considerable uncertainty, so careful consideration would be required before applying them to risk assessment.

III. Statistical assessment of multi-species impacts using species sensitivity distributions (SSD)

SSD is a method for integrating information on the sensitivities of multiple species, but only when a sufficient amount of toxicity data has been accumulated for a large number of organisms. SSD does not directly express community structure or ecosystem functions themselves, and formalistic application without evaluating data quality and representativeness may not lead to appropriate risk judgments. While it can serve as a useful method for understanding the overall picture of ecological risk from chemicals and the associated uncertainty by integrating sensitivity information for multiple species[76], it may be important to consider its possible use as a means of complementing existing risk assessment results only after clearly identifying the substances and assumptions for which it is applicable.

(3) Use of *in silico* Prediction Methods

The *in silico* prediction methods discussed here are not intended to replace existing ecological effect tests or risk assessment, but rather to serve as auxiliary methods for screening and prioritizing large numbers of chemicals. As the number and uses of chemicals continue to increase, it is not realistic to test all substances and all combinations. Against this background, incorporating *in silico* prediction methods, including QSAR models, into risk assessment may constitute an important option. QSAR is a general term for prediction methods based on relationships between chemical structure and hazardous properties, and rule-based and statistical models have traditionally been used.

In recent years, in addition to such conventional QSAR approaches, *in silico* prediction methods using AI and machine learning have been developed and examined as part of NAMs and are attracting attention as efficient means of screening large numbers of substances[77]. When machine-learning models are used for regulatory purposes, it may be important to ensure the "transparency" and "explainability" required for regulatory decision-making, including through the visualization of confidence intervals and contributing factors in prediction results. The OECD has developed the

[76] Posthuma, L., et al. (2019). Species sensitivity distributions for use in environmental protection, assessment, and management of aquatic ecosystems for 12,386 chemicals. *Environmental Toxicology and Chemistry*, 38(4), 905–917. https://academic.oup.com/etc/article/38/4/905/7737100?login=false

[77] ECETOC. (2025). *Integrating AI into Chemical Safety Assessment – Flash Report*. https://www.ecetoc.org/wp-content/uploads/2024/03/ECETOC-Flash-Report-Integrating-AI-into-chemical-safety-assessment.pdf

(Q)SAR Assessment Framework, which provides common principles and checklists for the regulatory use of QSAR models, and is also promoting integrated approaches to testing and assessment (IATA/Defined Approach) that combine *in vitro*, *in chemico*, and *in silico* prediction methods[78]. It may therefore be desirable for Japan to continue participating actively in such international discussions.

(4) Initial Environmental Risk Assessment and New Assessment Approaches

The Ministry of the Environment's Initial Environmental Risk Assessment of Chemicals has played a certain role as a screening initiative for extracting relatively high-risk substances from among the vast number of chemicals[74]. At the same time, it has also been pointed out that the assessment is likely to depend on available exposure and hazard data and on administrative needs, and that there are limits to its ability to capture ecological impacts in detail. This Action Plan is not intended to immediately expand or replace the framework of initial environmental risk assessment. Rather, while taking into account the relationship with the complementary approaches and existing efforts organized under (2), it may be useful to review its positioning and future use, including practical feasibility and scope of application.

I. Assessment of chemical impacts using environmental DNA (eDNA) and environmental RNA (eRNA)

eDNA has developed as a method for understanding biological community composition and the presence of alien species by analyzing DNA derived from organisms present in water and other environments, and its possible use in monitoring ecosystem impacts of chemicals has been suggested. While it may be useful as a means of complementing existing biological monitoring, the accumulation of experimental and verification data is still required in order to directly link chemical exposure with biological responses. In this regard, eRNA, which may capture biological "responses" such as gene expression, may constitute a promising option from the standpoint of assessing chemical impacts. A recent study by a Japanese company reported that the use of eRNA made it possible to identify the species actually inhabiting a given site with high precision and to conduct ecological surveys with fewer false detections[79]. By incorporating such technologies into initial environmental risk assessment and follow-up surveys, it may become possible to detect changes in biological communities caused by chemical exposure at an early stage and connect them to adaptive management contributing to Nature-Positive outcomes. In applying such approaches, however, quality control would be essential, including with respect to natural variability (such as seasons and hydrological conditions),

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[78] OECD. (2023). *Report on Considerations from Case Studies on Integrated Approaches for Testing and Assessment (IATA)—Eighth Review Cycle (2022).* https://one.oecd.org/document/ENV/CBC/MONO(2023)31/en/pdf

[79] Miyata, K., et al. (2021). Fish environmental RNA enables precise ecological surveys with high positive predictivity. *Ecological Indicators*, 128, 107796. https://www.sciencedirect.com/science/article/pii/S1470160X21004611

measurement uncertainty, control settings, and the standardization of sample preservation and analytical procedures.

II. Introduction of NAMs

By making use of NAMs[80] consisting of *in vitro* tests, *in silico* prediction methods, omics analysis, and related approaches, the concept of Next-Generation Risk Assessment (NGRA) has been developing internationally as a means of reducing and replacing animal testing while enabling the rapid assessment of hazards and risks for larger numbers of chemicals. Case studies on NGRA[81] and guidance for QSAR assessment[82] are under discussion, and in Japan as well it may be possible to improve the efficiency of risk assessment and prioritization contributing to Nature-Positive outcomes by incorporating the results of NAMs into initial environmental risk assessment.

1.3 Review and Revision of Chemicals Management Systems

In reviewing chemicals management systems in ways that may contribute to Nature-Positive outcomes, consideration may be needed from such perspectives as the setting of conservation objectives, the identification and elimination of gaps in system design from a full life-cycle perspective, and the promotion of voluntary efforts by businesses.

From the perspective of conservation objectives, it may be possible to set domestic conservation goals that more explicitly foreground biodiversity and regional specificity, taking into account such benchmarks as the realization of "Nature-Positive by 2030" under the NBSAP of Japan 2023-2030 and GBF Target 7, which aims to reduce risks from chemicals.

From an institutional standpoint, given that laws such as the Chemical Substances Control Law, the Agricultural Chemicals Regulation Act, the Act on Pharmaceuticals and Medical Devices, and the Invasive Alien Species Act are operated separately by sector, it may be important to establish cross-ministerial assessment and coordination mechanisms that make it possible to connect assessment and management across the full life cycle of chemicals with ecosystem indicators. It may also be useful,

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[80] In this Action Plan, NAMs are used as a concept that includes not only alternatives to animal testing, but also mechanism-based estimation and high-throughput screening. For application to ecological impact assessment, it is necessary to clarify the relationship with existing ecotoxicity testing systems and to define the scope of assessment to which NAMs can be applied.

[81] Pallocca, G., et al. (2022). Next-generation risk assessment of chemicals—rolling out a human-centric testing strategy to drive 3R implementation: the RISK-HUNT3R project perspective. https://www.altex.org/index.php/altex/article/view/2461/version/2523

[82] OECD. (2024). *(Q)SAR Assessment Framework: Guidance for the Regulatory Assessment of (Quantitative) Structure Activity Relationship Models and Predictions, Second Edition.* https://www.oecd.org/en/publications/q-sar-assessment-framework-guidance-for-the-regulatory-assessment-of-quantitative-structure-activity-relationship-models-and-predictions-second-edition_bbdac345-en.html

in the course of revising individual legal systems, to add items for consideration from the perspective of promoting Nature-Positive outcomes. In addition, there may be value in considering policies that contribute to Nature-Positive outcomes from perspectives differing from conventional ones—for example, by combining contamination countermeasures with natural regeneration measures such as the greening and ecological restoration of contaminated soils[83].

Furthermore, in chemicals management, a balanced policy mix combining regulation and voluntary business management may be effective. From the perspective of encouraging voluntary management by businesses, it may also be important to incorporate into systems the concept of Safe and Sustainable by Design[84], which seeks to minimize environmental impacts by taking sustainability into account from the design stage of chemicals. In light of progress in nature-related financial disclosure under the Taskforce on Nature-related Financial Disclosures (TNFD)[85], it may also be necessary to develop frameworks for disclosing chemicals-management-related information that contributes to Nature-Positive outcomes in a manner aligned with international discussions. Such frameworks may serve as important elements in encouraging voluntary management by making it possible for investors and financial institutions to evaluate voluntary efforts by businesses and channel finance toward chemicals management initiatives that contribute to Nature-Positive outcomes.

These frameworks for nature-related disclosure and evaluation may also provide opportunities to reposition chemicals management not merely as a matter of institutional compliance, but as part of business strategy and supply-chain management. For example, by organizing information on the evaluation results of individual substances, actual patterns of use, and releases and transfers under existing chemicals management systems from a life-cycle perspective, it may become possible to make visible the ways in which business activities affect biodiversity. By sharing such information internally and externally through frameworks such as TNFD, businesses may be better able to advance individual management efforts—such as risk reduction and the consideration of alternatives—in a more strategic and proactive manner.

1.4 Actions and Strengthened Collaboration by Relevant Actors

(1) Education, Awareness-Raising, and Collaborative Actions Involving Local Residents and Citizens

To realize chemicals management that contributes to Nature-Positive outcomes, not only scientific

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[83] Mastervich, B., et al. (2024). Enhancing multiple benefits of brownfield cleanups by applying ecosystem services concepts. *Frontiers in Ecology and Evolution,* 12, 1286150. https://www.frontiersin.org/journals/ecology-and-evolution/articles/10.3389/fevo.2024.1286150/full

[84] European Commission, Joint Research Centre. (2025). *Safe and Sustainable by Design Chemicals and Materials – Framework for the Definition of Criteria and Evaluation Procedure for Chemicals and Materials.* https://publications.jrc.ec.europa.eu/repository/handle/JRC128591

[85] Ministry of the Environment, Japan. *Overview of the Taskforce on Nature-related Financial Disclosures (TNFD)* [in Japanese]. https://www.env.go.jp/press/press_03929.html

knowledge and policy measures but also collaboration with local residents and citizens, as well as the fostering of understanding, may be indispensable. It may therefore be desirable to create opportunities for citizen participation in policy-making processes and for consensus-building that takes local circumstances into account.

The Ministry of the Environment operates a "Chemicals Advisors" scheme, under which personnel possessing specialist knowledge and communication skills are registered and dispatched in order to answer questions about chemicals and provide information and advice from a neutral standpoint[86]. In addition, the Global Environmental Outreach Centre (GEOC), jointly operated with the United Nations University, and eight regional Environmental Partnership Offices (EPOs) function as hubs supporting environmental partnerships among NPOs, local governments, businesses, citizens, and other actors[87].

In coordination with such existing frameworks, it may be useful to promote the following types of action in a systematic manner.

- **Promotion of citizen science:** encouraging resident-led chemical monitoring, such as water sampling and simple analyses, as well as biological monitoring, in order to accumulate scientific data that may support local ecosystem conservation.
- **Collaborative risk communication:** in cases where chemicals management and biodiversity conservation become visible in different ways—such as the use of chemicals in invasive species control (for example, rodent eradication in the Ogasawara Islands), where appropriate chemical use may directly contribute to biodiversity conservation, or reduced pesticide use for the conservation of rare species (for example, crested ibis and Oriental stork)—sharing impacts and options among relevant actors, deepening understanding not only of short-term burdens but also of medium- to long-term benefits and synergies, and fostering consensus-building.
- **Building a knowledge base (education and awareness-raising):** providing scientific and policy information in accessible ways so that local residents and citizens may be better able to make informed judgments and take action on their own initiative.

Through such efforts, it may become possible to position "chemicals management that contributes to Nature-Positive outcomes" not simply as "prohibition and regulation," but rather as a process of choice and dialogue for protecting and making use of local nature.

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86 Ministry of the Environment, Japan. *Introduction to Chemicals Advisors* [in Japanese]. https://www.env.go.jp/chemi/communication/taiwa/haikei/adviser.html

87 Ministry of the Environment, Japan. *Environmental Partnership* [in Japanese]. https://www.env.go.jp/policy/post_156.html

(2) Human Resource Development and Strengthening of the Knowledge Base

In order to promote chemicals management and biodiversity conservation in ways that are effective in practice, it may be indispensable to develop human resources equipped with cross-cutting knowledge and practical capabilities. Internationally as well, it has been pointed out that, in the fields of chemicals management and biodiversity conservation, what is required is not only specialist knowledge within individual disciplines but also personnel who can understand, in an integrated manner, the life cycle of chemicals, socio-economic activities, and impacts on ecosystems and bridge scientific knowledge to policy and practice. For example, the IPBES Global Assessment Report highlighted the close relationship between biodiversity and ecosystem services, on the one hand, and human well-being and socio-economic activities on the other, and underscored the importance of the science–policy interface in providing scientific knowledge on biodiversity and ecosystem services in forms useful for policymaking[88]. IPBES also positions capacity-building as one of its core functions and works to strengthen the capacities of individuals and institutions[89]. The GFC likewise recognizes capacity-building and knowledge-sharing as elements that support implementation[54].

Within Japan, efforts related to human resource development are already underway in government, industry, and academia. In the governmental field, the Ministry of the Environment operates the "Chemicals Advisors" scheme as a mechanism for developing and mobilizing personnel who possess specialist knowledge relating to chemicals and skills in risk communication[86]. In industry, the Japan Chemical Industry Association and others have been engaged in personnel development and information sharing relating to chemicals management and environmental and safety issues[90]. In the academic field, information sharing is also advancing in areas of regulatory science—for example, through continuing symposiums such as those organized by the Special Committee on Pesticide Regulatory Science of the Pesticide Science Society of Japan, which shares specialist knowledge on pesticide risk assessment and management[91].

Building on such existing efforts, it may become important in the future to foster and secure human resources who can understand related fields—including ecology, toxicology, environmental chemistry, pesticide science, and risk communication—in a cross-cutting manner and who can connect governments, businesses, research institutions, and local communities. To that end, it may be desirable

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[88] IPBES. (2019). *Global Assessment Report on Biodiversity and Ecosystem Services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services.* https://www.ipbes.net/global-assessment

[89] IPBES. *Capacity-Building Mandate*. https://www.ipbes.net/capacity-building-mandate

[90] Japan Chemical Industry Association. *Human Resource Development: JCIA Initiatives* [in Japanese]. https://www.nikkakyo.org/jinzai

[91] Pesticide Science Society of Japan. *Pesticide Regulatory Science Study Group* [in Japanese]. https://www.pssj2.jp/committee/regulatory.html

not only to continue human resource development within individual fields, but also to strengthen mechanisms that promote cooperation and mutual understanding across disciplines and thereby support the formation of a knowledge base capable of sustaining chemicals management that contributes to Nature-Positive outcomes over the medium to long term.

(3) Voluntary Efforts and Partnerships by Businesses

As a foundation for voluntary efforts by businesses, the chemical industry has, since the 1980s, developed the Responsible Care initiative internationally. This is a framework under which the industry voluntarily advances consideration for safety, health, and the environment throughout the full life cycle of products, going beyond legal compliance, and places emphasis on the advancement of chemicals management, information disclosure, and dialogue with local communities[92]. Such long-standing efforts may provide an important basis for promoting chemicals management that contributes to Nature-Positive outcomes.

Building on this foundation, various mechanisms may also be utilized to make visible consideration for natural capital and biodiversity, including certification schemes in resource procurement—such as forest certification[93], MSC/ASC[94], and RSPO[95]—and environmental labels for consumers[96]. This may also respond to the indirect impacts discussed in Chapter 2, Section 1.2. In addition, as noted above, advancing investor-oriented disclosure such as that promoted by TNFD may create opportunities for voluntary environmental efforts to be linked to enhanced corporate value.

For business operators in the agricultural sector, the implementation of Integrated Pest Management (IPM) may also be important as an approach that suppresses the occurrence and increase of pests and weeds while combining available control methods appropriately so as to reconcile stable agricultural production with reduced environmental burden. IPM is an approach that comprehensively considers available measures—including cultural, physical, biological, and chemical control—and applies appropriate measures while taking economic considerations into account. Through proper pesticide use and reduced disturbance in agroecosystems, it may also help reduce burdens on surrounding ecosystems.

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[92] Japan Chemical Industry Association. *Do You Know Responsible Care?* [in Japanese]. https://www.nikkakyo.org/sites/default/files/2024-01/1130_RC%E3%82%92%E7%9F%A5%E3%81%A3%E3%81%A6%E3%81%84%E3%81%BE%E3%81%99%E3%81%8B%EF%BC%9F.pdf

[93] Forestry Agency. *Forest Certification* [in Japanese]. https://www.rinya.maff.go.jp/j/keikaku/ninshou/index.html

[94] Fisheries Agency. *Promotion of Fisheries Ecolabels* [in Japanese]. https://www.jfa.maff.go.jp/j/kikaku/budget/suishin.html

[95] Roundtable on Sustainable Palm Oil (RSPO) [in Japanese]. https://rspo.org/ja/

[96] Ministry of the Environment, Japan. *Environmental Labels Database* [in Japanese]. https://www.env.go.jp/policy/hozen/green/ecolabel/index.html

It may also be effective for businesses seeking to continue regionally rooted operations to pursue collaborative initiatives with local residents and citizens relating to chemicals management that contributes to Nature-Positive outcomes. In the course of preparing this Action Plan, several leading examples were identified through surveys and interviews with businesses. Organizing and communicating such examples and encouraging benchmarking and mutual learning among businesses and local governments may also be important.

1.5 Development and Implementation of Biodiversity Impact Assessment Indicators

Within environmental administration, the development and use of environmental indicators that quantitatively express the condition of the environment and ecosystems has been considered since the 1970s for the purposes of policy-making and environmental management[97]. As part of such efforts, indicators relating to biodiversity have also been organized and examined domestically and internationally as information for quantitatively understanding the condition of the environment and ecosystems and for evaluating policy progress and challenges. In the *Japan Biodiversity Outlook 4 (JBO4)*, indicators corresponding to the state-oriented targets in the NBSAP have been compiled on the basis of publicly available information and other data, and indicator sets for use in assessment have been organized after evaluating their appropriateness and availability[98].

At the same time, the GBF includes Target 7 as a target for reducing pollution risk, and under that target, a headline indicator (Target 7.2) has been positioned to track progress in reducing biodiversity risks from pesticides. For Target 7.2, indicators representing pesticide environmental concentrations and pesticide toxicity loads are being considered, and international discussions are underway regarding their detailed calculation methods and modes of operation.

In this way, indicators for understanding impacts on biodiversity and ecosystems are being organized and considered under different frameworks depending on their purpose and scope of application. In considering indicators under this Action Plan as well, it may be important to position indicators as one source of information for assessment and situational understanding and to use them in conjunction with other information and expert knowledge, while taking account of existing frameworks and the status of relevant discussions.

Domestically, the NBSAP of Japan 2023-2030[3], which sets out Nature-Positive by 2030, identifies pollution (including chemicals) as one of the drivers of biodiversity loss and establishes indicators and

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[97] Naito, et al. (1984). *A Study on the Development of Environmental Indicators Concerning the Natural Environment in Urban Areas and Their Surroundings: Environmental Indicators—Concepts and Methods of Preparation* [in Japanese]. https://www.nies.go.jp/kanko/kenkyu/pdf/972074-1.pdf

[98] Ministry of the Environment, Japan. (2025). *Annex to the Interim Recommendations toward the Comprehensive Assessment of Biodiversity and Ecosystem Services 2028 (JBO4)* [in Japanese]. https://www.env.go.jp/content/000348017.pdf

target values for a number of concrete measures (Table 1). Under the GFC, development is underway on "global environmental burden caused by chemicals and waste" as one of the high-level indicators for measuring progress in international efforts toward the sound management of chemicals and waste, and Japan is participating in that development work. In developing indicators, it has been recognized that it is difficult for a single indicator to comprehensively capture all impacts, and one of the key challenges is how existing indicators should be used depending on purposes and targets. Existing global indicators with differing purposes and scopes, such as the Stockholm Convention's Global Monitoring Plan for POPs[72] and international PRTR data compiled by the OECD[73], are already in place and in use.

At the regional level as well, there may be considerable value in turning resident-led monitoring into indicators as part of Nature-Positive practice. For example, citizen-participatory water sampling and biological surveys may be positioned as local indicators that make visible the improvement brought about by chemicals management, thereby helping people experience that "our own actions are contributing to the recovery of local nature."

Table 1. Examples of Chemicals-Management-Related Indicators Included in the National Biodiversity Strategy and Action Plan of Japan 2023–2030

Specific Measure	Indicator	Baseline Value	Target
1-3-1 Prevention of Lead Poisoning in Birds Caused by Lead Ammunition	Number of confirmed cases of lead poisoning in birds (raptors) caused by lead ammunition	5 cases (FY2021)	0 cases (2030)
1-3-2 Initial Environmental Risk Assessment of Chemicals	Number of substances subject to initial environmental risk assessment from the perspective of ecological impacts	12 substances (FY2022)	Approx. 12 substances per year
1-3-4 Operation of the Pollutant Release and Transfer Register (PRTR) System and Data Utilization Project	Number of views of the "PRTR Map-Based Display System"	16,548 views per fiscal year (FY2021)	19,051 views per fiscal year (FY2024)
1-3-5 Examination of Endocrine-Disrupting Effects of Chemicals	Number of substances for which evaluation is initiated	Approx. 10 substances per year	Approx. 10 substances per year

1.6 Input to International Frameworks and Domestic Plans

It may be important to appropriately reflect Japan's efforts and scientific knowledge in chemicals management, as well as the realities of biodiversity conservation on the ground, in international frameworks and domestic plans and strategies. Internationally, numerous processes are underway, including the CBD[10], the GBF[3], the new science-policy panel for chemicals and waste, ISP-CWP[16], the GFC[14], which addresses life-cycle management of chemicals and waste, the monitoring and effectiveness evaluation frameworks under the POPs and Minamata Conventions[72][99], and global assessment reports issued by IPBES[5]. In such fora, there may be value in sharing the outcomes of the present initiative while also taking the results of international discussions and indicators developed in those contexts back into domestic systems—in other words, establishing "two-way feedback."

Domestically, related plans and strategies include the Basic Environment Plan[100], the Strategy for the Promotion of Environmental Research and Environmental Technology Development[101], the NBSAP[3], and the medium- to long-term plan of the National Institute for Environmental Studies[102]. By appropriately reflecting the outcomes of the present initiative in the revision and follow-up of such plans and strategies, it may become possible to establish a cycle in which policies are adaptively updated from the perspective of chemicals management that contributes to Nature-Positive outcomes.

2. Implementation Framework

2.1 Institutional Arrangements

The implementation of this Action Plan may require cooperation among a wide range of actors involved in chemicals management, including: (i) the national government; (ii) local governments; (iii) academic and research institutions such as universities; (iv) businesses; (v) NGOs/NPOs; and (vi) the general public. The National Plan of Action for the Implementation of the GFC has already organized the roles of these actors[27], and this Action Plan follows that basic structure in Section 2.2 below. A forum in which such diverse actors can come together already exists in the Policy Dialogue on Chemicals and the Environment regularly convened by the Ministry of the Environment. At the 21st Policy Dialogue, held in February 2025[103], chemicals management contributing to Nature-Positive outcomes was already discussed. It may therefore be expected that future discussions on implementation of this Action Plan will continue to be deepened through that forum.

2.2 Roles of Relevant Actors

I. Roles to be Played by the National Government

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[99] UNEP. *Promoting the Minamata Convention on Mercury*. https://www.unep.org/topics/chemicals-and-pollution-action/chemicals-management/pollution-and-health/heavy-metals

[100] Ministry of the Environment, Japan. The Sixth Basic Environment Plan. https://www.env.go.jp/en/policy/

[101] Ministry of the Environment, Japan. *Promotion of Environmental Research and Environmental Technology Development* [in Japanese]. https://www.env.go.jp/policy/tech/kaihatsu.html

[102] National Institute for Environmental Studies. *Medium- to Long-term Objectives and Medium- to Long-term Plan* [in Japanese]. https://www.nies.go.jp/kihon/chukikeikaku/

[103] Ministry of the Environment, Japan. *The 21st Policy Dialogue on Chemicals and the Environment* [in Japanese]. https://www.env.go.jp/chemi/communication/seisakutaiwa/siryou/21.html

The national government may be expected to provide the foundation—including, where appropriate, financial support—for efforts by diverse sectors and actors through such means as the development of indicators and assessment frameworks, the maintenance of legal and institutional systems, dissemination and awareness-raising, education, dialogue, and responses to identified issues, in order to advance the sound management of chemicals as envisaged by this Action Plan.

II. Roles Expected by Local Governments

Local governments may be expected to play important roles not only in the steady enforcement of laws and ordinances in accordance with local conditions, but also in further encouraging management of chemicals throughout their life cycles by businesses, including small and medium-sized enterprises, and in promoting risk communication at the regional level.

III. Roles Expected by Universities and Other Academic/Research Institutions

Universities and other academic and research institutions may be expected to support policy-making and concrete action by relevant actors by strengthening academic and specialized knowledge on chemicals management and by providing objective and reliable scientific information in accessible forms.

IV. Roles Expected by Businesses

The term "businesses" includes not only manufacturers and importers of chemicals but also downstream users and sellers (including chemical and product manufacturers, producers in agriculture and forestry, and distribution actors involved in the sale and guidance of pesticides, such as agricultural cooperatives). In addition to complying with relevant laws and regulations in the course of development, manufacture, import, sale, use, disposal, and recycling, businesses may be expected to undertake voluntary evaluation and management of chemicals, provide information, and engage in dialogue with local residents. In particular, businesses may be expected to take proactive steps so that hazard and risk information on chemicals and products, as well as information necessary for their safe use, is appropriately communicated to and accessible by relevant actors, including consumers.

V. Roles Expected by NGOs/NPOs

NGOs and NPOs may be expected not only to provide objective and accurate information and advice in accessible ways on chemicals to relevant actors, but also to act as connectors among the general public, businesses, the national government, local governments, and others.

VI. Roles Expected by the Public

Members of the public may be expected to make efforts to access and understand accurate information on chemical risks provided by relevant actors through such media as labeling, and, as users, to translate that understanding into actions that avoid risks arising from chemicals used in daily life, including selecting products with lower impacts on biodiversity, ecosystems, and the environment, and ensuring appropriate waste management.

3. Action Plan

3.1 Action Plan

Based on the response options organized in Section 1, the policy directions for efforts toward 2030 to promote Nature-Positive outcomes through chemicals management are presented below as the Action Plan. This Action Plan is not intended to be an operational plan that clearly specifies who will do what by when. Rather, it organizes policy directions corresponding to the response options and, as stated in Section 4.2 below, may be further specified and elaborated as necessary in light of future consideration and developments.

(1) Implementation and expansion of monitoring, surveys, and research

The government may promote surveys and research on the status of biological habitats, the occurrence of chemicals, monitoring based on impacts on organisms, methodologies for evaluating impacts and risks, assessment indicators, and risk communication, making use of national survey and research projects and related initiatives.

(2) Advancement of risk assessment methodologies

Consideration of the advancement of risk assessment methodologies—including taking account of the life cycle of chemicals and the assessment of risks to biodiversity and ecosystems—may be promoted.

(3) Review and revision of chemicals management systems

While taking account of the efforts described above, the review and revision of existing chemicals management systems may incorporate the perspective of Nature-Positive outcomes. Systems and mechanisms that encourage voluntary efforts by businesses may also be strengthened.

(4) Actions and strengthened collaboration by relevant actors

Voluntary efforts by businesses and initiatives in local communities may be encouraged, while good practices are identified and shared. Support for collaboration among local actors (including citizens, local governments, NPOs/NGOs, and businesses) may also be strengthened, making use of existing systems and organizations where appropriate.

(5) Development and implementation of biodiversity impact assessment indicators

While contributing to the development of international assessment indicators, the development of biodiversity impact assessment indicators may be promoted, taking account of their use for encouraging action and evaluating outcomes.

(6) Input to international frameworks and domestic plans

The outcomes of relevant efforts may be appropriately reflected in domestic plans and international frameworks at relevant points in time.

3.2 Communications of Outcomes to Related Domestic and International Frameworks

This section presents directions for systematically and strategically communicating and reflecting the outcomes generated under this Action Plan in relevant domestic and international frameworks over the period from FY2026 to FY2030, as illustrated in Figure 2.

The relevant frameworks to which outcomes may be communicated and reflected can be grouped into three broad categories: research-related frameworks, chemicals-management-related frameworks, and biodiversity-related frameworks. The research-related group includes strategies and plans such as the Strategy for the Promotion of Environmental Research and Environmental Technology Development[101], the medium- to long-term plan of the National Institute for Environmental Studies[102], and concrete research programmes such as the Environmental Research and Technology Development Fund[65] and the Cross-ministerial Strategic Innovation Promotion Program (SIP)[66]. In the chemicals management field, the four chemicals-related conventions[9] and the GFC[14] are included, and the OECD workshop planned for June 2026 can also serve as an initial opportunity to communicate the outcomes of this Action Plan. As for the biodiversity-related group, frameworks such as the JBO[104] / NBSAP of Japan 2023-2030[3], as well as the assessment cycle of IPBES[15] and the cycle of the Conference of the Parties to the CBD[105], are also included. For each of these frameworks, outcomes may be communicated appropriately in line with relevant milestones and events.

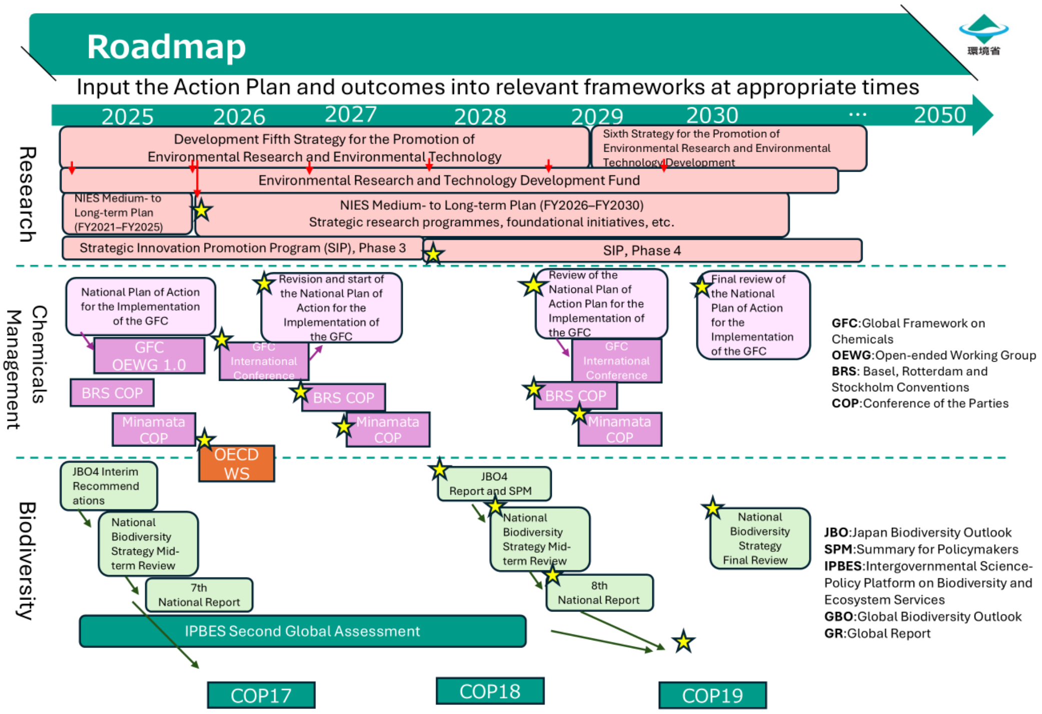

Figure 2. Illustrative Pathways for Communicating Outcomes to Relevant Domestic and International Frameworks

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104 Ministry of the Environment, Japan. *Japan Biodiversity Outlook (JBO)* [in Japanese]. https://www.env.go.jp/nature/biodiversity/jbo.html

105 Ministry of the Environment, Japan. *Conference of the Parties to the Convention on Biological Diversity* [in Japanese]. https://www.env.go.jp/nature/biodiversity/convention.html

4. Progress Review

4.1 Outcome Indicators

In order to support the steady implementation of this Action Plan, indicators may be established to understand the progress of each action. In setting such indicators, emphasis may be placed on items that can be quantitatively tracked, while consideration may also be given, where appropriate, to the use of biodiversity impact assessment indicators that are under development. Through such outcome indicators, it may become possible to evaluate progress in each action both quantitatively and qualitatively and to clarify necessary improvements and next steps. Examples of such indicators are as follows.

- **Implementation and expansion of surveys, research, and monitoring:**
  Launch and implementation status of relevant surveys, research, and monitoring.
- **Advancement of risk assessment methodologies:**
  Status of review and improvement of methodologies, and the implementation status of trial applications.
- **Review and revision of chemicals management systems:**
  Status of institutional review, the formulation of improvement proposals, and the implementation status of related system reviews.
- **Actions and strengthened collaboration by relevant actors:**
  Number of good practices identified, implementation status of support for collaboration, and related progress.
- **Development and implementation of biodiversity impact assessment indicators:**
  Status of efforts to develop indicators.
- **Input to international frameworks and domestic plans:**
  Record of inputs made into domestic and international frameworks.

4.2 Review and Revision

This Action Plan organizes the current situation, challenges, and possible actions on the basis of the discussions and observations of the Study Group on Promoting Nature-Positive through Chemicals Management and is published as Version 1.0. It is expected that the Action Plan may be updated and revised on a regular basis, including through further specification and elaboration in the following fiscal year, in light of changes in domestic and international trends, the accumulation of knowledge, progress in related efforts, and further consideration by the Study Group. In conducting such reviews, the following points may be examined in particular using the outcome indicators described above.

- **Checking whether progress is on track:**
  Assessing whether efforts under each action are progressing in line with the expected level and schedule.
- **Checking whether biodiversity impact assessment indicators are improving:**
  Examining whether the cumulative effects of the efforts are appearing as improvements in biodiversity impact assessment indicators and considering directions for any additional measures that may be needed.
- **Determining the need to update or add actions:**
  Considering whether existing actions need to be updated or new actions added in light of new scientific knowledge, updates to international frameworks, and changes in social conditions.

Through such review and revision, this Action Plan may be updated in a timely and appropriate manner so as to maximize policy effectiveness.

Chapter 4. Future Directions

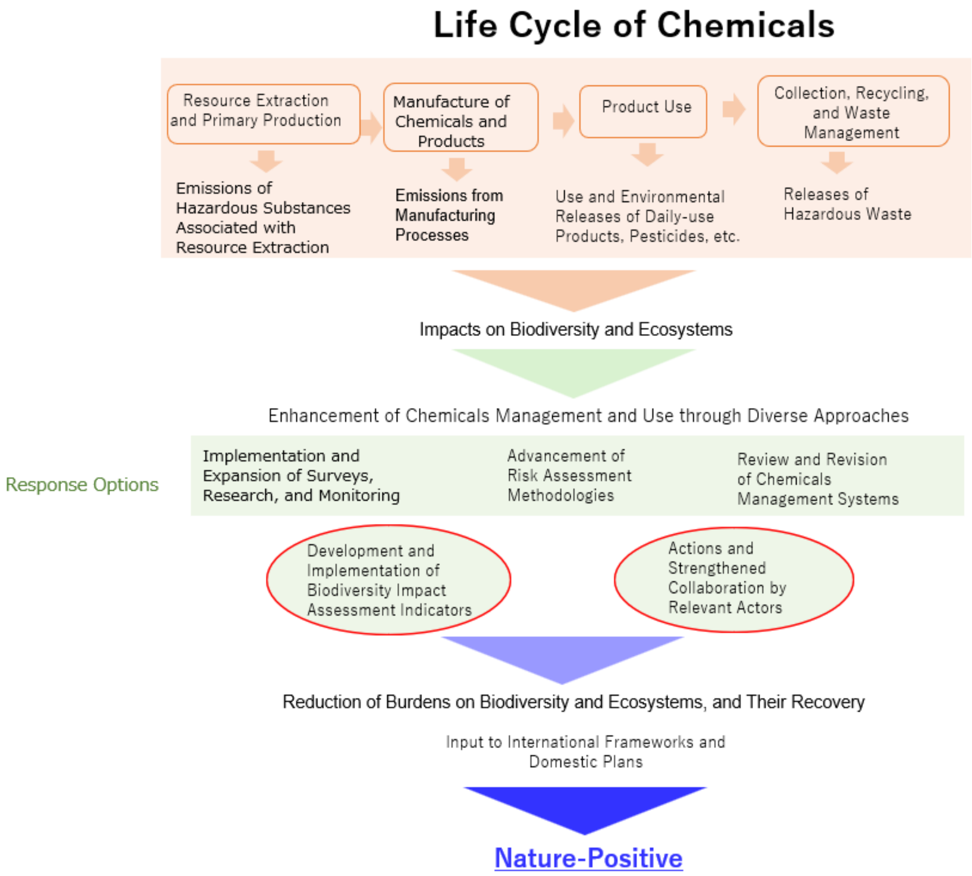
This Action Plan has been organized as the first phase toward promoting Nature-Positive through chemicals management, based on the scientific knowledge currently available and the discussions held in the Study Group. It is envisaged that the Action Plan will be progressively specified and enhanced in stages, taking into account future progress in related efforts and the accumulation of further knowledge. For this reason, it is important to consider not only the implementation of individual measures, but also the overall structure, underlying concepts, and method of organization of the Action Plan itself from a medium- to long-term perspective. Accordingly, this chapter distinguishes such matters from the review of the implementation and operation of the individual actions organized in Chapter 3, and sets out, from the perspective of future directions, issues that will need to be considered in further developing this Action Plan.

1. Positioning and Further Refinement of the Conceptual Framework

In order to achieve Nature-Positive outcomes through chemicals management, it is effective to make use of a conceptual framework that enables the life cycle of chemicals, releases and exposure to the environment, impacts on biodiversity and ecosystems, and the relationship between response options and their outcomes to be understood in a comprehensive and structured manner.

In the field of biodiversity, IPBES has presented a conceptual framework for organizing the relationships from identifying issues through to considering responses, and this has been positioned as an effective tool for visualizing complex causal relationships and supporting policy consideration. In this Action Plan as well, it is considered important to organize the issues through the use of a conceptual framework that can enable more integrated and strategic efforts by systematically presenting the life cycle of chemicals, pollution as a direct driver, the socio-economic background, and response options together with their outcomes (burden reduction and recovery). In order to give concrete form to this conceptual framework, two diagrams reflecting different perspectives were proposed in the Study Group (Figure 3).

(A)



(B)

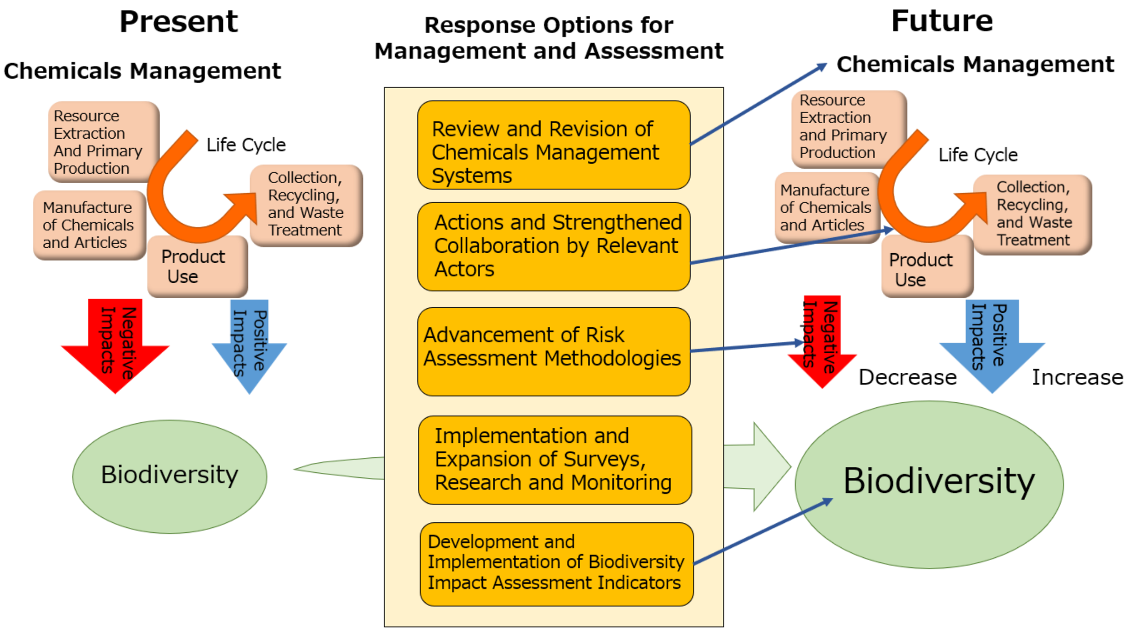


Figure 3. Conceptual Framework for Promoting Nature-Positive through Chemicals Management (Top: Figure A, focusing on the background to and roles of the response options; Bottom: Figure B, focusing on the changes brought about by the response options)

The conceptual framework is intended to be refined progressively through future discussion and is positioned as an important step for promoting more effective and steady efforts toward the realization of Nature-Positive outcomes. It will be necessary to refine it in stages, taking account of the following perspectives.

Examples of perspectives to be organized in the conceptual framework in the future:

- The relationships between each stage of the life cycle of chemicals (resource extraction, manufacturing, use, disposal and recycling, etc.) and direct burdens on biodiversity
- The organization of direct drivers affecting biodiversity and ecosystems through pollution, and the indirect drivers behind them, including socio-economic factors, consumer behavior, and international resource supply-and-demand structures
- Ways of understanding impacts in light of the fact that impacts on ecosystems may appear at different levels, such as individuals, populations, communities, and ecosystem functions
- The positioning of impact assessment that takes account of differences in ecosystem characteristics and sensitivities among regions
- The correspondence between response options—such as assessment and monitoring, release and use management, institutional responses, and collaboration among relevant actors—and the stages

or drivers to which they apply

- The direction of change in how burden reduction and recovery for biodiversity, and the transition toward Nature-Positive outcomes, may proceed through the implementation of responses

Taking these perspectives into account, the conceptual framework will be examined and revised in light of the views of relevant experts and stakeholders, and will serve as the basis for formulating a concrete action plan based on this Action Plan.

2. Further Specification of Actions and Implementation Arrangements

This Action Plan organizes directions for responses and the overall structure of efforts on the basis of existing measures and related policies. At the same time, with regard to the practical specification of implementation—such as which actors should carry out which individual actions, when, and in what sequence—it will be necessary to proceed in stages while taking account of the status of efforts by relevant actors and developments in related systems and institutions.

Going forward, through continued information-sharing and discussion with relevant actors, the matters to be addressed as priorities, the division of roles, and the procedures for implementation will be organized, and implementation arrangements will be made more concrete. In doing so, it will also be important to deepen consideration, including regarding the way communication with relevant actors should be undertaken, while clarifying the staged nature of consideration with respect to the relationship between the areas that are, for the time being, the principal focus of this Action Plan and broader areas including background factors (such as production and consumption structures and supply chains).

3. Continuous Review and Improvement

This Action Plan has been organized on the basis of the knowledge and discussions available at the present stage, and it is envisaged that its content will be updated as necessary in light of the accumulation of further knowledge, progress in related measures, and the broadening of efforts by relevant actors.

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