

Guidelines for Forestry Management to Enhance Forest Biodiversity

Forestry Agency

(Study Group on Approaches to Forest Management
Contributing to Biodiversity Conservation)

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In December 2023, the Forestry Agency established the “Study Group on Forest Management that Contributes to Biodiversity Conservation” consisting of 9 external experts, and held 3 meetings to summarize existing knowledge on practical examples of forest management that contributes to biodiversity conservation in forests and to consider how forestry management should be to enhance biodiversity. Based on discussions and public comments in the Study Group, these Guidelines were compiled as “Guidelines for Forestry Management to Enhance Forest Biodiversity (interim report).”

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Note that these Guidelines shall be revised when deemed necessary in light of the accumulation of new knowledge on biodiversity and the challenges faced in utilizing the Guidelines in the field.

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1. Purpose of preparation of these Guidelines

(1) Recent movements in biodiversity conservation

The conservation of biodiversity, along with the issues of climate change, is recognized as the most important issue in maintaining a sustainable socioeconomic system for the next generation, and the enhancement of initiatives is urgently needed.

In December 2022, the Kunming-Montreal Global Biodiversity Framework was adopted at the 15th meeting of the Conference of the Parties to the Convention on Biological Diversity (COP15), setting a target “to take urgent action to halt and reverse biodiversity loss to put nature on a path to recovery” by 2030 (this target is called “Nature Positive” in the 2021 G7 agreement). As performance indicators, targets such as the “30 by 30” target (conservation of at least 30% each of land and sea through protected areas and OECM¹) and the “sustainable business management of areas where agriculture, forestry, and fisheries are operated” were set up.

In addition, triggered by the 30 by 30 target and the discussions on OECM, the Ministry of the Environment launched a scheme to certify “areas where biodiversity is being conserved by initiatives of private companies, etc.” as “nature symbiosis sites.” The number of certified areas has been limited to date, and the majority of them have forests as target areas.

In Japan, the promotion of “consideration of a legal system to certify voluntary efforts toward the goal of halting and reversing biodiversity loss by 2030, with a view to submitting the proposal to the Diet within this fiscal year” is stipulated in the “Basic Policy for Economic and Fiscal Management and Reform,” which was decided on by the Cabinet in June 2023. The Act on Promoting Activities to Enhance Regional Biodiversity (Act No. 18 of 2024) was enacted in April 2024 to promote activities by corporations, etc. for regional biodiversity.

In the field of climate change, information disclosure based on the recommendations of the “Task Force on Climate-Related Financial Disclosures (TCFD)” has already been advanced as an initiative by private companies, etc., and it has also become an international standard to present corporate strategies to financial institutions and institutional investors to avoid financial losses associated with climate change.

Even in the field of “natural capital,” which consists of resources derived from nature such as forests, soil, water, and the atmosphere, private companies, etc. have been required by movements of the “Taskforce on Nature-related Financial Disclosure (TNFD),” etc. to evaluate their dependence on natural capital and take initiatives to maintain and fulfill ecosystem services provided by biodiversity conservation. As of October 2024, companies in Japan account for the largest share, with 133 companies (as of October 2024), out of a total of 502 “TNFD Adopters” that have expressed their intention to engage in disclosure based on the TNFD’s recommendations. This indicates growing interest in taking such initiatives.

(2) Biodiversity conservation in forests

Forests, which cover about 70% of Japan’s land area, are the largest treasure trove of species in the land area of the country’s rich biota. In light of this, it is essential to maintain all forests, regardless of whether they fall under the category of protected areas or OECM, as “green social capital” that supports Japan’s rich natural

¹ OECM: Other Effective area-based Conservation Measures, referring to areas contributing to biodiversity conservation other than protected areas

environment in a sound condition, and to implement business management of them appropriately.

From the perspective of contributing to the promotion of sustainable forest management, the Forestry Agency has been conducting the “Forest Ecosystem Diversity Basic Survey” since 1999 in order to obtain objective data for understanding and evaluating the state of forests and trends in their changes based on a nationwide unified method². Through this Survey, the composition of forest ecosystem types based on dominant tree species, distribution of tree species, forest damage, and forest accumulation have been grasped.

In addition, by taking advantage of the 10th meeting of the Conference of the Parties to the Convention on Biological Diversity (COP10 in Nagoya) held in October 2010, the “Measures to Promote the Conservation and Sustainable Use of Biodiversity in Forests” were compiled in July 2009 as a proposal for the future direction of forest and forestry measures. Based on the monitoring of forest ecosystems, said Measures aim to make the process of formulating forest plans for the conservation and sustainable use of biodiversity more transparent while indicating the policy to form a network of forest ecosystems through appropriate development and conservation of forests, regeneration and restoration of forests in close proximity to human habitat through sustainable use, and establishment of green corridors in private forests in partnerships with national forests.

Moreover, World Natural Heritage sites are aimed at protecting and preserving natural areas with outstanding and universal value, and in Japan, “Yakushima,” “Shirakami-Sanchi,” “Shiretoko,” “Ogasawara Islands,” and “Amami-Oshima Island, Tokunoshima Island, Northern part of Okinawa Island, and Iriomote Island” are registered. National forests cover 86% of the land area of these World Natural Heritage sites, and most of them are protected and managed as protected forests (forest biosphere reserve, etc.).

Forests provide habitats for a wider range of species as compared to other ecosystem types or land-use categories, and the threats to biodiversity attributed to deforestation are not significant in Japan. On the other hand, evaluation methods for the impacts of business management of forests on biodiversity and forest management methods for enhancing biodiversity have not necessarily been clarified, and information on initiatives to conserve biodiversity in forests has not been sufficiently disseminated.

For this reason, with the aim of presenting the ideal way of forestry management to enhance forest biodiversity, these Guidelines are prepared by clarifying issues and opportunities for forest management that addresses risk factors causing biodiversity loss, and by referring to existing knowledge on practical examples of forest management that contributes to biodiversity conservation in forests. “Enhancing forest biodiversity” refers to improving from the current situation the quality of forests as a growth and habitat space for a variety of plants and animals by avoiding negative impacts on biodiversity and implementing forest management that gives greater consideration to biodiversity conservation, including the restoration of biodiversity through the restoration of forests with reduced functions. In this case, it is important to have a perspective of enhancing native biodiversity not only in an individual stand unit but also in the region as a whole, and forestry management that enhances biodiversity will also contribute to the transition to a Nature-Positive Economy.

Together with this, these Guidelines were compiled with the idea of utilizing them in the operation of the Forest Management Plan system based on the Forest Act (Act No.

² It was called the “Forest Resource Monitoring Survey” until FY2009.

249 of 1951), for example, as a reference for those who prepare Forest Management Plans when preparing plans. Moreover, in light of these Guidelines, it is desirable for municipal governments to enhance the content of descriptions on biodiversity conservation in their Municipality Forest Plans.

2. Subject of these Guidelines

These Guidelines describe the approaches of forest management that enhance biodiversity in forests where business management has been implemented to a certain extent through forestry production activities. The primary users of these Guidelines are assumed to be forest owners who manage forests (including corporations with company-owned forests, self-logging forestry households, and municipalities possessing communal forests), forest owners' cooperative associations who are practically in charge of forest management, and forestry organizations, as well as companies engaged in forest management through concluding agreements with forest owners, etc. (hereinafter referred to as "forestry organizations, etc.").

Most of the forests in Japan are under the ownership structure by individuals on a small and micro scale. In order to conserve biodiversity, it is important to consider the growth and habitat areas of various species and to take the perspective of practicing forest management at the "landscape level" with a certain extent of area. Specifically, it is assumed that initiatives to conserve biodiversity will be promoted with a Forest Management Plan as a unit.

It is also expected that these Guidelines will serve as a reference for NPOs engaged in conservation activities, surveys, and monitoring for village mountain restoration in cooperation with forestry organizations, etc., as well as for organizations engaged in the protection of specific endangered species that grow in and inhabit forests, and for those engaged in activities that see different ecosystem types and land uses as an integrated field in consideration of ecosystem networks (securing nesting trees for Japanese crested ibis, storks, and grey-faced buzzards that forage in rice paddies, and promoting inland water fishery through the development of valley forests).

3. Significance and purpose of initiatives by forestry organizations, etc. to conserve biodiversity

(1) Forestry production activities contribute to the fulfillment of ecosystem services

The Basic Act on Biodiversity (Act No. 58 of 2008) aims at conservation and sustainable use of biodiversity, and the term "sustainable use" includes the sustainable operation of production activities such as agriculture, forestry, and fisheries (hereinafter, the term "conservation of biodiversity" in these Guidelines is used to include the concept of sustainable use of components of biodiversity).

Under this Act, "biodiversity" is defined as "ecosystem diversity, species diversity, and intraspecific diversity (genetic diversity)." Therefore, for the conservation of biodiversity in forests, it is necessary to have a perspective of maintaining and managing forest ecosystems in which a variety of plant and animal species, including common species, can grow and inhabit.

Our livelihoods and social economy are supported by the blessings obtained from ecosystems based on natural capital, which is a resource derived from nature, such as forests, soil, water, and air. These blessings are called "ecosystem services." The conservation of sound biodiversity will maintain the foundation of natural capital and lead to the fulfillment of ecosystem services that support socioeconomic systems,

including resource supply. Specifically, ecosystem services are classified into four categories: supply services (e.g., supply of timber, etc.), adjustment services (water resource conservation, control of pests and diseases, etc.), cultural services (e.g., recreational opportunities), and infrastructure services (e.g., soil formation).

The Basic Plan for Forest and Forestry (decided on by the Cabinet in June 2021) stipulates that multifunctional roles, such as the land conservation function, water resource conservation function, and global warming prevention function, are to be fulfilled through comprehensive and systematic measures including appropriate development and conservation of forests, and the multifunctional roles of forests include biodiversity conservation. Said Plan states that biodiversity conservation functions are “performed by all forests.” For example, forest management practices such as thinning and reforestation, which are conducted to supply forest products and conserve national land, are evaluated as initiatives that contribute to the soundness of biodiversity, which is the basis of ecosystem services generated from forests. The importance of forest management practices is also recognized in the National Biodiversity Strategy 2023-2030 (decided on by the Cabinet in March 2023).

Under these circumstances, conservation of biodiversity in national forests is positioned as one of the basic policies in the “Basic Plan for the Management and Operation of National Forests” (formulated in December 2023), and appropriate conservation and management will be promoted through monitoring surveys, etc. in protected forests and green corridors, while various initiatives will be promoted for the creation of diverse forests, appropriate conservation and management of forests, and consideration for biodiversity at management sites such as regeneration-cutting and reforestation.

What forestry organizations, etc. should undertake to conserve biodiversity is sustainable forest management itself, which is to contribute to the social economy through the supply of timber by ensuring the multifunctional roles of forests and through management practices in consideration of ecosystems. Forest management that contributes to biodiversity conservation is also important for sustainable timber production, and ensures the healthy growth of trees by preventing soil runoff through the growth of undergrowth, controlling pests and diseases, dispersing seeds, and supplying nutrients through soil microorganisms. Furthermore, it will contribute to the achievement of the following 2030 Targets set in the Kunming-Montreal Global Biodiversity Framework.

2030 Mission To take urgent action to halt and reverse biodiversity loss to put nature on a path to recovery

2030 Targets

(1) Reducing threats to biodiversity

1. Place all areas under participatory, integrated, and biodiversity-considerate spatial planning and/or effective management processes
2. Place 30% area of degraded ecosystems under effective restoration
3. Conserve at least 30% each of land and sea areas through protected areas and other effective means (OECM) (30 by 30)
4. Secure urgent management actions to significantly reduce extinction risks, and minimize human-wildlife conflict
5. Make the use of wild species sustainable, safe, and legal by preventing overhunting, etc.
6. Reduce the introduction and establishment rates of invasive alien species by at least 50%
7. Halve excess nutrients released into the environment, halve the overall risk from pesticides and highly harmful chemicals, and prevent/reduce plastic pollution
8. Minimize the impacts of climate change on biodiversity through nature-based solutions/ecosystem-based approaches

(2) Meeting people's needs

9. Make management and use of wild species sustainable to bring social, economic, and environmental benefits to people
10. Manage agriculture, aquaculture, fishery, and forestry areas sustainably, thereby contributing to the resilience of production systems and long-term efficiency and productivity, as well as to food security
11. Restore, maintain, and enhance nature's contributions to people (NCP) through nature-based solutions/ecosystem-based approaches
12. Increase the area, quality, access, and benefits of green spaces/hydrophilic spaces in urban areas, and secure biodiversity-considerate urban planning
13. Take benefit-sharing measures for genetic resources and digital sequence information (DSI), and promote a significant increase in benefit-sharing in accordance with the documents on access to genetic resources and benefit-sharing (ABS)

(3) Tools and solutions

14. Ensure that the diverse values of biodiversity are integrated into policies/measures, regulations, planning, development processes, poverty eradication strategies, strategic environmental assessments, environmental impact assessments, and, where appropriate, national accounts
15. Take measures to enable businesses, particularly large companies and financial institutions, to evaluate and disclose risks regarding biodiversity as well as dependence and impacts on biodiversity, and to provide information necessary for sustainable consumption
16. Reduce global footprint by enabling sustainable consumption choices with appropriate information, halving food waste, significantly reducing overconsumption, and significantly reducing waste generation
17. Establish biosafety measures, and measures for handling of biotechnology and its benefit-sharing
18. Identify and eliminate or reform incentives (such as subsidies) that are harmful to biodiversity to reduce at least \$500 billion per year, and expand incentives that are beneficial to biodiversity
19. Mobilize \$200 billion per year from all capital sources; international funding from developed to developing countries increased to \$20 billion per year by 2025 and \$30 billion per year by 2030
20. Reinforce capacity building and development, access to technologies, and technical transfer
21. Make the best available data, information, and knowledge available to decision makers, practitioners, and the public
22. Ensure the participation of indigenous inhabitants, local communities, women and girls, children and youth, and persons with disabilities in biodiversity-related decision-making
23. Ensure gender equality through a gender-responsive approach that includes the recognition of the rights of women and girls regarding land and natural resources, as well as their participation at all levels

Table. 2030 Mission and Targets of the Kunming-Montreal Global Biodiversity Framework (excerpt from the Ministry of Agriculture, Forestry and Fisheries Biodiversity Strategy)

(2) Biodiversity conservation in partnership with private companies serves as a new profitable opportunity for forestry management

The degradation of biodiversity due to climate change, such as increased frequency of natural disasters, will lead to a loss of ecosystem services and is coming to be regarded as a threat to shake the very foundations of corporate activities. Under these circumstances, various discussions are underway even internationally on the need to promote integrated approaches to climate change and biodiversity issues. In particular, in the forest and forestry sectors, where the two issues are closely related, synergies between the two can also be expected.

For example, by combining the creation of J-credits in forests to combat climate change with the activities to enhance biodiversity in forests to conserve biodiversity, it is expected that J-credits derived from forests will be preferentially selected and that the sales price will reflect the added value that is not inherent in other J-credits for reduction, the profit of which will lead to further investment in forest management. In addition, if information can be disseminated in an easy-to-understand manner that forestry organizations, etc. are working on forestry management to enhance biodiversity through maintenance and fulfillment of multifunctional roles of forests, it will lead to the creation of partnerships with industries that are working on TNFD.

Through these initiatives, the value of forest ecosystem services, which have not been evaluated economically in the past, will be evaluated quantitatively or qualitatively. This will make it easier to receive investment and financial cooperation for forest improvement from private companies and the financial sector, thereby expanding the possibility of obtaining profitable opportunities other than timber sales.

Initiatives by forestry organizations, etc. to conserve biodiversity will provide an opportunity to bring about changes in forestry itself by creating links with private companies that regard biodiversity conservation as a priority management issue and

with consumers who prefer environmentally friendly products.

(3) Intensification of forest management that also contributes to conservation of biodiversity

The multifunctional roles of forests have been secured through the improvement and conservation of forests by forestry organizations, etc. However, some planted forests are not properly managed, because forest owners have lost interest in forestry management due to the prolonged stagnant stumpage price. In addition, from the perspective of ecosystem conservation, it is necessary to manage forests at the landscape level with a certain extent of area, but in some cases, it is difficult to work on the intensification of forests under a small-scale and dispersed ownership structure. Under such circumstances, if forestry organizations, etc., can appeal to the outside world that it is engaged in forestry management that increases biodiversity through the expansion of its area by receiving the transfer of forests other than those they own or manage (for example, poorly maintained forests in the vicinity of managed areas) or by being entrusted with the management operation, it can be an opportunity to increase corporate value.

4. Issues in enhancing forest biodiversity

In order to enhance biodiversity in forests in Japan, it is necessary to restore degraded biodiversity, including the restoration of planted forests with reduced functions due to poor maintenance. On the other hand, in view of the current situation where many forests have matured as resources and reached the utilization period, it is important to take initiatives not only for nature restoration in the narrow sense to restore degraded biodiversity, but also for the promotion of the circular use of forest resources through forestry production activities while conserving biodiversity.

Based on this recognition, issues in implementing activities to enhance biodiversity by forestry organizations, etc. can be summarized as follows.

(1) Issues in forest management

(i) Management of forests with a cohesive extension

In order to conserve biodiversity in forests, it is necessary to have various stands within a certain extent of area. For this purpose, it is important to arrange forests composed of various growth stages and tree species that are suitable for the natural conditions unique to the land in a balanced manner, while they constantly change due to moderate disturbance over time. It is necessary to continuously and integrally prepare a management plan for forests with a cohesive extension, and to nurture and induce forests based on a long-term policy.

However, because the ownership structure of private forests in Japan is small and dispersed, it is difficult to achieve diverse forest arrangements within a certain extent of area.

(ii) Consideration for conservation of biodiversity in forest management practices

While the soundness of forest ecosystems can be enhanced by appropriate forest management practices, the soundness of forest ecosystems can be adversely affected if there is a lack of consideration for the conservation of growth and habitat environment of plants and animals, if there is an approach to nature that is contrary to local

topography and natural conditions, or if there are no management practices necessary to maintain forest functions. Therefore, forest management practices must work on the forest ecosystems at an appropriate level while giving consideration to conservation of biodiversity

[Implementation of various operational guidelines]

In the forest planning system based on the Forest Act, operational guidelines for thinning and tending are specified in Municipality Forest Plans, and criteria for certification of Forest Management Plans are established based on these guidelines. In addition, the “Guidelines for Logging and Carrying out during Regeneration-Cutting” (March 16, 2021: 2 Rinya Sei Sei No. 1157: Notice issued in the name of Director-General, Forestry Agency, partially revised on March 31, 2023), which were formulated as the code of conduct for forestry organizations, etc., indicate the matters for consideration that contribute to biodiversity conservation in forest management practices, and their steady implementation is further required.

[Implementation of timely and appropriate management practices in planted forests]

Although cut-over land can contribute to the conservation of biodiversity from the perspective of creating a grassland environment, leaving cut-over land as it is may make it become bare land, which is considered to pose negative impacts from the perspective of not only national land conservation but also biodiversity conservation. Therefore, it is necessary to ensure reliable regeneration after regeneration-cutting, but reforestation after regeneration-cutting is often abandoned due to deterioration in the profitability of forestry, lack of successors, etc.

Moreover, forests with thinning not carried out and the forest floor not receiving sufficient sunlight due to overcrowding will become a factor that leads to biodiversity degradation.

[Induction into mixed forests of conifers and broadleaf trees and broad-leaved forests]

Steep slopes and planted forests with low forest land productivity should be induced to be mixed forests of conifers and broadleaf trees or broad-leaved forests, but such forests are difficult to include in planned forest management, and in many cases, it is difficult to induce them based on long-term policies.

Moreover, when broad-leaves trees are planted for such induction, it is important to take into consideration the prevention of genetic disturbance and to utilize seedlings that use seeds/budwood from a known source. If possible, it is desirable to use seeds for seedling production collected from a place as close as possible to the planting area (for example, within the same prefecture), but for this purpose, the challenge is to establish a system to utilize such seeds and seedlings.

(iii) Degradation of biodiversity due to reduced approach to forests

In Japan, it has been pointed out that the reduction or withdrawal of approaches to nature by humans has negative impacts on biodiversity, and the underuse of natural resources has also become an issue in biodiversity conservation. In particular, long-term declines in grassland ecosystems have led to declines in populations of indigenous species.

[Decline in grassland ecosystem (decrease of young forests)]

Forests undergo a transition into a forest ecosystem with a hierarchical structure through the regeneration and growth of grassland ecosystems after the logged area temporarily becomes a grassland ecosystem. However, due to intensive development during the post-war reconstruction period, more than half of single-storied forests are now 50 years old or older, and the composition of the forest age is uneven, with an extremely small proportion of young forests.

[Decline of forests in close proximity to human habitat]

Forests in close proximity to human habitat used to be an object of daily use. In particular, in secondary broad-leaved forests mainly for fuelwood production, forest restoration through logging and natural regeneration by shoots has been repeated in a short cycle of about 20 years, and a biota that prefers a relatively bright environment has been formed. However, forests have been left unused due to the fuel revolution, depopulation, etc., and the forest interior has become dark due to the aging of trees, the transition to laurel forests, and the invasion of bamboo, etc., which has led to more forests with biota changed to a different one as compared to before.

These forests are facing “a crisis due to the reduction of approach to nature” as described in the second crisis³ related to the loss of biodiversity, which is also a factor in the expansion of damage caused by oak wilt.

(iv) Expansion of feeding damage, etc. by deer

According to the results of the Forest Ecosystem Diversity Basic Survey conducted by the Forestry Agency, the number of sites where damage to forests by deer has been confirmed has increased by about 40%⁴ in the 5 years since FY2013, and the distribution range has expanded nationwide. Even in areas where the habitat density is currently low, there is a risk that the habitat density will increase rapidly in the future, causing expansion of forest damage. Deer feeding damage accounts for about 70% of forest damage caused by wild birds and animals⁵. Not only does this cause damage to forestry by feeding damage to young trees and bark stripping of mature trees, but it also causes damage such as the inhibition of natural regeneration by feeding damage to understory vegetation, soil runoff, and feeding damage to endangered species. As a result, the expected recovery of understory vegetation has not been achieved by thinning in some cases.

(v) Other issues related to forest protection

Regarding biodiversity conservation functions, the Basic Plan for Forest and Forestry states that “all forests are to fulfill such functions, but in terms of forests where functions are fulfilled territorially, forests that constitute indigenous biological communities, such as primeval forest ecosystems, forests in which rare organisms grow and inhabit, and valley forests in which unique organisms grow and inhabit across land and water areas” are the desirable image.

[Protection of endangered species, etc.]

Among the “forests that should fulfill biodiversity conservation functions territorially” mentioned above, primeval forest ecosystems have been designated as areas under

³ National Biodiversity Strategy 2023-2030 (decided on by the Cabinet on March 31, 2023)

⁴ Announcement of the Results of the Fourth Forest Ecosystem Diversity Basic Survey (Forestry Agency)

⁵ Forestry Agency website: <https://www.rinya.maff.go.jp/j/hogo/higai/tyouju.html>

various laws, and appropriate conservation measures have been taken. On the other hand, from the perspective of protecting endangered species and rare species, forests, etc. where such species grow and inhabit are not disclosed in detail, and sufficient measures are not always taken, because it is difficult to recognize that they grow and inhabit forests owned or managed and because specialized knowledge is essential for species identification.

[Conservation of valley forests]

The conservation of valley forests has been carried out from the perspective of preventing soil runoff so far. However, from the perspective of conserving them as important habitats for living organisms, planning their arrangement as part of forest layout has not always been carried out sufficiently.

(2) Social and economic issues

(i) Changes in land use

Diversion to non-forest land uses is a major contributor to biodiversity loss internationally as well. Although the forest area in Japan has been kept almost constant as a whole, the diversion to other land uses by forest development, regardless of the scale of forest, may lead to fragmentation of the growth and habitat environment of organisms.

(ii) Cost sharing and securing workforces

Initiatives to conserve biodiversity include initiatives taken as part of forestry production activities and forest recreation, while initiatives such as converting forests into mixed forests of conifers and broadleaf trees, protecting endangered species, and monitoring ecosystems will incur additional costs and thus require the development of systems for their implementation.

In addition, as the number of people engaged in forestry has been decreasing over the long term, in order to conserve biodiversity in forests while continuing forestry production activities, it is necessary to improve the working environment of people engaged in forestry, foster and secure them, and provide education on conservation of biodiversity.

(3) Issues in setting, monitoring, and evaluating activity targets

In order to continue activities aimed at conserving biodiversity in forests, it is necessary to clarify the status of initiatives and establish a framework for objective evaluation. To this end, it is important to set targets in advance, and then run the “PDCA cycle,” in which the achievement status is grasped and monitored on an ongoing basis. However, a unified method for evaluating biodiversity has not been established, and a scheme to secure the implementation of the PDCA cycle is not clear either.

(4) Global warming and climate change

Global warming increases the risk of extinction and also affects forest vegetation and fauna. Moreover, the increased risk of natural disasters and insect and animal damage to forests associated with climate change could become a factor in the loss of forest ecosystems. Initiatives to solve all social issues, including mitigation and adaptation measures to climate change, by utilizing the functions of healthy natural ecosystems

are internationally regarded important as “Nature-based Solutions (NbS).” Conservation of biodiversity must be addressed in an integrated manner by securing forests as carbon sinks and demonstrating synergies.

Furthermore, in relation to the land use change mentioned in (2) (i), it is necessary to keep in mind that forest development through the installation of solar panels, etc. causes degradation of biodiversity even if the objective is to mitigate climate change.

5. Forest management methods to enhance forest biodiversity

In order to enhance biodiversity, it is important to ensure the multifunctional roles of forests through a forest planning system and a protection forest system based on the Forest Act, then further improve the quality of the growth and habitat space of various plants and animals by implementing forest management that gives greater consideration to biodiversity conservation, and publicize the results of initiatives through monitoring.

As mentioned above, forest management aimed at fully exercising the multifunctional roles of forests also contributes to the conservation of biodiversity in forests. For forest management to enhance biodiversity, a minimum requirement is to comply with standards and rules based on existing laws and regulations aimed at maintaining and strengthening the multifunctional roles, such as logging and transport regulations, diversion regulations, reliable regeneration after regeneration-cutting, and operational guidelines for thinning and tending. In addition, the forest management standards can be further improved by additionally implementing activities based on local natural conditions.

It is also important that timber produced from forests that have been managed to contribute to biodiversity conservation is used selectively in the supply chain.

Based on the above, the following is a summary of initiatives that forestry organizations, etc. can take to possibly improve forest management standards.

As for the implementation of specific measures, forestry organizations, etc. are encouraged to include specific policy initiatives and matters for monitoring to enhance biodiversity in forest management plans, “enhancement activity implementation plans,”⁶ and plans prepared by forest managers under the forest certification system (a plan in which these are described are hereinafter referred to as a “Forest Management Plan, etc.”), and to implement the PDCA cycle as indicated in “(3) Setting, monitoring, and evaluating activity targets” described later. In implementing “Forest Management Plans, etc.,” for example, the PDCA cycle may be implemented after specifying matters related to biodiversity conservation in the “long-term policy on forest management” in a Forest Management Plan. It is also effective to utilize other third-party evaluation systems and frameworks, including forest certification and enhancement activity implementation plans, etc.

(1) Addressing issues in forest management

(i) Arrangement of variety of forests

In order to ensure the growth and habitat environment of a variety of plants and animals in forests, it is important to arrange forests composed of various tree species, stand structure, forest age, successional stage, etc. in a balanced manner within a certain

⁶ Referring to “enhancement activity implementation plans” as prescribed in Article 9 of the Act on Promoting Activities to Enhance Regional Biodiversity (Act No. 18 of 2024).

extent of area. For forests owned or managed by individuals or companies, it is important to set target forest types with a variety of stand compositions in the “Forest Management Plan, etc.” based on zoning, etc. specified in Municipality Forest Plans. In the “Forest Management Plan, etc.,” it is desirable to clarify the policy for induction into a target forest type over time in line with the forest layout, and the policy and content of activities such as forest management practices and protection, and conservation activities of forests in close proximity to human habitat.

In addition, since forest organisms are strongly dependent on the structure and composition of forests (at the landscape and stand levels), initiatives for induction into diverse forest structures are effective. For example, the following initiatives can be taken:

- Setting a target of making the area of natural forests to maintain and restore at a certain ratio compared to the total forest area within the forest area owned or managed⁷
- Conserving grassland/open-land dependent species through systematic logging of planted forests for timber production and subsequent reliable reforestation, and by maintaining juvenile planted forests less than 10 years old in the local ecosystem⁸
- Maintaining the functions, etc. of forests as habitats for various organisms by securing old trees, large-diameter trees, dead trees, etc., through forest management practices in which forest structures and organisms are left behind during logging to maintain them over the long term (this type of management practice method is called “retention forestry”)⁹

etc.

In order to enhance ecosystem connectivity and form a forest ecosystem network, it is effective to organically connect forests in consideration of ecological cohesion, such as natural forests around planted forests or forests along mountain streams or along ridge lines as retention zones during logging operations. Moreover, it is important to maintain not only areas where standing trees grow but also natural grasslands and wetlands that are integrated with forest ecosystems, as well as to ensure the diversity of ecological functions of individual landforms in order to conserve the habitats of rare species. In order to prevent soil runoff and conserve understory vegetation, it is also effective to preserve forests that are at risk of local collapse, by judging from microtopography, during clear-cutting.

In addition, as for poorly maintained forests located in the vicinity of forests owned or managed, owners are also encouraged to work on biodiversity conservation in an integrated manner through the expansion of areas by accepting transfers or being entrusted with the management operation.

⁷Yamaura, Y., Amano, T., Kusumoto, Y., Nagata, H., Okabe, K., 2011. Climate and topography drives macroscale biodiversity through land-use change in a human-dominated world. *Oikos* 120, 427-451. Arroyo-Rodríguez V et al., 2020. Designing optimal human-modified landscapes for forest biodiversity conservation. *Ecology Letters* 23, 1404-1420.

⁸In: Hiroaki Kakizawa, Yuichi Yamaura, Koichi Kuriyama (Eds.) 2018. Retention forestry: Protecting living things while logging trees. Tsukiji Shokan Publishing (Chapter 1 Column) Shinsuke Koike, Yuichi Yamaura, Hisatomo Taki (Eds.) 2019. Forests and wildlife. Kyoritsu Shuppan (Chapter 10)

⁹In: Hiroaki Kakizawa, Yuichi Yamaura, Koichi Kuriyama (Eds.) 2018. Retention forestry: Protecting living things while logging trees. Tsukiji Shokan Publishing (Chapter 1 Column) Shinsuke Koike, Yuichi Yamaura, Hisatomo Taki (Eds.) 2019. Forests and wildlife. Kyoritsu Shuppan (Chapter 10) Yuichi Yamaura, Akira Unno 2023. Conservation of birds by maintaining broad-leaved trees in planted forests. *Forest Technology* 974:28-31., Newton, I., 1994. The role of nest sites in limiting the numbers of hole-nesting birds: a review. *Biological Conservation* 70, 265-276, Simonsson, P., Gustafsson, L., Östlund, L., 2015. Retention forestry in Sweden: driving forces, debate and implementation 1968-2003. *Scandinavian Journal of Forest Research* 30, 154-173¹⁰ Operational guidelines for thinning and tending, etc. specified in Municipality Forest Plans, and “Guidelines for Logging and Carrying out during Regeneration-Cutting” (March 16, 2021: 2 Rinya Sei Sei No. 1157: Notice issued in the name of the Director-General, Forestry Agency)

(ii) Forest management practices in consideration of biodiversity conservation in planted forests

Planted forests for timber production are also an important component of forest ecosystems and provide habitats for many plant and animal species. The implementation of meticulous management practices with consideration for biodiversity conservation will ensure the growth and habitat space of organisms and increase the connectivity of ecosystems, thereby contributing greatly to the enhancement of biodiversity. Many biodiversity conservation initiatives will also lead to the prevention of sediment runoff and maintenance of soil fertility, and contribute to the maintenance of the foundation for sustainable timber production in the long term, thereby also bringing benefits to forestry production activities.

However, in planted forests, it is essential to give consideration to biodiversity conservation in forest management practices so that human-induced disturbance, such as logging and carrying-out, will not adversely affect biodiversity¹⁰. Measures that should be taken in common in all planted forests include the prevention of sediment runoff and soil erosion, and the conservation of valley forests along mountain streams that are important for biodiversity conservation, in addition to systematic forest management practices such as timely and appropriate thinning. In particular, since soil runoff degrades the ecosystem infrastructure, it is necessary to prevent the generation of bare land caused by deer feeding and trampling damage, and also to perform thinning to restore the soundness of planted forests with reduced functions, such as the decline of understory vegetation and soil erosion, due to the long-term lack of timely and appropriate thinning.

On the other hand, in consideration of natural conditions, etc., the following initiatives can be considered as voluntary efforts to further enhance the quality of the growth and habitat space for a variety of plants and animals according to the originality and ingenuity at the site:

- (a) Selection of a long final harvesting age and target forest types, such as induction into multi-storied forests
- (b) Careful consideration (preserving invaded broad-leaves trees and branches, etc.) for each type of work (site clearance, planting, weeding, cleaning cutting, thinning) and maintenance of ridge lines
- (c) Territorial protection and conservation, including measures against insect and animal damage, control of alien species¹¹, and conservation of endangered species, etc.
- (d) Initiatives for specific purposes, such as the creation of hunting grounds for birds of prey, maintenance of forests in close proximity to human habitat, and response to prescribed burn

etc.

As for a), when planted forests unsuitable for forestry production activities are induced to be mixed forests of conifers and broadleaf trees or broad-leaved forests¹², it is common to expect the invasion of broad-leaves trees by intensive thinning, but it is also an option to combine clear-cutting of small areas with monitoring of the status of

¹⁰ Operational guidelines for thinning and tending, etc. specified in Municipality Forest Plans, and “Guidelines for Logging and Carrying out during Regeneration-Cutting” (March 16, 2021: 2 Rinya Sei Sei No. 1157: Notice issued in the name of the Director-General, Forestry Agency)

¹¹ In these Guidelines, it refers to species listed on the “list of alien species that may pose risks to ecosystems in Japan” (the Ministry of the Environment, the Ministry of Agriculture, Forestry and Fisheries, March 2015).

¹² For example, the Implementation Manual for Management Practices Utilizing Natural Power in National Forest Projects (National Forest Planning Division, National Forest Department, Forestry Agency, March 2018)

subsequent natural regeneration.

Regarding b), the following initiatives can be considered as matters for consideration for each type of work.

- Limit the site clearance to the minimum amount of mowing and soil preparation necessary, and leave some branches in the forest land
- For planting, utilize seedlings that use seeds/budwood from a known source, and give consideration in a way to make appropriate trees for the appropriate location
- In weeding and thinning, leave invaded broad-leaves trees and fringe vegetation that serve as habitats for birds, etc., as long as they do not affect the growth of planted trees. If there is no risk of disease or insect infestation, leave dead trees and hollow trees as long as they do not interfere with work.

etc.

Note that preserving invaded broad-leaves trees and branches may make the footing of the work poor and be an obstacle to evacuation during logging, which makes it difficult to secure the safety of workers. Therefore, it is necessary to give top priority to ensuring the safety of workers. Moreover, when broad-leaves trees are planted, it is important to maintain a tree species composition suitable for natural vegetation and appropriate compensatory vegetation for the area such as a mountain village, and to utilize seedlings that use seeds/budwood from a known source in consideration of preventing genetic disturbance. If possible, it is desirable to use seeds for seedling production collected from a place as close as possible to the planting area (for example, within the same prefecture)¹³. On the other hand, since seedling production takes time on a multi-year basis, it is necessary to coordinate with seedling suppliers in advance. It is desirable to use biodegradable chainsaw oil when working in the headwaters area, such as near a valley forest.

As for c), in accordance with the Forest Pests and Disease Control Act (Act No. 53 of 1950), it is important to implement control measures by appropriately combining exterminating/preventive measures against pine weevil damage, etc. and conversion of tree species, etc., as well as to make efforts to detect other insect and animal damage to forests as early as possible.

With regard to the control of alien species, which is necessary for the conservation of biodiversity, it is important to appropriately grasp and analyze the status of the characteristics, distribution, and establishment stage of the species, as well as damage situation, then formulate a control plan based on the priority of countermeasures, conduct monitoring, and take adaptive measures¹⁴.

For tree species to plant, avoid selecting applicable species as much as possible if there is a risk of genetic disturbance due to effects on ecosystems, etc. or introduction of organisms of the same species based on the “list of alien species that may pose risks to ecosystems in Japan”¹⁵ (hereinafter referred to as the “list of alien species to prevent ecological damage”).

As for d), initiatives may be implemented in accordance with local conditions while

¹³ Genetic guidelines for the transfer of broad-leaved seedlings (Forestry and Forest Products Research Institute, January 2011)

¹⁴ Alien Species Damage Prevention Action Plan, Second Edition (the Ministry of the Environment, the Ministry of Agriculture, Forestry and Fisheries, the Ministry of Land, Infrastructure, Transport and Tourism, March 2025)

¹⁵ List of alien species that may pose risks to ecosystems in Japan (list of alien species to prevent ecological damage) (the Ministry of the Environment, the Ministry of Agriculture, Forestry and Fisheries, March 2015)

referring to existing manuals¹⁶ and research results.

(iii) Conservation of biodiversity through moderate approach to forests

[Establishment of “logging, using, planting, and growing” recycling system in single-storied forests (creation of grassland environment)]

Among the single-storied forests that have matured as resources, it is important to induce those that are in a geographical condition of a location suitable for timber production into forests of various forest ages by establishing a “logging, using, planting, and growing” recycling system. Because logging of forests will change the successional stage of forests from the mature stage to the grassland ecosystem that is the initial stage of stand, in areas where it is necessary to conserve the habitat of golden eagles and other birds, for example, it is expected that populations can be maintained and restored by systematic small-scale clear-cutting to maintain the grassland environment that serves as their hunting grounds.

On the other hand, if the frequency and scale of logging (disturbance) exceed the resilience of the ecosystem, it will be a factor resulting in the degradation of biodiversity. In addition, if forests are not renewed after regeneration-cutting, it will lead to the abandonment of forest management. Therefore, logging, including subsequent regeneration, must be systematic.

Natural regeneration requires a thorough assessment of the age and diameter class of the logged trees, the occurrence of advance growth of young seedlings, the distribution of mother trees, and the state of decline of understory vegetation due to deer feeding damage in the surrounding forests, thereby requiring a high level of knowledge and judgment. Therefore, it is necessary to refrain from carelessly choosing natural regeneration.

[Development of forests in close proximity to human habitat]

Forests in close proximity to human habitat form a diverse and complex ecosystem by securing continuity through human activities and material circulation with “satochi (mountain village),” which consists of a mosaic of land uses such as communities, paddy/upland fields, and irrigation ponds.

Among them, trees in secondary broad-leaved forests have become larger in diameter as a result of being left for a long period of time, which has become a factor for the expansion of oak wilt damage. In order to develop secondary broad-leaved forests, it is important to restore the use of resources by repeatedly performing logging, such as clear-cutting over a small area, and natural regeneration by shoots. In the case of rejuvenation of forests in close proximity to human habitat that are already large in diameter and difficult to sprout, appropriate measures shall be taken, such as monitoring poor natural regeneration by shoots and the presence of feeding damage by deer in order to grasp the state of restoration, and implementing renewing and planting with seedlings, and supplementary work according to the local situation¹⁷. Such initiatives are also important in mitigating the damage of oak wilt and conserving

¹⁶ For example, “Forest management practices at the nesting sites of goshawks: Habitat environment management and measures for thinning, etc.” (Maebashi Regional Forestry Office, 1998), “Planted forests of Japanese cedar as a habitat for Japanese flying squirrels: Aiming to conserve rare animals utilizing planted forests” (Forestry and Forest Products Research Institute, Forest Research and Management Organization, 2023), and “Start management of village mountain: A notebook for sustainable use” (Forestry and Forest Products Research Institute, Kansai Branch, 2014)

¹⁷ How to restore a *Quercus serrata* forest in cut-over land of an aged *Quercus serrata* forest - Revised version of recommendation of regeneration-cutting of *Quercus serrata* forest - (Forestry Research Institute, Toyama Prefectural Agricultural, Forestry and Fisheries Research Center, May 2022)

biota that prefers a bright environment.

In order to create economic benefits by promoting initiatives rooted in local industries for the continuous use of village mountain resources, it is effective to consider the use of not only village mountain resources but also forest space, such as the use as wood for paper chips and biomass materials, and the use of firewood, charcoal, mushroom bed logs, and sawdust for mushrooms as resources. It should also be reevaluated that forests in close proximity to human habitat not only provide raw materials for traditional crafts (musical instruments, wooden basis for lacquerware, Japanese paper, vine work, dyes, etc.), medicine and food culture (mushrooms, wild vegetables, medicinal herbs and trees, tree nuts, game meat, smoking wood chips, etc.), and daily life (resin, essential oil, sakaki (sacred tree in Shinto), shikimi (sacred plant in Buddhism), etc.), but also provide cultural services. Note that it is important to build consensus among local communities on the utilization of resources that are valued by local communities, such as the Chinju no Mori (sacred shrine forest) and the symbolic trees of the region. Furthermore, the continuous implementation of these activities is expected to fulfill a buffer function between the living space of humans and the habitat of large wild animals. In addition, the induction of broad-leaved forests into timber forests shall be actively considered in some conditions, but in doing so, it is necessary to sufficiently consider the sustainable use, the target tree species composition, and the management system, and to secure the timber supply chain.

(iv) Measures against deer feeding damage

Measures for deer feeding damage are an extremely important issue for the conservation of biodiversity in forests. Deer feeding damage measures should be implemented through both protection and capture. In particular, protecting planted trees and rare plants with protective fences is also important for ensuring the regeneration and conserving endangered species, etc. A manual on deer feeding damage measures has been prepared based on past experience, and the following references are useful.

In addition, due to the expansion of deer feeding damage, it is necessary to install protective fences and actively plant broad-leaves trees in areas where natural regeneration cannot be expected by natural forces alone.

(Reference) Reference literature on deer control

- Deer Catching Technique Manual - For those trying to catch deer - (Forestry Agency, March 2021)
<https://www.rinya.maff.go.jp/j/hogo/higai/attach/pdf/tyouju-85.pdf>
- Deer Damage Control Manual - Protecting planted trees with protective fences - (Forest Management Center, Forest Research and Management Organization, March 2020)
https://www.green.go.jp/gijutsu/pdf/zorin_gijutsu/deer_pest_control_manual.pdf
- Efficient and effective deer capture profiles in national forests (Forestry Agency, FY2022)
https://www.rinya.maff.go.jp/j/kokuyu_rinya/shinrinhigai.html

In order for forestry organizations, etc. to implement deer feeding damage control measures, it is essential to acquire practical knowledge and techniques on the ecology, protection, and capture of deer. Therefore, it is necessary to develop human resources¹⁸ such as wildlife damage control coordinators.

¹⁸ It is also effective to utilize a training program for regional leaders (forest) and wildlife damage control coordinators among the wildlife damage control base support project of the wildlife damage prevention comprehensive countermeasure subsidy.

(v) Other forest protection measures

[Protection of endangered species, etc.]

According to the results of the Forest Ecosystem Diversity Basic Survey, vascular plants designated as endangered species appear in about 5% of the total number of plots surveyed, regardless of forest types such as planted forests and natural forests¹⁹. When fauna is included, it is conceivable that more forests are providing habitats for endangered species.

In grasping what kinds of rare wild fauna and flora or endangered species are possibly growing and inhabiting forests owned or managed by forestry organizations, etc., they can first refer to the growth and inhabit data compiled by the national and local governments. However, it is difficult to identify rare wild fauna and flora and endangered species in the field without expert knowledge, and it is difficult to select an appropriate forest management method. Therefore, when there is a possibility that endangered species, etc. are growing or inhabiting, it is necessary to consult with experts and consider measures.

[Conservation of valley forests]

A mountain stream watershed forms a continuous network of forest ecosystems from headwaters through middle and lower reaches to the coast, thereby contributing significantly to the conservation of biodiversity throughout the watershed.

In particular, valley forests²⁰ fulfill many functions, such as providing habitats and migration routes for unique wildlife, supplying seeds and nutrients, and blocking solar radiation in water areas. If they are lost on a large scale, a unique ecology will be lost, thereby requiring time for recovery. Therefore, intensive logging is not recommended. In restoring the valley forests, it is necessary to nurture broad-leaves trees that have invaded nature from the perspective of improving the quality of the growth and habitat space of plants and animals in the entire riparian area, including the river system, and to induce the forest to be in a natural state over the long term.

In addition, it is important to actively promote the designation of valley forests as protection forests for fish breeding in order to conserve the habitat and breeding environment of fish.

¹⁹ FY2022 Survey Report on the Promotion of Forest Improvement and Conservation Projects (Forestry Agency, March 2023)

²⁰ Forest Management Textbook Taking Biodiversity into Consideration, Chapter 8: Conservation of valley forests (Forestry and Forest Products Research Institute, Forest Research and Management Organization, March 2020)

[Examples of biodiversity conservation approaches in forest management (positive list)]

Based on (i) to (v) above, examples of biodiversity conservation initiatives in forest improvement to enhance forest biodiversity are shown below as a positive list.

Matters	Matters to address	Common	By situation
Extensive management	Plan a layout of forests composed of various tree species, stand structure, forest age, successional stage, etc.	○	
Operation method	Perform forest management practices based on a Municipality Forest Plan.	○	
	Avoid logging in forests along mountain streams (valley forests) and areas at risk of collapse by regarding them as protective tree belts. Note that if logging must be carried out, employ logging and regeneration methods in consideration of biodiversity conservation.	○	
	Minimize the effects when passing overhead wires or skidding roads through the set protective tree belts or reserved trees.	○	
	Make a final harvesting age long.		○
	Create multi-storied forests by logging trees in strips or groups.		○
	Set and preserve protective tree belts on ridge lines.		○
	Preserve invaded broad-leaves trees to the extent not inhibiting the growth of planted trees. Leave the fringe vegetation.		○
	Leave reserved and dead trees (fallen trees and standing dead trees) and hollow trees as long as they do not hinder the safety of work.		○
	Preserve places with low economic rationality, such as a small single-tree volume or a long carrying-out distance, without logging.		○
	Limit the site clearance to the minimum amount of mowing and soil preparation required for planting.		○
	Use seeds and seedlings from a known source.		○
	In the headwaters area, use biodegradable chainsaw oil.		○
Address insect and animal damage (e.g., measures against deer feeding damage)	When new planting is carried out in forest land with a high risk of deer feeding damage, or when endangered species, etc. should be protected from deer feeding damage, install protective fences (block defense, patch defense, etc.) and single-tree protective materials (feeding damage prevention tubes, etc.), and capture (including requests for capture) deer by traps and firearms as necessary depending on the damage situation.		○
Addressing alien species, etc.	Exterminate alien species for the restoration of native vegetation. As far as possible, avoid selecting tree species to plant that are likely to have an impact on the ecosystem, etc. or cause genetic disturbance due to the introduction of organisms of the same species based on the "list of alien species to prevent ecological damage."		○

Addressing endangered species, etc.	Collect information on the growth and habitat of endangered species, etc. in controlled areas.	○	
	Consult with experts and make efforts to conserve the species if the growth or inhabitation of endangered species, etc. is “recognized.”		○
Development of forests in close proximity to human habitat (secondary broad-leaved forests, etc.)	In order to maintain the continuous use of resources in village mountains, perform regular logging and tending, and prevent deer feeding damage in order to protect plants on the forest floor and promote natural regeneration. Induce broad-leaved timber forests by actual conditions of resource utilization and tree species composition.		○
Prescribed burn	Make a plan for prescribed burn (location, time, purpose, method, fire prevention system, responsible person, etc.), and give sufficient consideration when performing it to prevent the spread of fire.		○

(2) Addressing social and economic issues

(i) Avoidance of land-use change

Diversion and development from forests to non-forests have negative impacts on biodiversity and thus should be avoided in forest management, to enhance forest biodiversity. In particular, while the expansion of renewable energy power generation capacity holds great promise for the transition to a carbon-neutral society, the development of forests as sites for such purpose may result in the loss of biodiversity. Therefore, careful attention should be paid to this issue.

On the other hand, diversion from non-forests to forests is expected to have positive impacts on biodiversity. However, it is also necessary to consider the potential negative effects, such as soil fertility decline, in performing uniform logging of early maturing trees at a short final harvesting age for biomass utilization on abandoned cultivated land, etc.

(ii) Partnerships with a variety of entities

As the profitability of forestry has been low, it is necessary to secure a stable supply of human and financial resources to implement activities that enhance forest biodiversity. In contrast, due to the movements of TNFD and the 30 by 30 target, interest in biodiversity conservation by private companies is increasing, and there are an increasing number of cases with initiatives of financial cooperation for forest improvement, as well as forest creation by companies. At the same time, there is a movement to seek timber with consideration for sustainability, including the perspective of biodiversity conservation.

In order to secure funds, it is beneficial to economically evaluate ecosystem services, such as carbon dioxide absorption by forests, biodiversity conservation, and water resource conservation, which have been regarded as external economies, and to strengthen partnerships with various stakeholders, such as companies and civil organizations. In this case, it is desirable that forestry organizations, etc. not only respond passively, but also conduct push-type information dissemination and advertising activities.

In addition, it can be expected that, by engaging in activities to enhance forest

biodiversity, forestry organizations, etc. will strengthen ties with downstream stakeholders who are highly interested in sustainability, including the perspective of biodiversity conservation, expand commercial distribution, and realize advantageous sales of produced timber.

(3) Setting, monitoring, and evaluating activity targets

As described above, the conservation of biodiversity in forests is synonymous with the fulfillment of the multifunctional roles of forests and must be implemented at the landscape level. When forestry organizations, etc. implement biodiversity conservation initiatives, it is necessary to set activity targets according to the objects to be conserved and the ecosystem services expected from forests, taking into account regional characteristics. Setting activity targets is effective not only in providing motivation and a sense of fulfillment to workforces at the site to continue activities, but also in promoting the outcomes of activities externally.

Furthermore, in order to further improve forest management standards based on the results of initiatives and to gain external evaluation through dialogue with stakeholders, it is important to run a “PDCA” cycle in which the progress of set targets is evaluated through monitoring to lead to a revision based on the analysis of results.

(i) Setting activity targets

It is important to verbalize the activity targets in an easy-to-understand manner, including the process of setting the targets, while taking into account the needs of local communities, the risk of biodiversity loss that poses a real threat, and the forest management policy that the organization is aiming for. It is also recommended that activity targets be set while recognizing the “2030 Global Targets (23 items)” of the “Kunming-Montreal Global Biodiversity Framework.” Targets do not necessarily have to be quantitative, but can be qualitative. However, it is desirable to describe specifically the area or project volume required for forest management practices if possible.

Specifically, the following examples of targets can be considered.

< Examples of forest management practices >

- Practice management of close-to-nature planted forests.
- Actively promote the introduction of multi-storied forests and long final harvesting age.
- Secure a mosaic forest ecosystem consisting of different forest ages and hierarchical structures, including a temporary grassland environment, by implementing regeneration-cutting of ○○ ha. In the former site thereof, create ○○ ha of planted forest resources by reforestation of conifers, and induce ○○ ha of natural vegetation by planting broad-leaves trees, in accordance with the geographical condition of a location.
- Induce ○○ ha of planted forests scattered or intervening in the forest environment centered on natural forests to be broad-leaved forests by clear-cutting (also contributing to the reduction of cedar pollen dispersion).

< Examples of forest protection >

- In order to conserve the microhabitats of endangered species (○○) and protect endangered species (○○), avoid the effects of human disturbance in the habitats of these species.

- Preserve the valley forest to improve the riparian habitat of native amphibians, fish, aquatic insects, and birds. Designate 〇〇 ha of protection forest for fish breeding.
- Preserve places with a risk of collapse and places with low economic rationality.
- Perform thorough extermination of alien species (*Phyllostachys pubescens*, etc.) that pose a threat to natural vegetation.
- Systematically capture deer in order to reduce their excessive browsing pressure as part of forest management.
- Develop forest environments where indicator species (native long-horned beetles, etc.) and umbrella species (golden eagles, etc.) can inhabit.
- Maintain the growth of more than 〇〇 indigenous species (arbor species, herb species) representing the natural vegetation in the region.

< Examples of improving ecosystem services >

- Secure water resource conservation through forest improvement to meet the water demand of industries located downstream.
- Provide natural environmental education, forest service industry, ecotourism, and recreation opportunities that take advantage of the rich forest environment.

< Examples of conservation of forests in close proximity to human habitat >

- Restore the village mountain environment through the development of secondary broad-leaved forests, create local industries through the utilization of unused resources, and secure materials for traditional crafts.
- Develop integrated village mountain environments in consideration of connectivity with surrounding ecosystems, such as water systems and rice paddies.

< Examples of partnerships with companies >

- Reinvest in forest improvement through premium sales of J-Credit, which generates J-Credit〇〇t-CO₂ and adds the value of biodiversity conservation.

When setting activity targets, it is necessary to include in the “Forest Management Plan, etc.” the forest layout and the policy for inducing forest types (single-storied forests, multi-storied forests, naturally regenerated forests) to achieve their expected functions.

(ii) Monitoring

Since monitoring is carried out in order to evaluate the activity targets, it is necessary to carry out both “monitoring of activity status” to record the history of operations and “monitoring of the state of forest environment” to record changes in the state of the forest environment.

“Monitoring of activity status” is to record the places, areas, methods of forest management practices, types of conservation activities, etc. regarding the activities carried out based on a “Forest Management Plan, etc.” Observation records can also be useful information for protecting endangered species, etc. and controlling deer.

“Monitoring of the state of forest environment” is to record changes in the forest environment resulting from activities, such as (a) changes in vegetation in a specific area or stand, or (b) increases or decreases in the growth and abundance of specific species or individuals as well as their frequency of appearance. Specifically, there are methods to survey a wide area by utilizing satellite images and aerial photographs, and methods to continuously survey by setting a certain survey area.

It is important to record monitoring continuously and chronologically, and it needs to

be possible to do so without excessive effort or cost. Most of the forests in Japan are private forests owned by individuals, and small and medium-sized forestry organizations, etc. entrusted with the management operation by forest owners are playing a central role in forest management. Therefore, it is necessary to adopt a method that can be implemented even by small and medium-sized forestry organizations, etc. while conducting ordinary forest management.

From this point of view, as a method to record (a) changes in vegetation in a specific area or stand, if there are changes in forest conditions resulting from the implementation of operations based on a "Forest Management Plan, etc.," there is a method to record them periodically (at least once every five years) at the designated survey points through observation by forest patrols and photographing of forest conditions.

In addition, it is conceivable to utilize public data in places where management practices, etc. are not implemented with no expectation of changes in forest conditions. As public data, it is also effective to utilize the results of the Forest Ecosystem Diversity Basic Survey, which continuously surveys approximately 15,000 forests located at a 4 km mesh interval across the country every five years.

Moreover, with regard to the method of recording the (b) increases or decreases in the growth and abundance of specific species or individuals as well as their frequency of appearance, since specialized knowledge is required for species identification, it is conceivable to utilize an application that displays the geographical distribution of specific species on a map. Furthermore, to monitor large and medium-sized animals such as mammals, there is a way to use an infrared sensor camera with an automatic photographing function. Note that regarding the accuracy of the survey results, it is important to conduct the survey to the extent that can be ascertained in accordance with the purpose of the survey. It is also effective to perform monitoring in partnership with not only forest and forestry-related parties but also local residents, urban residents, volunteer groups, private companies, etc., and, if possible, ask experts with specialized knowledge to cooperate in the survey. In addition, since the purpose of monitoring is to determine the soundness of the ecosystem as a whole, it is often more effective to target symbolic common species rather than species designated as endangered.

In areas with deer feeding damage, etc. the negative impacts on biodiversity are considered to be particularly large. Therefore, it is necessary to continuously monitor the impacts of deer based on plant coverage and feeding traces.

(References) Reference literature on monitoring damage by deer

- Judgment of risk of damage by Sika deer in reforested areas - Shikoku version - (Shikoku Branch, Forestry and Forest Products Research Institute, April 2017)
https://www.ffpri.affrc.go.jp/skk/kenkyushokai/kenkyuseika/documents/nihonnzika_higaikikenndo.pdf
- Assessment and evaluation of damage by Sika deer in forest areas (Forestry Agency, 2016)
https://www.rinya.maff.go.jp/j/hogo/higai/pdf/7_siryou6.pdf

In particular, it is necessary to continuously check the status of forest regeneration when aiming to induce broad-leaved forests by natural regeneration after regeneration-cutting.

(iii) Evaluation of activities

In evaluating activities, it is necessary to judge whether the activities based on the "Forest Management Plan, etc." are being appropriately implemented, and whether the

forest environment is being maintained and managed according to the “Forest Management Plan, etc.,” in light of the results of monitoring.

If it is difficult to achieve the activity targets, it is necessary to analyze the causes and lead to a revision of the “Forest Management Plan, etc.”

In the process of inducing the target image of forests, there is a possibility that forests are being affected by natural disturbances such as meteorological disasters, as well as bird and animal damage. Therefore, it is important to recognize that the initial “Forest Management Plan, etc.” may not proceed as planned and to rather revise the “Forest Management Plan, etc.” flexibly. To this end, it is effective to continuously monitor the forest environment and to employ a method of adaptively reviewing forest management based on the results (adaptive management).

It is important not only to use the evaluation results of activities internally to improve one’s own forest management, but also to disclose information externally to gain social evaluation. This will facilitate the acquisition of external funds, including financial cooperation for forest improvement and ESG investment by private companies. It is also expected to link with downstream companies that disclose financial information based on the TNFD recommendations in the supply chain.

(4) Addressing global warming and climate change

As climate change is a significant risk factor for biodiversity loss, the loss of forest ecosystem soundness can also become a factor that threatens the stability of forestry management. At present, as natural disasters with extreme events increase, the intensity of ecosystem disturbances, such as the collapse of mountainous areas, tends to increase. It is also suggested that there is a possibility of the decline of Japanese cedar forests due to the atmosphere drying and the increased water stress, in addition to the increase in pine wilt damage caused by the pine wood nematode, which is an alien species. Other potential risks associated with rising temperatures include increased uncertainties about the amount of standing tree growth, seasonality of tree physiology, volume of available water resources, the scale and frequency of forest fires, and the type and extent of damage from forest pests and diseases.

As stated in the Climate Change Adaptation Plan (decided on by the Cabinet in October 2021), the basis of adaptation measures in the field of natural ecosystems is to grasp changes in ecosystems and species through long-term continuous monitoring and other surveys, as well as to focus on stress caused by factors other than climate change, and to conserve and restore healthy ecosystems that are highly adaptable to climate change by reducing stress and building ecosystem networks with protected areas.

As the impacts of climate change are inevitable, ecosystem conservation itself is an adaptive measure to the future uncertainty of forestry. Therefore, monitoring becomes also important as risk management for the continuity of sustainable forestry management.

6. Roles of the national, prefectural, and municipal governments

It is important for the national, prefectural, and municipal governments to cooperate and support the initiatives of forestry organizations, etc. in conducting forest management in harmony with biodiversity conservation.

It is important for the national government to disseminate examples of advanced initiatives, provide useful information and technical advice, etc., and promote the

preparation of Forest Management Plans based on these Guidelines so that initiatives based on these Guidelines can be expanded. In addition, in implementing forest management at the landscape level, partnerships between national forest-related stakeholders and private forest-related stakeholders shall be promoted.

In Regional Forest Plans and Municipality Forest Plans, it is desirable that prefectural and municipal governments provide technical advice to forestry organizations, etc. aiming to prepare Forest Management Plans and register as nature symbiosis sites, by clearly presenting methods of forest management practices that give consideration to biodiversity conservation, as well as forest areas that are required to territorially exercise biodiversity conservation functions, such as valley forests, in light of on-site needs.

In local governments that have established a “Support Center for Regional Cooperation Activities on Biodiversity Conservation” as a base for mediating coordination and cooperation among entities and providing necessary information and advice, their networks are enhanced by promoting cross-sectoral initiatives using such existing systems, and they are expected to efficiently obtain information on the growth and habitat conditions of rare and endangered species, for example.

Moreover, fostering general forest supervisors (foresters) who support the formulation of Municipality Forest Plans, forest management practice planners who play a central role in the preparation of Forest Management Plans in line with Municipality Forest Plans, and forest management planners who practice sustainable forest management will contribute to the promotion of appropriate forest management practices also from the perspective of biodiversity conservation.