SUNTORY

Suntory Natural Water Sanctuaries:

Biodiversity restoration report

ACTIONS

ACTIONS

Introduction

➤ To the FACT Introduction

How this "Biodiversity restoration report" is structured

This report comprises an **ACTION section**, which outlines the activities that Suntory is taking to revitalize biodiversity, and a **FACT DATA section**, which presents information from surveys etc. relating to these activities. As shown below, links connecting these sections have been placed at the top left-hand corner of each page.

- **Example of a link connecting the sections**

ACTION 1 ➤ To the FACT 1

Data relating to the ACTION 1 activities can be viewed in FACT 1

- **Explanation of the icons that are shown on the top right-hand corner of each page**

This report is presented as a PDF with interactive functions.

A	F	◀	Page	▶
To the top page of ACTION	To the top page of FACT	To the previous page		To the next page

When considering Mother Earth's environmental issues, one school of thought that has risen to prominence worldwide is being "nature-positive."
To create a sustainable society capable of coexisting with nature, it is not enough to merely reduce our environmental impact, as we've believed in the past.
The idea that we must be more proactive in restoring nature has received a huge increase in support recently.
Making this idea a reality will require as many companies as possible to tackle the task of nature restoration, and each company must address the challenge at home, through the fields in which it is most closely involved.
For Suntory, that is sustainably preserving our water resources.

Our water-positive initiative: Suntory's Natural Water Sanctuaries

Suntory is a company built on water. Our beers, our whiskeys, our soft drinks: almost all our products start with quality spring water—natural water— as their primary ingredient.
In other words, natural water is the lifeline of Suntory's business.
Isn't it only natural, then, that we protect that lifeline?
Therefore, we've launched the Suntory Natural Water Sanctuaries Initiative: an initiative to recharge the groundwater in our water-conservation forests and the surrounding wetlands, grasslands, and winter-flooded farm fields.
The forests and other lands we maintain currently cover approx. 12,000 ha.
Our original goal was to utilize forestation to recharge double the amount of groundwater drawn by our factories— a goal that has already been comfortably surpassed.

Suntory Natural Water Sanctuaries:
Approx. 12,000 ha in 21 locations and 15 prefectures across Japan
Recharging more than twice the amount of groundwater drawn by Suntory Group's Japan factories (as of June 2022)

ACTION 1

➤ To the FACT 1

Forest thinning

Controlled forest burns

Winter-flooded farm fields

Restoring biodiversity in a variety of ecosystems is an effective means of achieving nature positivity. The grass-lands, wetlands, and winter-flooded farm fields surrounding our Natural Water Sanctuaries are also maintained as a part of this initiative.

We do not consider our Natural Water Sanctuaries as part of our volunteer efforts. These sanctuaries are central, prioritized project for the Suntory Group, and is key to supporting water sustainability—the lifeline of its business activities. The goals of this initiative for our forests can be broadly categorized into five types:

+ **Forests that function effectively as watershed protection forests**
+ **Forests that offer abundant biodiversity**
+ **Forests that offer protection against flooding and sediment disasters**
+ **Forests that absorb great amounts of CO_2**
+ **Forests that are beautiful and allow us to enjoy nature's abundance**

Another defining aspect of our initiative is forest maintenance grounded in science. At the beginning of the project in the year 2000, when planning began, the exact scientific foundation required to determine the type of forest maintenance that would be the most useful for groundwater replenishment was unclear. Subsequent collaborative research with experts in a variety of forest- and water-related disciplines clarified that cultivating healthy forest soil and appropriate control of evapotranspiration are key to groundwater replenishment.

Restoring biodiversity comes down to these two key points.

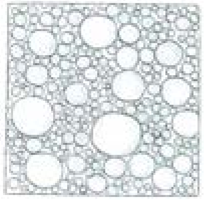
WATER-POSITIVE = NATURE-POSITIVE

Suntory Natural Water Sanctuaries
https://www.suntory.co.jp/eco/forest/

ACTION 2 ➤ To the FACT 2

The key to water-source conservation: Protecting and cultivating healthy forest soil

In poorly maintained planted forests, the softer soil is lost and the surface hardens, preventing rainfall from infiltrating the ground. In heavy rain, the water just runs along the the ground's surface, causing further erosion and muddying streams. In severe cases, it can cause flooding downstream.



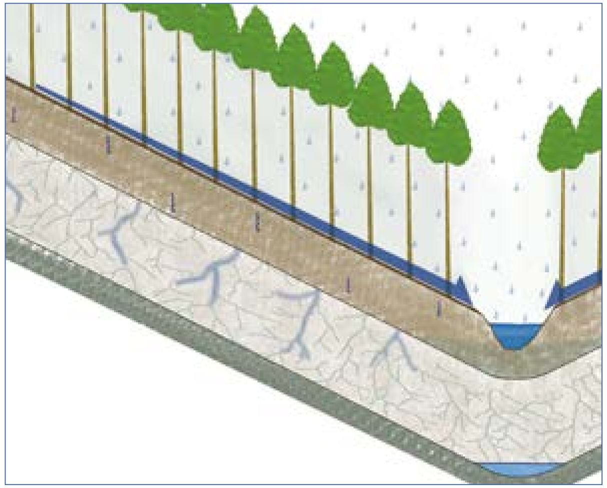
Unforested, inorganic soil consisting only of sand and clay.

Soil from a forest that supplies organic matter such as fallen leaves and grass. Small animals and microbes help aggregate the soil and give it a soft texture. The soil then acts as a sponge to absorb rainwater, making it a more effective microbial purifier.

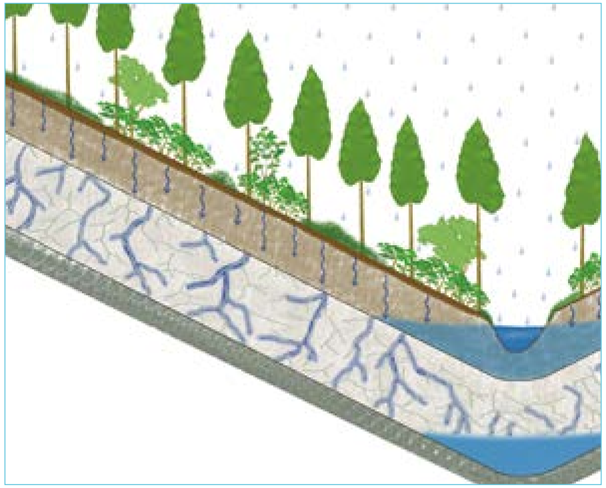
Conversely, in forests where healthy soil has been protected, the earth is soft with numerous pores and spaces to soak up rainfall gently, like a sponge. This allows the water to infiltrate deep into the soil. Healthy forest soil acts as a gateway for water, guiding it to deep within the earth.

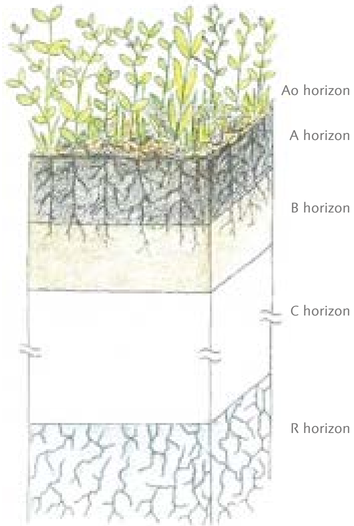
Flood damage

Poorly maintained planted forest



Forest where healthy soil is protected





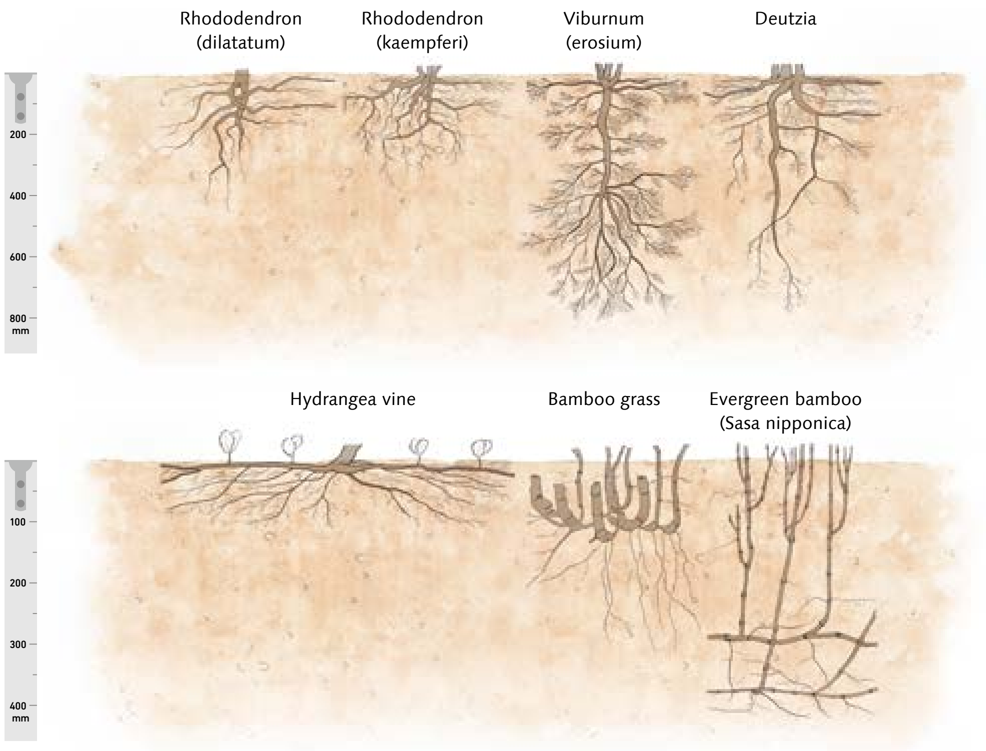
It is important to cultivate a spongy A horizon

ACTION 3 ➤ To the FACT 3

The many little friends who pitch in to help create soft soil

Soil cultivator #1: **Tree and plant roots**

Forests are filled with a diversity of life, and their soil is interwoven with a network of roots from a rainbow of plants. The smaller, finer rootlets at the tips of these roots dry up in winter and regrow in spring. This cycle slowly cultivates the surrounding soil. The roots also proactively extract nutrition to attract the fungi and bacteria that protect them. The lifeforms that are attracted differ for each plant; therefore, the greater the diversity of plant life in a forest, the greater the microbial diversity in its soil.

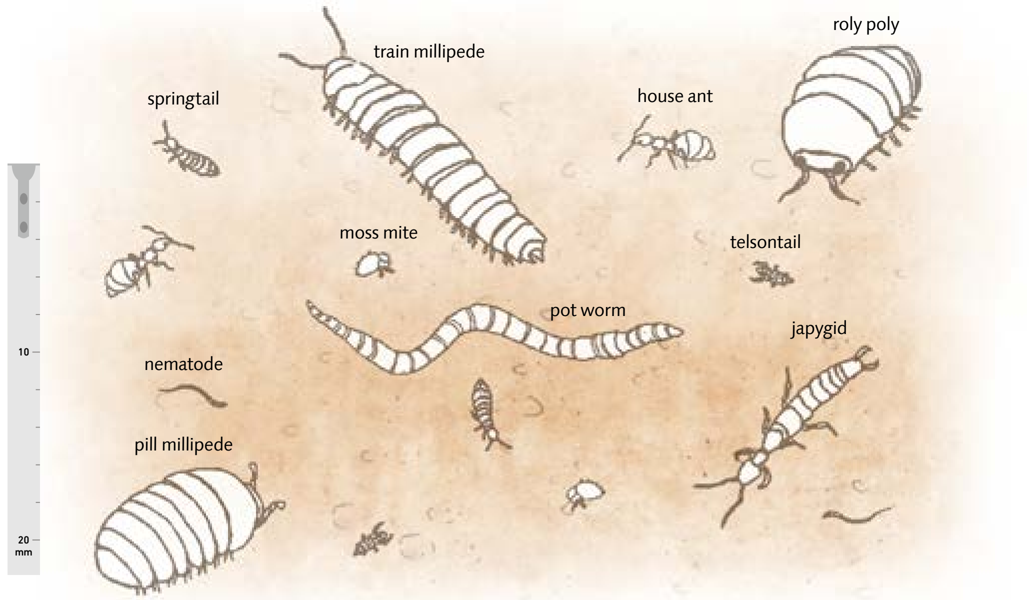


Soil cultivator #2: **Microbes and soil life**

In late autumn, fallen leaves and twigs pile up on the forest floor, providing food for soil life, including mushrooms, molds and microbes, earthworms, and springtails. The activity of these lifeforms, in turn, provides gentle cultivation for the soil.

The soil life multiplies and helps remove impurities from rainwater and animal droppings and carcasses. The soft soil provides not only an entrance through which water can infiltrate the ground but also a mechanism for biotic purification.

Cultivating forests to protect the future of our water means working together with a variety of plant and animal life to create forests that cultivate rich, soft soil.

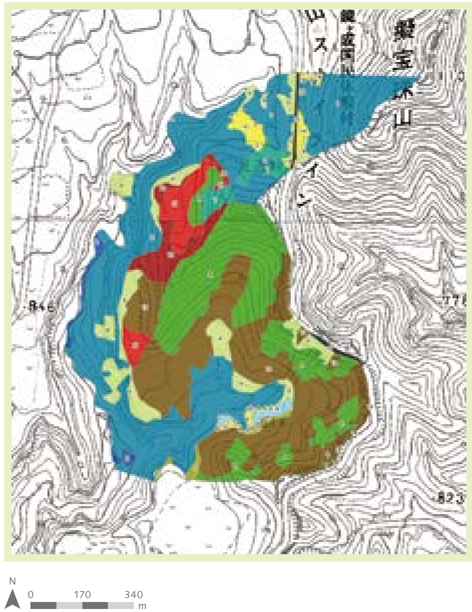


ACTION 4 ➤ To the FACT 4

Maintaining Natural Water Sanctuaries begins with plant biodiversity surveys

The map below represents our Natural Water Sanctuary at Oku-Daisen. The colonies and communities in the legend represent smaller "biodiversity pyramids." Each of these smaller pyramids boasts its own assortment of plant life, its own community of insects and animals who eat those plants, and its own networks of birds and carnivores who eat those insects and smaller animals. Combining the smaller pyramids yields the great mountain of life at the Natural Water Sanctuary at Oku-Daisen.

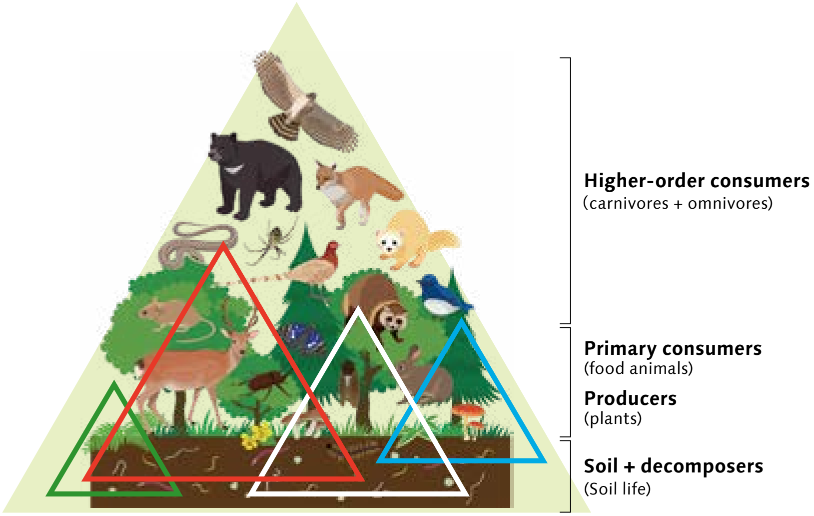
The smaller pyramids frequently have missing parts, including plants that were originally present but are now sorely missed. We are taking a close look at these smaller pyramids and promoting the recovery of any missing plant life. Enhancing the biodiversity of a habitat's plant life will also enhance the biodiversity of the animal life that calls it home.



Legend

- 1. Natural shrub communities
- 2. Sword fern-Japanese wingnut group
- 3. Japanese beech-spicebush group
- 4. Chestnut-Mongolian oak community (bladed)
- 5. Chestnut-Mongolian oak community (non-bladed)
- 6. Sweet oak-chestnut-Mongolian oak community
- 7. Maple community (bladed)
- 8. Maple community (non-bladed)
- 9. Himeyashabushi community
- 10. Japanese larch community (bladed)
- 11. Japanese larch community (non-bladed)
- 12. Cedar community
- 13. Hinoki cypress-koshiabura community
- 14. Chishima bamboo-broadleaf bamboo community
- 15. Road

Ecosystem pyramid



% of plant life surveyed:

78%

* Approx. **100%** not counting university research forests

Rare plants identified in the Natural Water Sanctuary

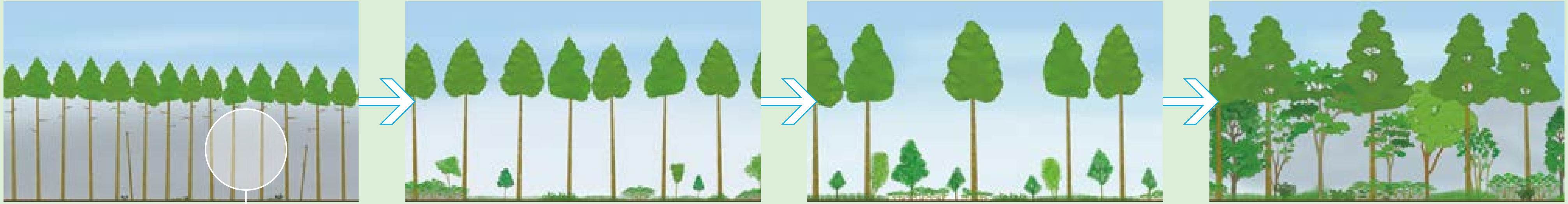
Ministry Red List:
31 species
Prefectural Red List:
130 species

136 total

ACTION 5

➤ To the FACT 5

Case study: Creating a rich, healthy mix of broadleafs and conifers through careful thinning of neglected planted forests



Neglected, the planted forest grows dark

Thinning allows light to enter, promoting understory growth

A second thinning promotes further understory growth

An overstory of large conifers + a midstory and understory of broadleafs: the first step toward a healthy mixed forest of conifers and broadleafs

Inside a neglected planted forest

Many Natural Water Sanctuaries are at high elevations and have many areas where it is exceedingly difficult to cultivate cedar and cypress. This leads to planted forests being abandoned and unmaintained. When these poorly maintained forests are suddenly clear-cut, or when broadleaf trees are planted instead, it can increase the risk of landslides.

Conducting careful, diligent and periodic thinning of these forests can—slowly, and over time—produce balanced forests with overstories of large coniferous trees mixed with mid- and understories of broadleafs. This ultimately leads to forests with a rich, healthy mix of conifers and broadleafs.

The ideal: a mixed forest of conifers and broadleafs

Logging roads:

110,212m (as of June 2022)

Logging roads are an essential part of forest management. At Suntory, we endorse Oohashi- and Tanabe-style logging roads that are durable, long-lasting, and minimize environmental burdens, and we use our Natural Water Sanctuaries to help train young engineers and technicians.

The front line of forestry: creating mixed forests
https://www.suntory.co.jp/eco/forest/protect/works.html

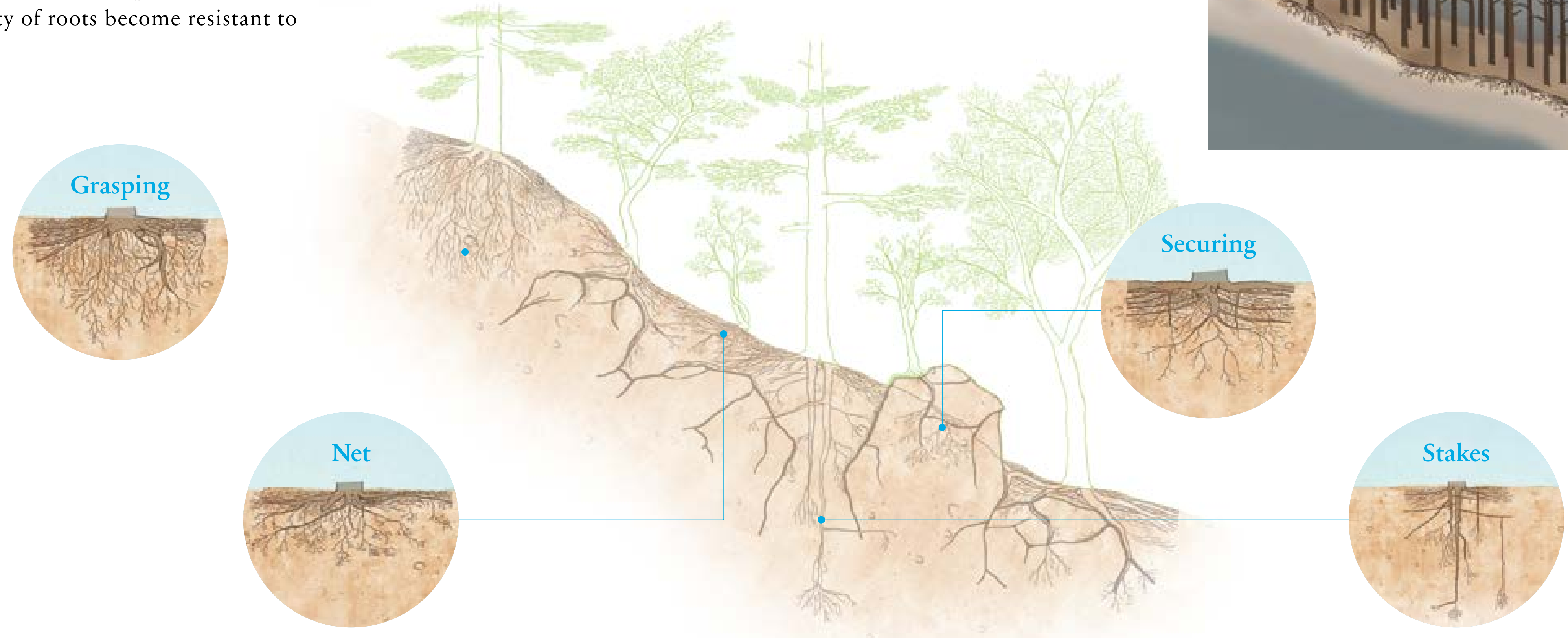
The front line of forestry: creating environmentally friendly logging roads
https://www.suntory.co.jp/eco/forest/protect/guide.html

ACTION 6 ➤ To the FACT 6

Case study: Using tree roots to reduce the risk of slope failure

Strengthening slopes requires a variety of root shapes

Root shapes differ by species. Thick tree roots that grow straight down act as stakes that help secure the slope. Tree roots that spread out horizontally act as nets over the surface of the soil. Finely spreading tree roots grasp the earth firmly, while roots that wrap around stones help stabilize these stones on the slope. In this manner, slopes that host a variety of roots become resistant to failure and are more effective at preventing floods and landslides. Conversely, as shown in this illustration, a slope covered by a dense monoculture of one species of tree with shallow roots is highly prone to sudden failure in heavy rains or typhoons. We believe that in the natural world, complexity is strength—and that means that restoring biodiversity is vital.



ACTION 7 ➤ To the FACT 7

Case study: Growing and planting local seedlings carefully selected down to their DNA

Planting trees in a natural water forest starts with collecting seeds from the surrounding trees. Importing seeds from outside the drainage basin, even if they are the same species, has a negative impact on biodiversity. Preserving seed traceability is our priority.

Employee tree festival

A variety of seeds collected from a natural water forest

Seedling garden with traceability in mind

Regreening deforested land with local seedlings

ACTION 8 ➤ To the FACT 8

Case study: Coping with the pressures of deer foraging at the base of the pyramid

One of the biggest challenges for our Natural Water Sanctuaries comes from foraging pressures from deer. As shown in these photos, many forests have had their surface vegetation completely devoured by deer, leading in some places to severe soil runoff. The deer begin by feeding on delicious grasses, but then proceed to eat even poisonous plants. As the number of plant species consumed by the deer increases, the insects, birds and animals who rely on them disappear.

For example, when bamboo grass is depleted, Japanese bush warblers, Japanese robins and Siberian blue robins vanish as well.

Therefore, we erected fences in select places prone to landslide hazards or where essential plants grow to preserve the resources within for future use as a gene bank. We also always use fences during tree planting and periodic forest thinning to avoid providing deer with an excess of food. Without fences, all plant life is at risk from overgrazing, leading to an explosion in the deer population.

The ground outside these fences is covered with vegetation that is not to the deer's liking to prevent sediment loss and slope failure. It is fundamentally necessary to keep deer population density at a reasonable level. However, as it can be difficult for a private enterprise to implement these projects in an optimal manner, we work to involve the national and local government in aspects of the project. Incidentally, even Japan's Ministry of the Environment is in the process of switching from a policy of pure conservation to population management; however, public awareness of this shift in perspective is still incomplete.

Broadleaf forest ravaged by deer, with not a blade of grass to be found

A conspicuous difference is apparent between the area outside the fence (left of photo) and inside

Securing our fences requires a variety of tricks

1. Spots over which deer could jump or step are raised up
2. Net skirting prevents deer from running up to the fences
3. Stumps are cut to the ground so that deer cannot use them as pedestals
4. Fences are secured with metal stakes in valleys so that deer cannot slip under them

Forests where the deer population density is capably managed demonstrate forest-floor vegetation recovery both inside and outside the fencing

Vegetation-protection fencing:

30,576m (as of June 2022)

ACTION 9 ➤ To the FACT 9

Case study: Controlling pest damage

“Are all insects that cause trees to wither harmful?”

This question frequently comes up regarding oak wilt. The oak ambrosia beetle, which causes oak wilt, is native to Japan; felling larger specimens of konara oak and Mongolian oak promotes new forest growth.

Currently, members of the beech family, including the aforementioned konara oak and Mongolian oak as well as the sawtooth oak, comprise a particularly high percentage of trees in broadleaf forests near human habitation in Japan. These trees were originally grown for firewood and charcoal and used and consumed on a 10-to-20-year cycle; therefore, they were rarely allowed to grow especially tall. After WWII, however, as Japan switched to electricity and gas and charcoal and firewood were subsequently phased out, these trees were allowed to grow unchecked—an unnatural circumstance.

From the beetle’s perspective, giant specimens of the beech-family trees in which it lives have popped up across Japan. The beetle’s simple pursuit of habitat has resulted in the spread of oak wilt disease.

For communities first encountering oak wilt, the disease is cause for concern and sorrow. However, oak wilt does not wipe out every specimen of a species; it just provides an appropriate amount of culling. Thus, from a biodiversity perspective, it might well be considered a positive.

Conversely, trees extensively bored by the oak ambrosia beetle cannot be used for lumber. Therefore, thicker trees are culled in advance before the beetles can proliferate, then a variety of seedlings are planted where they once stood to increase biodiversity.

1. Oak wilt strikes: konara oak and Mongolian oaks see their leaves suddenly turn brown in midsummer, and the trees wither
2. Planting a variety of trees in the wake of culled Mongolian oaks
3. Large amounts of sawdust from holes bored by the oak ambrosia beetle
4. To prevent the beetles from spreading, trees are taped up to capture adult beetles as they emerge the following year; this is a somewhat effective tactic for preventing the beetles from spreading as much as possible
5. Culling large Mongolian oaks at Oku-Daisen before the beetles can devour them
6. Whiskey barrels made from culled Mongolian oak

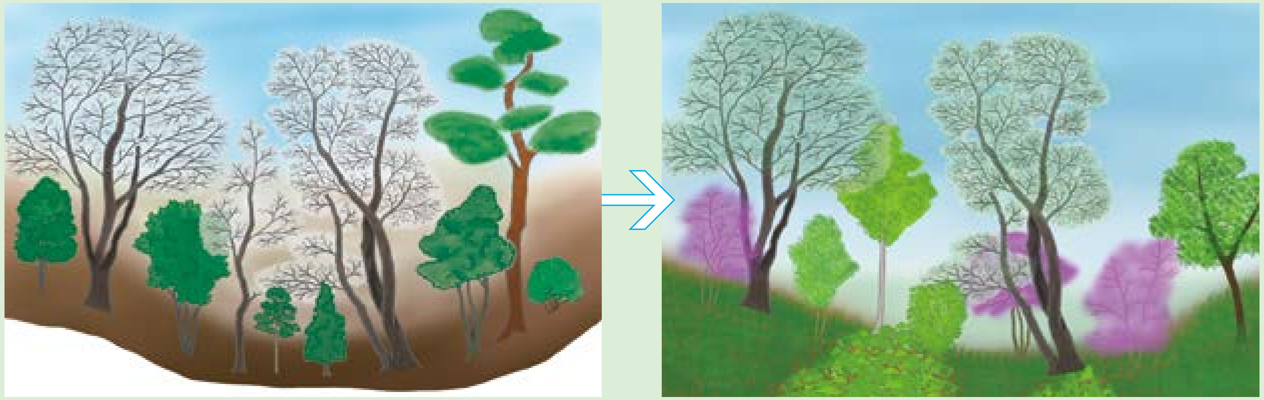
The front line of forest stewardship: counteracting oak wilt
https://www.suntory.co.jp/eco/forest/protect/naragare.html

Filling the gaps in the pyramid

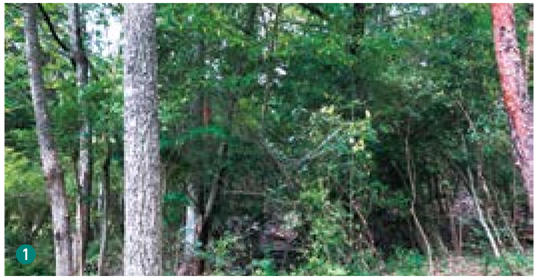
ACTION 10 ➤ To the FACT 10

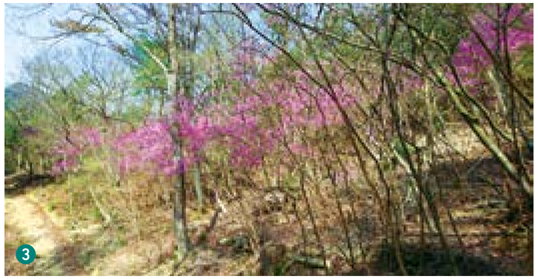
Case study: Protecting deciduous broadleaf forests from conifer invasion

For centuries, Japan's *satoyama* woodlands—woodlands in mountain foothills adjacent to settlements in rural valleys—have been preserved as bright, lively spaces. They have served as sources of firewood, charcoal, humus and cuttings for fertilizer, mushrooms, edible wild plants and more. Of course, evergreens such as East Asian euryas, Japanese blue oaks and camphor trees would also sprout in these forests from seeds brought by birds and other methods, but these were typically cut for firewood or kindling when they were still small and therefore were not allowed to overtake the forests' broadleaf mainstays. This style of forest management has long allowed *satoyama* woodlands to remain filled with natural sunlight and maintain healthy ecosystems hosting unique plant life. However, as populations left the mountains and these woodlands were abandoned and left unmanaged, the unharvested evergreens grew unchecked, eventually blocking out light from the forest floor. Ecosystems that were maintained for centuries began to vanish from lack of light, creating a biodiversity crisis.



Culling evergreens—large and small alike—that have infiltrated deciduous broadleaf forests allows sunlight to again reach the forest floor.
This allows the trees and grasses unique to sunlit forests to start to recover, biodiversity to revive, and seasonal color to make a comeback.





1. A dark forest, prior to maintenance
2. As part of HR enrichment, Suntory Holdings employees enter a Natural Water Sanctuary and participate in hands-on forestry training. Even amateur foresters can easily help cull the evergreens, making it a popular choice for a main training program
3. Rhododendrons revived after maintenance

Employees trained:

7,822

(as of June 2022)

Suntory's Natural Water Sanctuaries: Employee Hands-on Forestry Project
https://youtu.be/0Orl4s6jn3c

ACTION 11 ➤ To the FACT 11

Case study: Reclaiming forest thickets from encroaching bamboo

The issue of bamboo groves encroaching on surrounding forests and exhausting their supplies of water is becoming a hot topic across Japan. Furthermore, bamboo roots are shallow, putting the steep slopes across which they spread at higher risk of failure. Clear-cutting shoots in the summer growing season has proven effective in the past at holding bamboo in check. However, in the natural water forests of Honshu, cutting underground bamboo during the winter, when they are dormant, has also yielded results.

If the bamboo are cut in winter, then the underground stalks begin pumping out sap once they're awakened at the beginning of spring, exhausting the sugars they've stored and drying the bamboo up. Leaving the bamboo alone during its dormant season allows sap to rise and new shoots to grow, rendering culling pointless. It should be noted that this approach is not successful in warmer Kyushu, where the stalks do not go dormant.

Slender grass-like structures will subsequently sprout, but these can be cleaned out easily with a few passes of a weed trimmer.

Bamboo encroach on the surrounding forest, drying it up

Bamboo logged at waist height in winter

A few years after logging and planting

Suntory Natural Water Sanctuaries: The challenge of bamboo
https://youtu.be/-4-_QoM1pQI

Filling the gaps in the pyramid

ACTION 12 ➤ To the FACT 12

Case study: Wetland restoration

Rice paddies represent one of Japan's most vital forms of wetlands. At our "Natural Water Sanctuary in Aso", forests, rivers and rice paddies have been maintained as one as part of a new approach to headwater conservation: one based on the idea that taking care of the upstream forests and river increases wintertime river flow and allows to percolate water to underground from the rice paddies in the alluvial fans. We also hope to convert the rice paddy cultivation method to organic farming when possible, and we are working with local farmers to develop new technologies to revive the variety of organisms in rice paddies to reduce pests and diseases with their help.

Efforts to increase biodiversity in winter-flooded paddies

Biannual lifeform surveys with local elementary schools

Establishing a biodiversity canal

Peatland restoration activities in Scotland (Peatland Water Sanctuary)

Suntory Holdings and Beam Suntory have jointly launched an initiative to restore and conserve peatlands in Scotland. This is to ensure the sustainability of peat which is essential for adding the distinctive smoky flavor to whisky, and sustainability of peatlands which are also important as a source of water for whisky production. Peatlands are crucial both as a carbon sink and as a habitat for animals and plants unique in such ecosystems. Suntory has made a commitment to achieve the restoration and conservation goals of 1,300 ha of peatlands by 2030 in order to maintain the sustainability of peat used by the Suntory Group, with even more ambitious targets to be achieved by 2040.

Peatland to be restored and conserved:

By 2030: 1,300ha

By 2040: An area of peatland capable of producing double the peat used by Suntory

Peatland covered with heath and cotton grass.

Traditional hand-cutting of peat for whiskey (hand-cutting is rarely practiced commercially nowadays). First, the surface vegetation is stripped and set aside; once the required depth has been harvested, the stripped vegetation is returned to its bare surface. Successfully restored peatlands can accumulate peat at a rate of 1mm a year; therefore, assuming an average depth of 60cm of peat is harvested, restoring and conserving 600 times of the area harvested in a year, would ensure sustainability (restoration methods vary as each restoration site has different site conditions).

Natural Water Sanctuaries: the Kumamoto earthquake and the winter-flooded paddy restoration project, Part 2
https://youtu.be/R2BkQk4FHnM

Filling the gaps in the pyramid

ACTION 13 ➤ To the FACT 13

Case study: Reviving grasslands

One plot of the natural water forest at Oku-Daisen, which is semi-natural grassland once used as hay fields and grazing land for army horses, is hosting an experiment to determine which of a variety of approaches to grass management is most effective at improving biodiversity. The experiment examines burning plus mowing at various heights: high, low and not at all. An initiative was also launched to propagate the Golden lace plant, which is needed to reintroduce the butterfly *Melitaea protomedia*, a critically endangered species that is facing extinction as its grassland habitat shrinks across Japan.

Furthermore, in areas stricken by an expanding epidemic of oak withering and overrun by clusters of broadleaf bamboo in the former grasslands and pastures of what was once the Higashiyama Ranch, there are plans to cull the Mongolian oaks and bamboo to revive the grassland habitat. This area might once again serve as a hunting ground for the nearby Golden Eagle, which requires open spaces to hunt. Preserving and reviving grassland environments is critical to avoid the extinction of these eagles.








❶ Cutting pampas grass ❷ A controlled burn ❸ Golden lace ❹ *Melitaea protomedia* ❺ Cutting Mongolian oaks ❻ Mowing broadleaf bamboo ❼ Revived clusters of thistle after maintenance ❽ A Golden Eagle builds a nest nearby

ACTION 14 ➤ To the FACT 14

➤ To the FACT 14

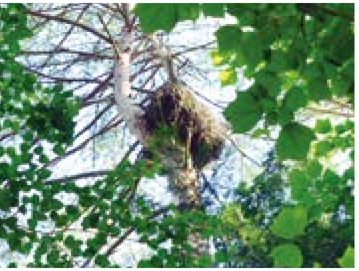
Case study: The pyramid's pinnacle - protecting umbrella species


Northern goshawk

Projects to support breeding by eagles, hawks and falcons

Our Natural Water Sanctuaries are home to an initiative to protect the raptors at the pinnacle of the biodiversity pyramid. For these “umbrella species” to thrive, they must have sufficient prey, and so must their prey, and so on down the line. Environments that support this food chain must be protected. Thus, for the pinnacle of the pyramid to breed and thrive, the entire pyramid must be protected. In this sense, policies to protect biodiversity in the Natural Water Sanctuaries also serve to preserve raptors.

There is, however, one large problem: a housing shortage. The pine forests where raptors such as the northern goshawk like to nest are withering from pine wilt; even if the pine forest survives, the broadleaf trees that spring up from beneath the pines can grow to cover up pines suitable for nesting. Furthermore, owls require hollows in large trees for nesting, but there may be few trees large enough to suit the purpose. That’s why we support their nesting efforts through initiatives such as maintaining pine forests suitable for northern goshawks and building nesting boxes for owls.


Old northern goshawk nest


Northern goshawk chicks


A pair of Mountain Hawk-eagle preparing for breeding


An old nest lies in the center tree; however, the growing broadleaf trees get in the way, making the nest unusable. The interfering broadleaf trees are therefore removed, creating space for hawks to fly in and return to the area.


The owl nesting boxes are the size of a doghouse. Perhaps due to the housing shortage, approximately 50% are occupied.

Raptor nesting confirmations:

103 across 8 species

Suntory Natural Water Sanctuaries: Eagle, hawk, and falcon breeding project: Satoyama
https://www.youtube.com/watch?v=D2lzjgRAUx4

ACTION 15 ➤ To the FACT 15

Case study: Cultivating forests with the help of smaller birds

Surveying wild birds as a barometer of the environment

Birds have wings; therefore, if their environment degrades even a small amount, they fly away, whereas if it improves, they return. Thus, wild birds can serve as a barometer of the environment. Moreover, as birds can be identified by their calls, surveys can still be conducted in places such as deep forests where visual identification is not always possible. Therefore, we continuously conduct wild bird surveys in all our forests and use the information to assist in forest maintenance.

Working with wild birds to cultivate the forests

Despite this, we do not plant many of the trees that grow berries and fruit eaten by smaller birds in the Natural Water Sanctuaries. Why is that? Well, many smaller birds swallow their fruit whole—which leads to the seeds being distributed and planted along with their droppings. The photos in the upper-right corner show a forest several years after the culling of poorly performing hinoki cypress. As you can see, the forest floor is covered with broadleaf trees—the ground is barely visible. It is impossible for so many seeds to be sown by human hands. Thus, about half the saplings likely sprouted from seeds scattered by birds.

Seeds sown by birds, known as "buried seeds" can lie dormant in dark places year after year, then all sprout simultaneously once an opportunity arises, for example, after periodic forest thinning and the increased light that follows. Some seeds carried by the wind, such as maples, have a similar ability. A surface that is covered with seedlings after being thinned is most likely the result of this process: several years' worth of dormant seeds sprouting all at once.

Koshiabura, Gray's chokecherry, spicebush, scarlet-leaved viburnum, and other trees whose seeds were sown by birds

Using the power of birds to cultivate forests yields woodlands suited to the birds' tastes far more quickly than through human efforts.

The same could be said for all species: microorganisms and the smaller creatures of the soil; grasses and trees; insects, reptiles, and amphibians; and mammals. Natural Water Sanctuaries are the result of the collaboration of all life, and our goal is to collaborate with this larger whole to create forests that are a joy to all inhabitants. The future of water and life depends on it.

Bird species confirmed in Natural Water Sanctuaries:

137

(14 on the IUCN Red List of Threatened Species)

Initiatives for Suntory's avian friends
https://youtu.be/GwCZbLuiEdo

➤ To the last page of FACT

Moving toward a more diverse, more beautiful world: The Natural Water Sanctuaries follow the R-PDCA spiral staircase

R

And then go back to R...
In partnering with nature, it is necessary to understand that there will always be new challenges. Preparation is required. To solve these new challenges, we must once again return to the research step. In this manner, step by step, the Natural Water Sanctuaries will climb the spiral staircase leading to a more diverse, more beautiful world.

A C

Check / Action
Continuously monitor the quadrat (study area) established in the research step to confirm the effectiveness of the plan. Assess the impact of the terrain, geological features, the microclimate, etc. Discontinue or course-correct plans proven uneffective in the small experimental plot; expand the usage of plans clearly proven effective.

D

Do
Follow the solution strategies in implementing maintenance activities.
For plans whose effectiveness is unproven, first run an experimental test on a small plot of land, then expand the implementation of plans with strong results.

P

Plan
Draft multiple solution strategies for each challenge. Devising multiple plans enhances diversity.

R

Research
Understand the present situation of each community and group and identify challenges.

Maintenance of the Natural Water Sanctuaries follows the R-PDCA cycle.

The beauty of the forest: Suntory's Natural Water Sanctuaries Initiative
https://www.youtube.com/watch?v=9hJ8__xKsKc&t=4s

SUNTORY

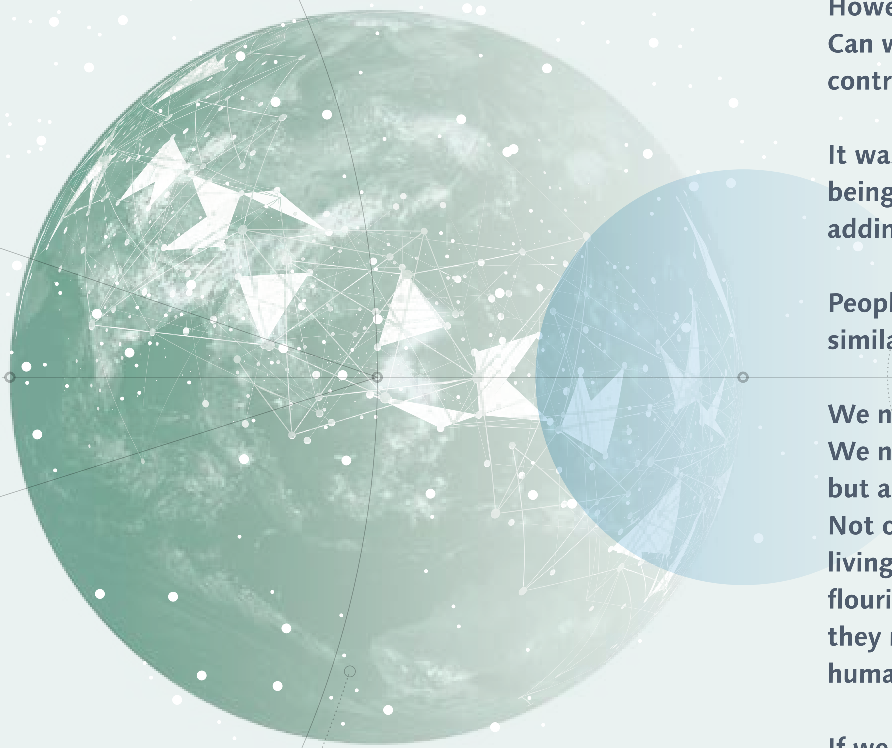
Suntory Natural Water Sanctuaries: Biodiversity restoration report FACTS & DATA

FACTS & DATA

Nature-positive 2030

Introduction

➤ To the ACTIONS Introduction



What do we need to do to save the Earth
10 years from now—100 years from now?
Reduce CO_2. Reduce trash. Reduce waste.
Yes—make no mistake, all of these are necessary.
However, will these efforts alone really do the trick?
Can we protect the future of the Earth solely by
controlling the negatives?

It was this realization that sparked the idea of
being “nature positive”: taking steps forward,
adding to the positive side of the ledger.

People all over the world are reaching
similar conclusions.

We need to go beyond net zero CO_2.
We need not only to hold deforestation in check
but also to take proactive steps toward reforestation.
Not only do we need to achieve zero extinction of
living species, but we also need endangered species to
flourish under our watch to create a world in which
they reproduce and thrive unthreatened. A world where
humanity and nature live in harmony.

If we act today, we still have time.
Probably.

However, if we put off action until tomorrow,
it might be another story.

TRANSFORMING
THE NEW FUTURE

FACT 1 ➤ To the ACTION 1

"30 by 30" Ecosystem maintenance and use in accordance with nature

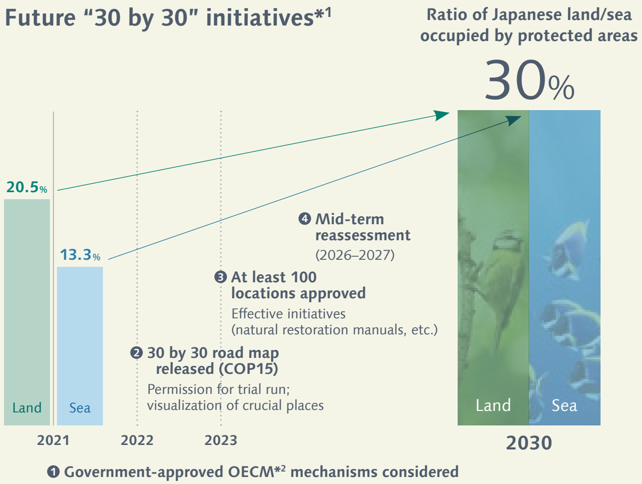
We launched our nature-positive initiative to stave off biodiversity loss and promote conservation and natural restoration. Scientific analysis makes it clear: Expanding the percentage of global land under conservation protection to 30% through the optimal broadening of protection zones will halve extinction risk. It is the business sector that will determine this initiative's success or failure. We are entering a new age of cooperation with business: one where business sustainability is strengthened through the conservation and restoration of the blessings of nature—our natural capital—and the biodiversity that is their source.

Yasuhiro Kubota
Professor, Faculty of Science, University of the Ryukyus

Earth's biodiversity is the source of the abundance we receive from the land and oceans—the natural capital that supports our very way of life. However, that biodiversity is now rapidly vanishing, a phenomenon that threatens human society itself. The cause: the negative impact of disordered economic activity on nature. Therefore, we've launched a national initiative in Japan called "30 by 30," with the goal of conserving at least 30% of our land and seas by 2030.

The point of 30 by 30 is to preserve biodiversity where it matters most by expanding sanctuary zones for priority areas, preventing species extinction and strengthening the effectiveness of preservation efforts. However, this poses a difficult problem: Many priority areas for biodiversity conservation are scattered among private lands managed by private enterprises and cities that are to many. It is difficult to establish public sanctuaries on privately owned land, or to sufficiently protect biodiversity under circumstances completely restricted by private rights. Therefore, let's take a close-up look at the role of business sector in 30 by 30. We're seeing a social transformation based on the idea that the biodiversity that shapes nature also holds up the economy. The model for this is Suntory's long-term Natural Water Sanctuary Initiative.

Future "30 by 30" initiatives*1



*1 Drafted based on Ministry of the Environment documents.
*2 OECMs: Other Effective Area-based Conservation Measures. Methods of preserving biodiversity through mechanisms other than sanctuaries. In contrast to sanctuaries and other methods that solely seek preservation at the exclusion of all other activity, these approaches deem places dedicated both to use and preservation as contributing to biodiversity.

According to analysis based on biodiversity big data, the Natural Water Sanctuaries are positioned in areas connecting the cities where people live with *satoyama* woodlands and remote mountain areas, contributing to the conservation of Japan's representative forest ecosystems. Managing the Natural Water Sanctuaries maintains water source cultivation, a vital service provided by ecosystems, and preserves wildlife habitats. Specifically, while the Natural Water Sanctuaries at 21 sites across Japan represent only 0.03% of Japan's area, they cover over 50% of Japan's native vascular plants and mammals and 17–40% of bird, amphibian and freshwater fish species. Thus, these forests massively contribute to preventing species extinction, particularly in high-priority areas such as the Aki River area in the Tokyo suburbs and Mt. Tenno in Kyoto Prefecture. The Natural Water Sanctuaries are more effective at biodiversity conservation compared with legally protected areas such as national parks scattered throughout more remote mountain areas.

Suntory's sustainability initiatives in its business activities are directly linked to the conservation of the biodiversity that creates nature's abundance. Suntory promotes using ecosystems while also conserving and restoring them. The Natural Water Sanctuaries constitute an Other Effective Area-Based Conservation Measure (OECM) toward the coexistence of humans with nature. Through sustainable use of natural capital, they foster a nature-oriented focus toward passing on our biodiversity to future generations and embody a nature-positive mindset.

Yasuhiro Kubota
Professor of science at the University of the Ryukyus. President of Think Nature Inc. Conducts fundamental research into the sources of biodiversity, from forests to coral reefs, and clarifying the mechanisms for maintaining them. Develops applied research to implement biodiversity preservation and climate change adaptation projects through scientific mechanisms, as well as promotes collaboration with government and private enterprise to implement research results in society.

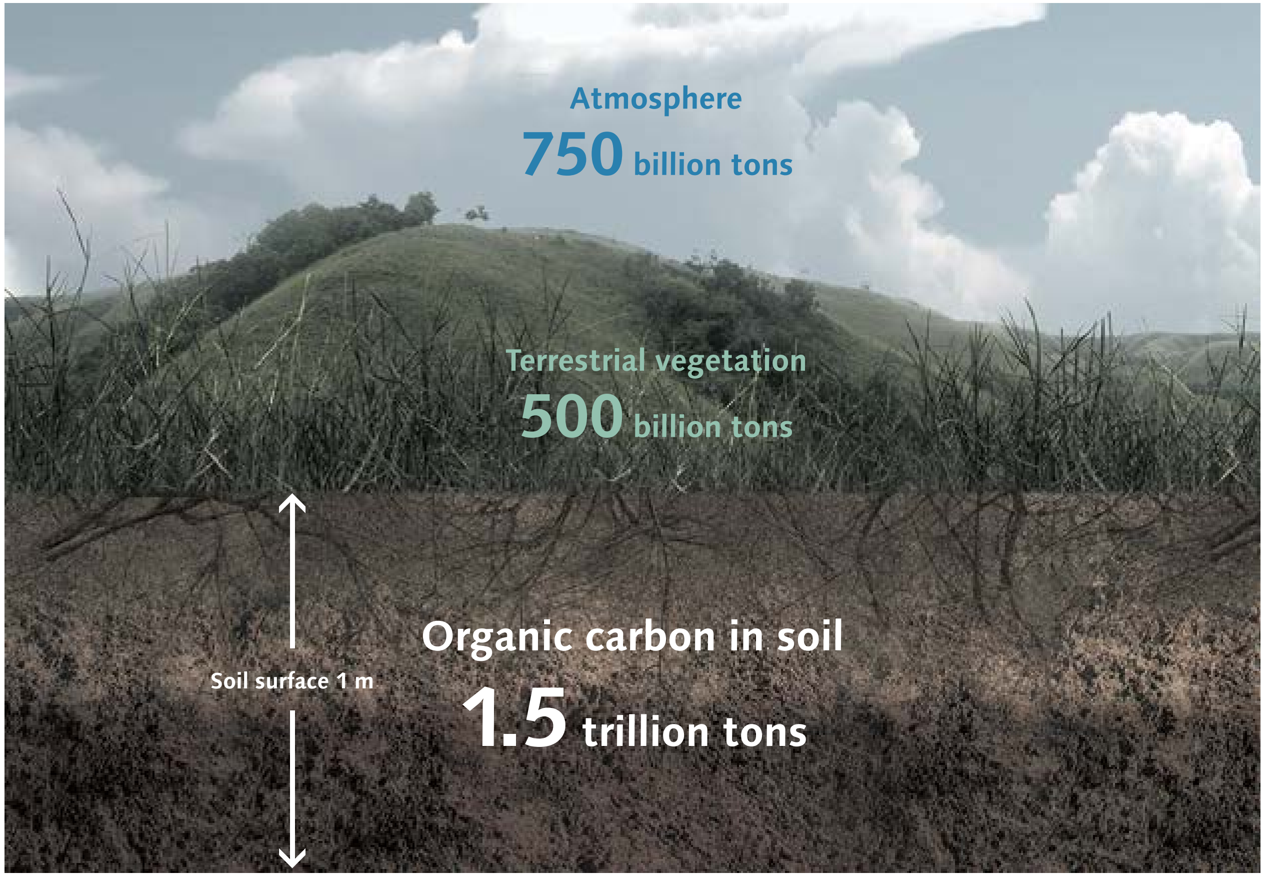
FACT 2 ➤ To the ACTION 2

Amount of CO_2 stored in organic matter in top 1 m of soil: ▷ 1.5 trillion tons

Soil deterioration includes not only degradation of soil quality—through loss of its organic carbon, nutrient imbalance, soil acidification, soil pollution, being covered by concrete or asphalt and other issues—but also erosion of the soil by wind and water. Soil erosion is attracting increased attention from the perspective of global warming prevention, particularly under the term "carbon pool."

Humic substances—refractory or decomposition-resistant, organic matter—in the top 1 m of the soil serve as a massive sink for carbon dioxide, storing a whopping 1.5 trillion tons of CO_2. That is twice the size of the atmospheric carbon pool and three times the carbon pool represented by terrestrial vegetation.

CO_2 emissions from fossil-fuel combustion generally attract the most headlines; however, soil erosion has been responsible for almost double the emissions since the dawn of history. Increasing soil carbon by 0.4% annually through forest restoration efforts to prevent soil runoff and no-till farming on agricultural land has the potential to offset atmospheric CO_2 increases.



The organic carbon in the surface 1 m of soil acts as a gigantic carbon sink. Small amounts of soil erosion can lead to massive CO_2 emissions.

FACT 3

➤ To the ACTION 3

Protecting soil biodiversity and preserving soil health

Farmers tend their paddies and fields when cultivating crops, but who looks after our forests? In our terrestrial ecosystems, soil and plants join forces to turn the sun's energy, via photosynthesis, into organic matter for microbes and animals to use. Our soils supply the plants we grow with the water and the nitrogen, phosphorous and other nutrients they need to thrive. Healthy soil sustains not only the roots of plants but the variety of microbes and animals that live there—in other words, the biodiversity beneath our feet.

Nobuhiro Kaneko
Professor, Fukushima University

Forests are filled with life. Vegetation whose green suffuses the landscape, the song of birds and chirps of insects that delight the ears, and the beasts, unseen to the eye, shaking the bushes as they run. However—though many might not realize it—a closer look at the world beneath our feet yields 10 times the amount of life, in earthworms and centipedes and other creatures of the soil than can be found among the forests' birds and beasts.

Unlike agriculture, forestry does not involve growing plants via fertilizer and chemicals. Another big difference: Forestry does not entail tilling the earth. Unplowed fields are said to harden and lose drainage capacity. However, compared to farmland, forest soil both drains and holds water superbly; it features a dramatically more efficient and sustainable production system—all through natural mechanisms.

Every year, a layer of fallen leaves covers the forest floor, and roots equal to or greater than that die to feed the soil. Plants also supply the soil through their roots with a great amount of organic matter obtained by photosynthesis.

This organic matter becomes food for the animals and microorganisms of the soil, circulating throughout the ecosystem. As the organic matter the plants discard circulates among the soil food web, the carbon it contains becomes carbon dioxide through the act of respiration, returning to the atmosphere, while the nutrients of nitrogen and phosphorous are broken down into forms that allow them to be reabsorbed by plant roots.

Not only does the soil ecosystem act as the driving force behind the ecosystem's nutrient cycling, it also serves an important role in conserving the soil structure. Microbes and animals both act to keep the soil porous. Soil organisms achieve the ideal soil texture with no muss and no fuss just by breaking down fallen leaves and tree roots without all the trouble of tilling.

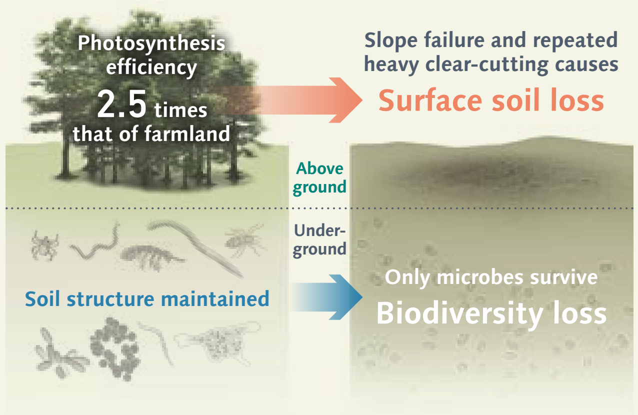
Therefore, forests represent the pinnacle of recycling systems—they take in solar energy, rain and carbon dioxide from outside the system and circulate, with high efficiency, the nutrients essential for living organisms. As a result, photosynthesis in forests is over 2.5 times more efficient than it is in farmland.

The greater the biodiversity of the lifeforms that make up the soil ecosystem, from microorganisms to earthworms and other animals, the more effective the ecosystem: the better it can maintain internal circulation and soil structure.

Human civilization has cultivated many forests. All of them provide a variety of services that only they can deliver, including climate stability; supplying water, timber, and fuel; and providing habitat for wildlife. Deforestation, air pollution and climate change all have the potential to threaten the health of our forests. However, if we preserve the soil, then even if logging is conducted, the forests will rapidly recover. Soil ecosystems are highly stable and resilient, greatly capable of protecting the environments they inhabit. However, if the soil itself is lost, if logging is too frequent and severe, or if soil biodiversity is devastated through the removal of leaf litter (as in earlier *satoyama* woodlands), then we will no longer be able to preserve our forests.

It is vital that we preserve all the soil—the entire environment in which soil life dwells—so that we may continue to enjoy the blessings of a harmonious relationship with our forests for generations to come.

Effect of agitation underground



Nobuhiro Kaneko
Doctor of Agriculture specializing in soil ecology; studies the diversity and ecosystem functioning of soil invertebrates. Author of *An Introduction to Soil Ecology: The Diversity and Functions of Soil Life*; editor of *Practical Soil Science Series 2: Soil Ecology*. Former Professor at Graduate School of Environment and Information Sciences, Yokohama National University. He has been a professor of Faculty of Food and Agricultural Sciences at Fukushima University since 2019.

FACT 4 ➤ To the ACTION 4

Number of endangered/ threatened species on the Red List 2020 ▷ 3,716

Biodiversity hotspots were originally defined by Norman Myers and his colleagues in their paper "Biodiversity Hotspots for Conservation Priorities." Approximately 50% of plants, 60% of amphibians, 40% of reptiles and 30% of birds and mammals live exclusively in biodiversity hotspots.

In 2017, there were only 36 designated biodiversity hotspots in the world, accounting for only 2.4% of the Earth's total land area. The entire Japanese archipelago is counted among them.

Hotspot Japan is rich in endemic species, with approximately 25% of its vertebrates and 75% of its amphibians considered endemic. In contrast, let us turn to the Red List 2020: a list compiled by Japan's Ministry of the Environment of endangered and threatened species in Japan, itself based on the Red List of Threatened Species published by the International Union for the Conservation of Nature (IUCN). According to the Red List 2020, Japan is also home to 3,716 endangered and threatened species: the total number of species either in great danger of going extinct in the near future (Category I, IA or IB/Critically Endangered or Endangered) or, though not as endangered as Category I, still facing an expanding threat of extinction (Category II/Threatened). Furthermore, in 2017, 56 species were added to the Red List of Threatened Species for aquatic life.

Trends in the number of Red List species

	1st ed. (1991)	**2nd ed.** (1997-2000)	**3rd ed.** (2006-2007)	**4th ed.** (2012-2020)
Endangered/ threatened species	**224**	**2,694**	**3,155**	**3,716**
Category I	110	1,593	1,811	2,110
Category II	114	1,101	1,344	1,606

Red List categories (ranks) are reassessed every several years. The latest version, the 4th edition, was released in 2020; there have been five revisions so far.

Source: Drafted from data from the Ministry of the Environment's Red List 2020 (https://www.env.go.jp/press/107905.html)

FACT 5 ➤ To the ACTION 5

50-year increase in planted forest area (1966–2017)

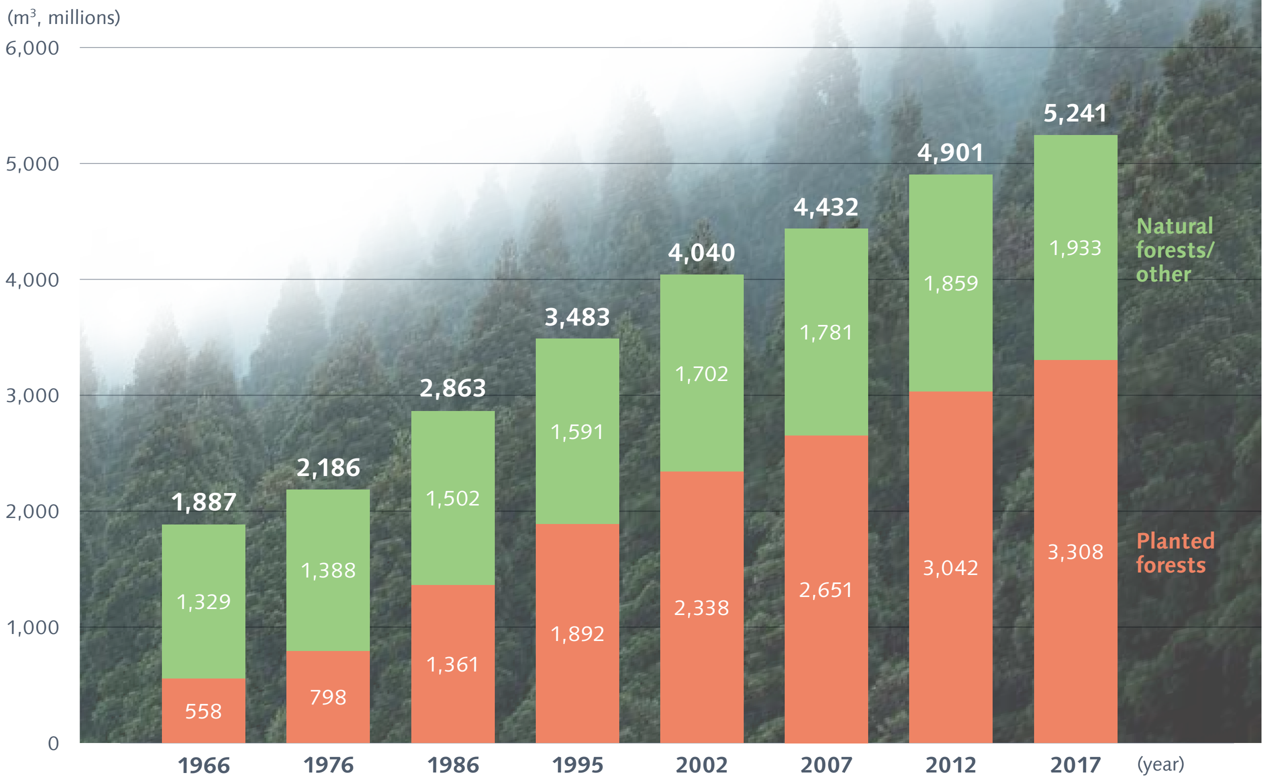
▷ Up to 30%, to 10.2 million ha

Japan's forests cover approx. 25.05 million ha—about two-thirds of the country (up to 70%). Natural forests account for approximately 13.48 million ha, or roughly 50% of all Japanese forests, while planted forests comprise approximately 10.20 million ha, or 40%. The remainder consists of bamboo groves or forests whose trees are no longer standing.

This places Japan third among OECD member states in forest area ratio—the percentage of the country covered by forest. Thus, Japan could be considered a leading developed forested nation. The amount of forest area in Japan saw no huge fluctuations in the 50-year period from 1966–2017; however, the planted forest area did increase by approximately 30%, with the natural forest area decreasing by the same amount.

The total volume of tree trunks of a forest's still standing trees is called its forest stock. As stated above, while total forest area in Japan has not seen any major fluctuations, the increase in planted forest area has caused forest stock to increase 2.8 fold during the 1966–2017 period. This indicates that planted trees that should have been harvested for timber have been allowed to grow past the time when they traditionally would have been harvested. As a result, Japan's timber self-sufficiency, pressured by many years of cheap imported lumber, hit a low of 18.8% in 2002—though it did rebound to 41.8% in 2020.

Trends in forest stock



Many forests planted during the post-WWII boom ("cultivated" forests) have grown beyond the 50-year deadline for cutting, with forest stock growing 2.8 fold over 52 years

Source: Drafted from data in "State of Forest Resources," Forestry Agency

FACT 6 ➤ To the ACTION 6

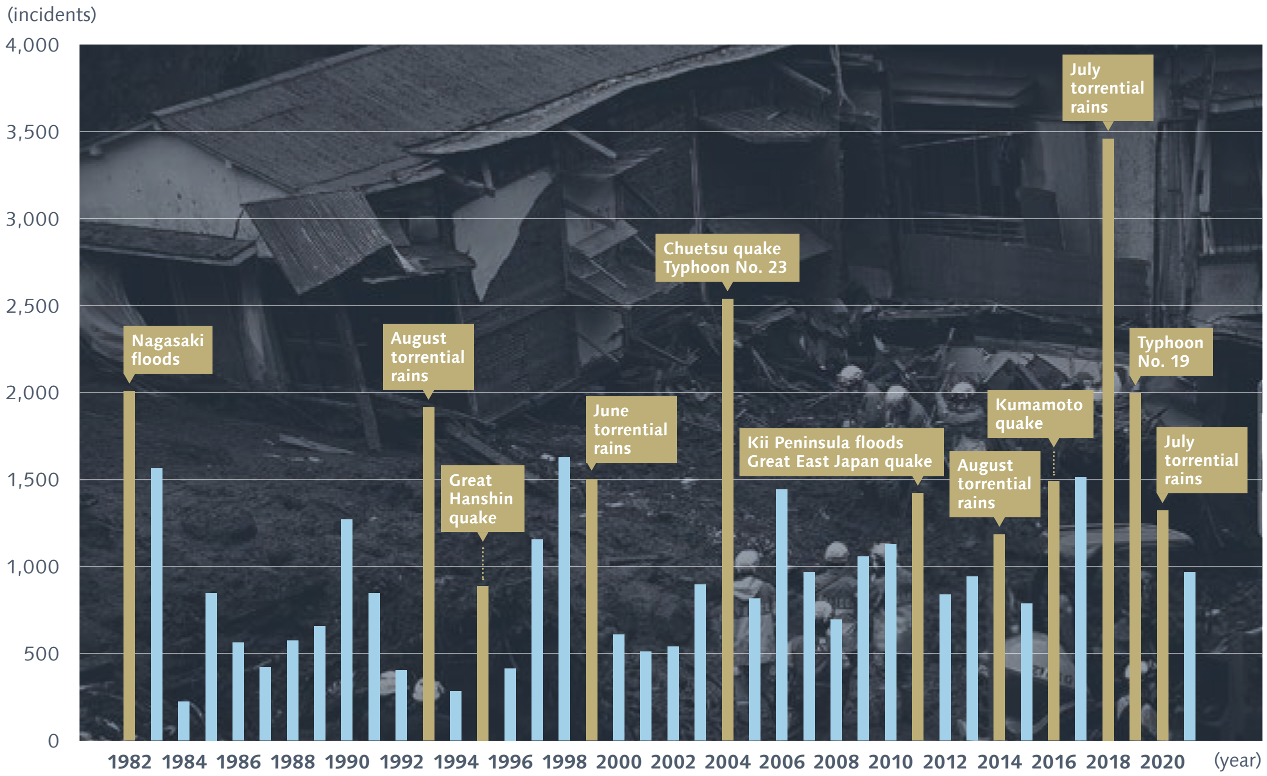
Landslide disasters in 2018: Up to 3 times the annual average

Every year, Japan's Ministry of Land, Infrastructure, Transport and Tourism issues totals for landslide and sediment disasters based on prefectural reports. Recent years have demonstrated the impact of abnormal weather, with 2018 recording the greatest number of disasters since 1982, when record-keeping began; records have continued to be broken in the years since. The Ministry's "July 2018 Torrential Rains" report states that the year saw 3,459 sediment disasters—over three times the yearly average (1,110, compiled from post-1982 data).

Damage is also becoming markedly more severe. 2019's Typhoon No. 19 (a.k.a. Typhoon Hagibis) caused 952 sediment disasters—and massive damage—across Japan, the highest number of sediment disasters ever to accompany a typhoon.

As for potential disasters in mountainous and hilly regions, Japan's Climate Change Adaptation Plan, formulated by the Cabinet Office in the wake of the December 2018 Climate Change Adaptation Act, predicts that annual maximum daily and hourly rainfall will rise by double-digit percentage points over current levels and indicates that further forest maintenance, plus support structures such as retaining walls and dams, will be necessary.

Landslide disaster trends



In 2021, there were 972 sediment disasters across 42 prefectures. In August alone, there were 448 such disasters across 33 prefectures.

Source: Drafted from data in "2021 Landslide Disasters," Ministry of Land, Infrastructure, Transport and Tourism (https://www.mlit.go.jp/river/sabo/jirei/r3dosha/r3doshasaigai.pdf)

Annual average: 1,110
(1982–2020)

FACT 7 ➤ To the ACTION 7

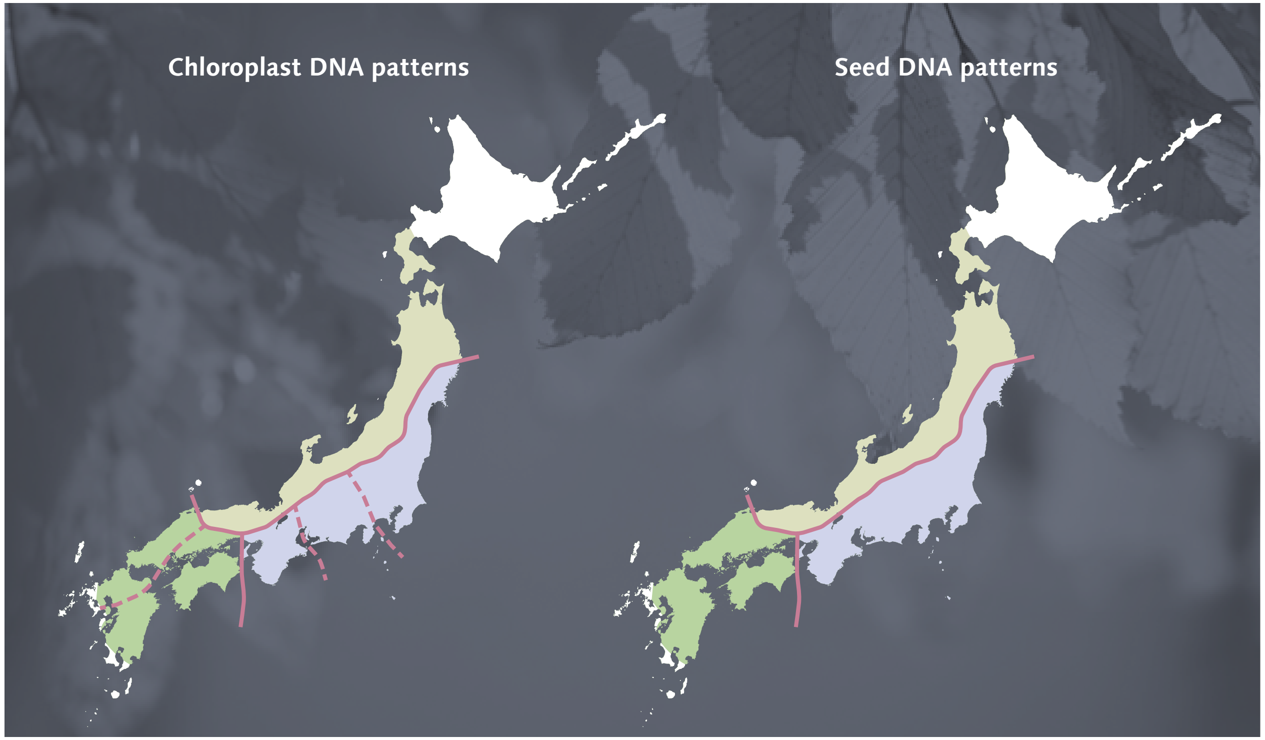
Regional differences in Japanese beech
▷ Six patterns (according to chloroplast DNA)

Japan's Plant Protection Act places limitations (travel restrictions) on the transfer and movement of saplings of four conifers useful to forestry: cedar, cypress, red pine and black pine. Broadleafs, meanwhile, face no such restrictions; saplings from any location may be planted and cultivated anywhere in Japan.

However, the results of a 2005–2009 survey published in the Forest Research and Management Organization's *Genetic Guidelines* for *Broadleaf Seedling Transfer & Movement* (the Ministry of the Environment's *Experiment & Research Costs for Global Environmental Conservation (Global Totals)*) indicate that trees in untouched forests have over the long term adjusted their distribution patterns to adapt to climate change and that even trees of the same species often demonstrate genetic differences by region.

Take Japanese beech, for example. Its seed DNA patterns indicate that there are three geographic varieties of beech, distributed in northern Japan along the Sea of Japan; in northern Japan along the Pacific Ocean; and in the southern Chugoku, Kyushu and Shikoku regions. Chloroplast DNA patterns yield further subdivisions into six distinct geographic varieties. Thus, it is highly likely that the transfer and movement of broadleafs to different environments, even if they are of the same native species of plant, can produce the same undesirable effects seen with conifers. Therefore, it is important to keep genetics in mind when planting.

Genetic guidelines on the movement and transfer of Japanese beech



Suggestions for seedling transfer restrictions (solid) Best practice for seedling transfer restrictions (dotted)

Japanese beech clearly engages in genetic specialization, as demonstrated by seed and particularly chloroplast DNA
Source: Drafted from data in Genetic Guidelines on Broadleaf Seedling Transfer, Forest Research and Management Organization

FACT 8 ➤ To the ACTION 8

The reproduction curve per the “deer formula”: ▷ A year-over-year population increase of 20%

Sika deer (hereafter just “deer”) have a profound impact on forests across Japan. The ideal population density for deer is 3 to 5 deer per km² (according to the Japan Wildlife Research Center), but areas in Japan where that is the case are becoming the exception.

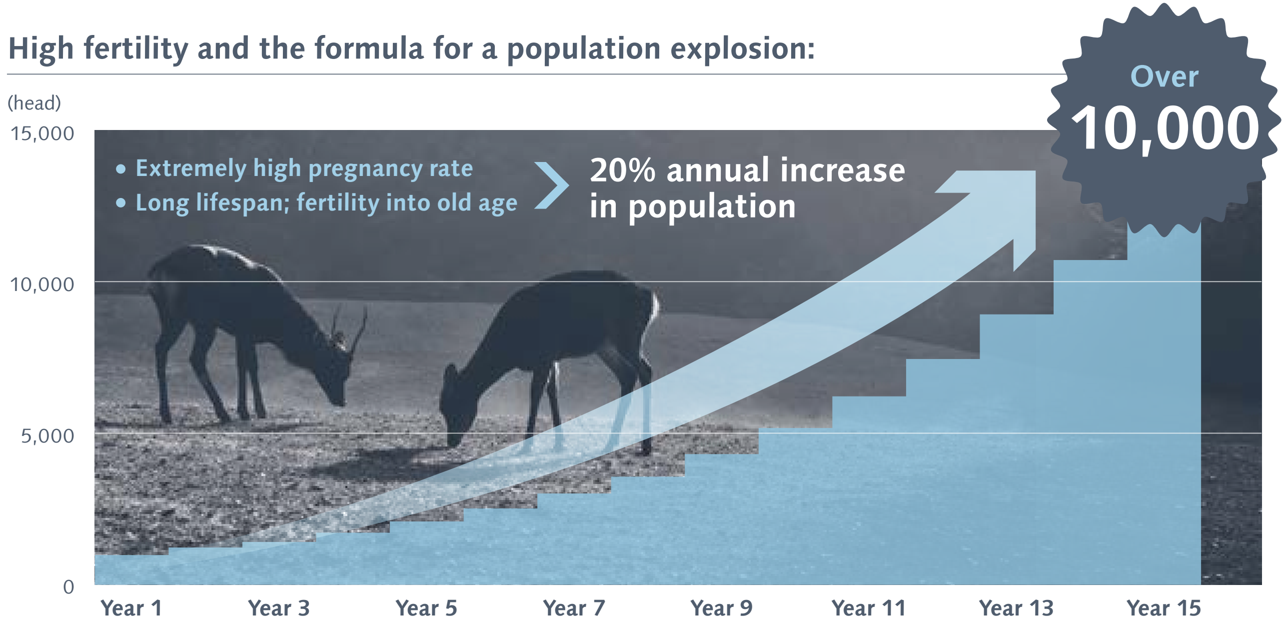
Deer have an extremely high rate of reproduction; they multiply exponentially. After 15 years, 1,000 head can easily become 10,000—and it can take only 4 years for that 10,000 to become 20,000.

When the deer population increases, forest understories are impacted by what is called “browsing pressure.” Save for a few species they find unpalatable, deer feed on almost all plant life—devastating plant diversity; impacting the insects, birds and mammals dependent on the vanished plants; and destroying the balance of the ecosystem.

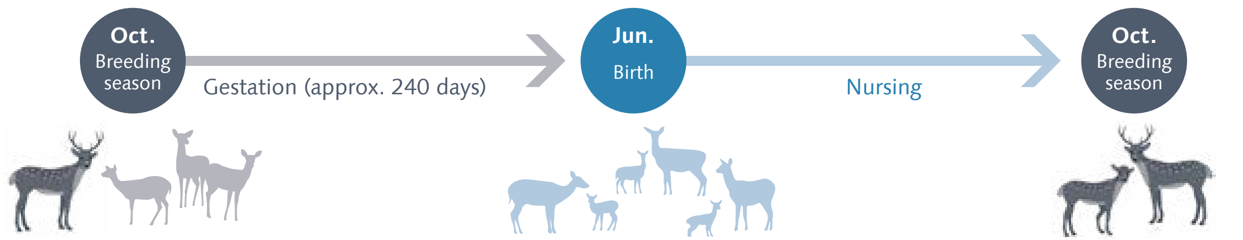
Furthermore, when winter arrives and food is scarce, these deer will strip the outer bark off trees to consume the tissue underneath, causing bark-stripping damage that can kill the trees. Areas overpopulated with deer can see their mature trees wither and their younger trees eaten before they have a chance to grow, with only the “unpalatable” plants remaining, devastating these forests.

After 15 years, 1,000 deer become:

High fertility and the formula for a population explosion:



Deer reproduction:



1 male creates a harem with several females

Typically, only one deer per birth

Just one birth per year

Sika deer, briefly feared threatened by extinction after WWII, have long been protected by government policies under which their numbers have grown exponentially; in the 1970s, they experienced the start of a population explosion.

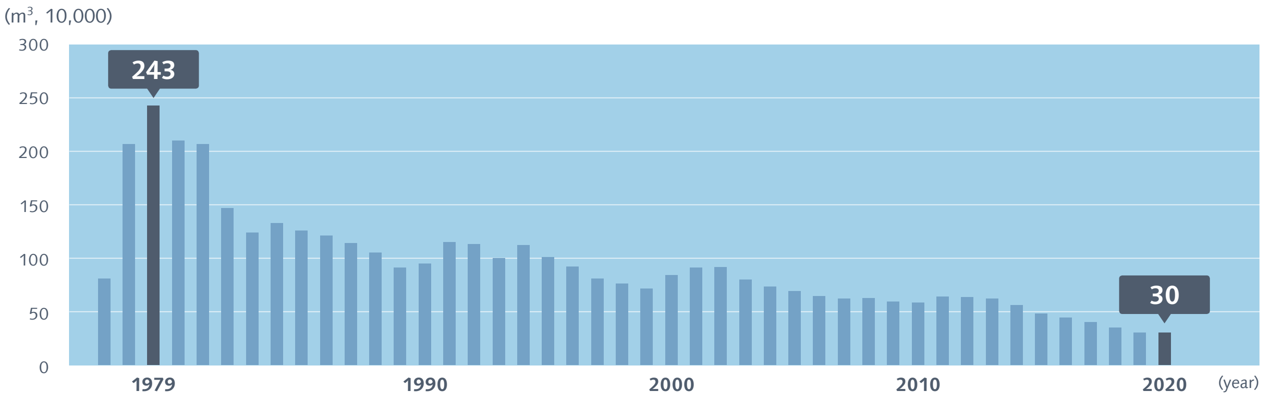
FACT 9 ➤ To the ACTION 9

Pines and oaks are withering across Japan: Pines: ▷ Up to 300,000 m^3; Oaks: ▷ Up to 192,000 m^3 (2020)

Pine wilt is a communicable disease among pines where the pine wood nematode—a 1-mm-long organism that lives in symbiosis with the Japanese pine sawyer beetle—invades and infects the wood. According to a survey by Japan's Ministry of Agriculture, Forestry and Fisheries, the amount of wood affected in 2020 totaled approximately 300,000 m^3—a record low, comprising approximately one-eighth of its peak. However, this evidently does not reflect the fact that almost all pines have already withered due to previous damage from pine wilt. It is also clear from the survey that in 24 prefectures in Japan, damage has increased compared to the previous year. Some land is newly affected, and while damage is waning, continued observation and control are required.

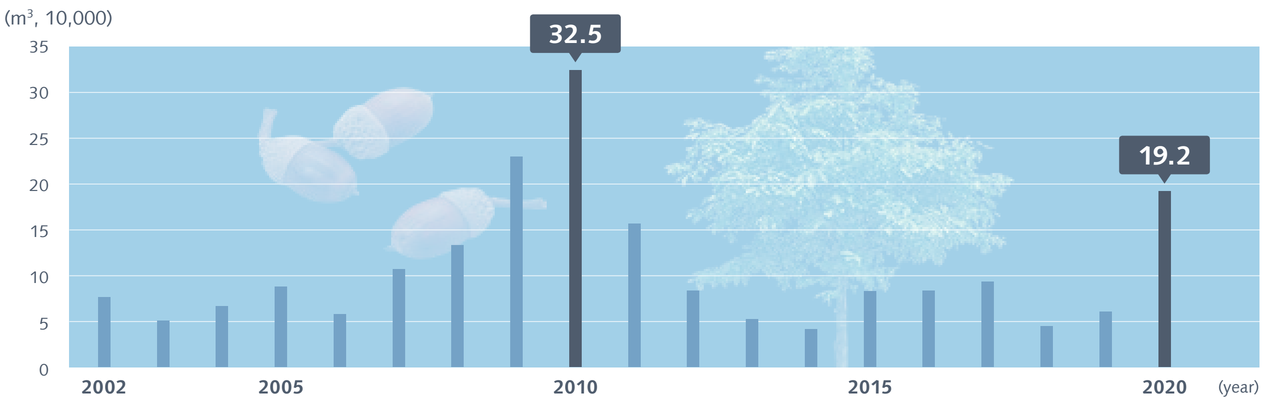
With oak wilt, the 5-mm-long oak ambrosia beetle burrows *en masse* beneath the trunks of Mongolian and evergreen oaks, introducing large amounts of oak fungus into the trees themselves. This ailment has declined since its peak at 325,000 m^3 in 2010; however, the survey identified a 318% year-over-year jump in 2020 to 192,000 m^3. Damage was observed in 42 prefectures, with two prefectures reporting damage for the first time. The remaining 40 all reported an increase in damage from the previous year—a situation that demands attention.

Trends in pine insect damage in Japan (by lumber volume)



* According to reports across prefectures. Total amount of damage in privately owned and national forests.

Trends in oak insect damage in Japan (by lumber volume)



* According to reports across prefectures. Total amount of damage in privately owned and national forests. Due to rounding, figures may not agree with damage totals by prefecture.

The pine wood nematode is not native to Japan, whose pines have no defense against it. The spread of oak wilt is evidently caused by the growth of large trees such as Mongolian oak in abandoned *satoyama* woodlands.

Source: Drafted from data in 2020 Forest Damage by Harmful Insects, Ministry of Agriculture, Forestry and Fisheries

FACT 10 ➤ To the ACTION 10

Vegetation control in undeveloped urban-adjacent forests to promote biodiversity

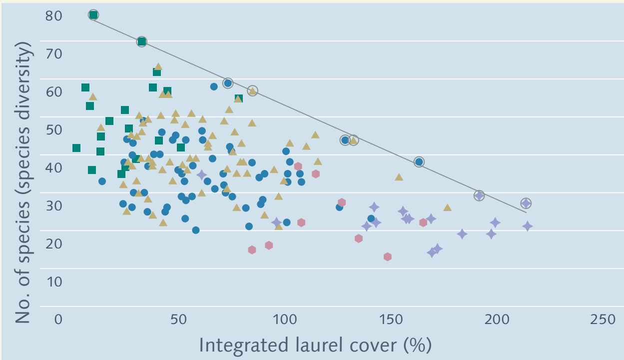
In the true sense of the word, *satoyama* forests are currently nearly extinct, as they are transitioning to abandoned *satoyama* forests. As this transition continues, they are becoming secondary laurel forests: forests with secondary growth of broadleaf evergreen vegetation. This entails a loss of biodiversity, a reduction in the soil's ability to retain water and prevent sediment disasters, and a disappearance of the seasonal sights of summer-green forests (forests where broadleaved deciduous trees predominate). To prevent this, let us consider an approach to cultivating species-diverse tall-tree summer-green forests.

Tamotsu Hattori
Professor Emeritus, University of Hyogo

Since Japan's Yayoi period, humanity has transformed primeval forests made from laurel-type trees (evergreen broadleaved trees) into *satoyama* forests: forests adjacent to human settlements in lowlands that supply fuel and fertilizer. In the Chubu region and further westward, these forests have chronologically transitioned into Yayoi-period (ca. 4th century B.C.) *satoyama* laurel forests (where laurel-type trees predominate), Nara-period (ca. 8th century) *satoyama* summer-green forests (where deciduous broadleaved trees such as konara oak predominate), Muromachi-period (ca. 15th century) *satoyama* needle-leaf forests (where the Japanese red pine predominates), Edo-period (ca. 18th century) denuded mountains, Meiji-period (early 20th century) needle-leaf *satoyama* forests, and Showa-era (late 20th century) *satoyama* summer-green forests. However, in the wake of the fuel revolution, *satoyama* summer-green forests have been abandoned, and their lower levels have begun to be reclaimed by laurel-type trees in a transition to so-called "abandoned *satoyama* summer-green-laurel forests" (as they are no longer used as fuel-collection sites), with upper layers of summer-green trees and lower layers of laurel-type trees. If this trend continues for 100 years or so, these forests will transition to secondary laurel forests, with the upper layer dominated by laurel-type trees as well.

Among the issues posed by abandoned *satoyama* summer-green-laurel forests and secondary laurel forests, foremost is the withering of summer-green shrubs and herbaceous plants due to the dense growth of laurel-type trees, producing a remarkable decline in species diversity. The graph examines various *satoyama* forests composed of trees such as kunugi and konara oak in Hyogo Prefecture and demonstrates the relationship between laurel-type tree coverage and the number of species present. As laurel-type trees predominate, the number of species—and biodiversity—decline. A transition to secondary laurel forests brings its own issues: a decrease in vegetative cover on the forest floor, erosion of the topsoil, and decreased water retention, as well as a change from the "new growth/ green growth/red foliage/fallen foliage" seasonal sights of summer-green trees to the simple year-round scape of laurel-type trees. To prevent the abandoned *satoyama* summer-green-laurel forests that currently occupy wide areas of Japan from transitioning into secondary laurel forests, it is necessary to prioritize them in forest planning.

Relationship between integrated laurel cover (%) and the number of species (species diversity) in the abandoned *satoyama* forests of Kobe and Hanshin region in Hyogo Prefecture



The results are clear: As laurel coverage increases, the number of species (species diversity) decreases

■ Kunugi oak forests ● Red pine forests ▲ Konara oak forest
● Arakashi evergreen oak forest ◆ Kojii forest
○ Survey sites at the boundary of the upper limit of the forest

For an example of a target forest project, let us consider a *satoyama* summer-green forest. To create a target forest, it is necessary to continuously log tall trees every 10 to 20 years and continuously gather firewood approximately every three years. From a timber-utilization or cost perspective, these processes entail massive expenditures. However, cultivating large-diameter summer-green trees in the upper-layer and selectively logging the laurel-type trees of the lower-layer is one possible approach to cultivating a highly biodiverse forest where tall summer-green trees predominate. Vegetational management with the goal of "species-diverse tall-tree summer-green forests" is being conducted throughout Hyogo Prefecture, and in Arimafuji Park, a continuous study spanning eight years is underway to resolve whether selective logging of laurel-type trees improves species diversity. The study's results indicate that the number of species increases after one to four years of selective logging. The effects of the logging continue for approximately four to five years, and logging must be performed again roughly every 10 years. However, the process does help prevent completely secondary laurel forests from taking root and not only improves species diversity but also yields other significant benefits, such as topsoil conservation, increased water retention and enhanced scenic value for the natural landscape.

Tamotsu Hattori
Completed postgraduate (doctoral) work in Natural Science at Kobe University's Graduate School of Science and Technology. After serving as a professor at the Himeji Institute of Technology's Institute of Natural and Environmental Sciences, became Professor Emeritus at the University of Hyogo and head of the Minami Tajima School of Nature in Hyogo Prefecture. Specializes in plant conservation, resource conservation, vegetation science, plant ecology, conservation ecology, and ethnobotany. Researches biodiversity conservation in and the revival of *satoyama* forests, among other topics.

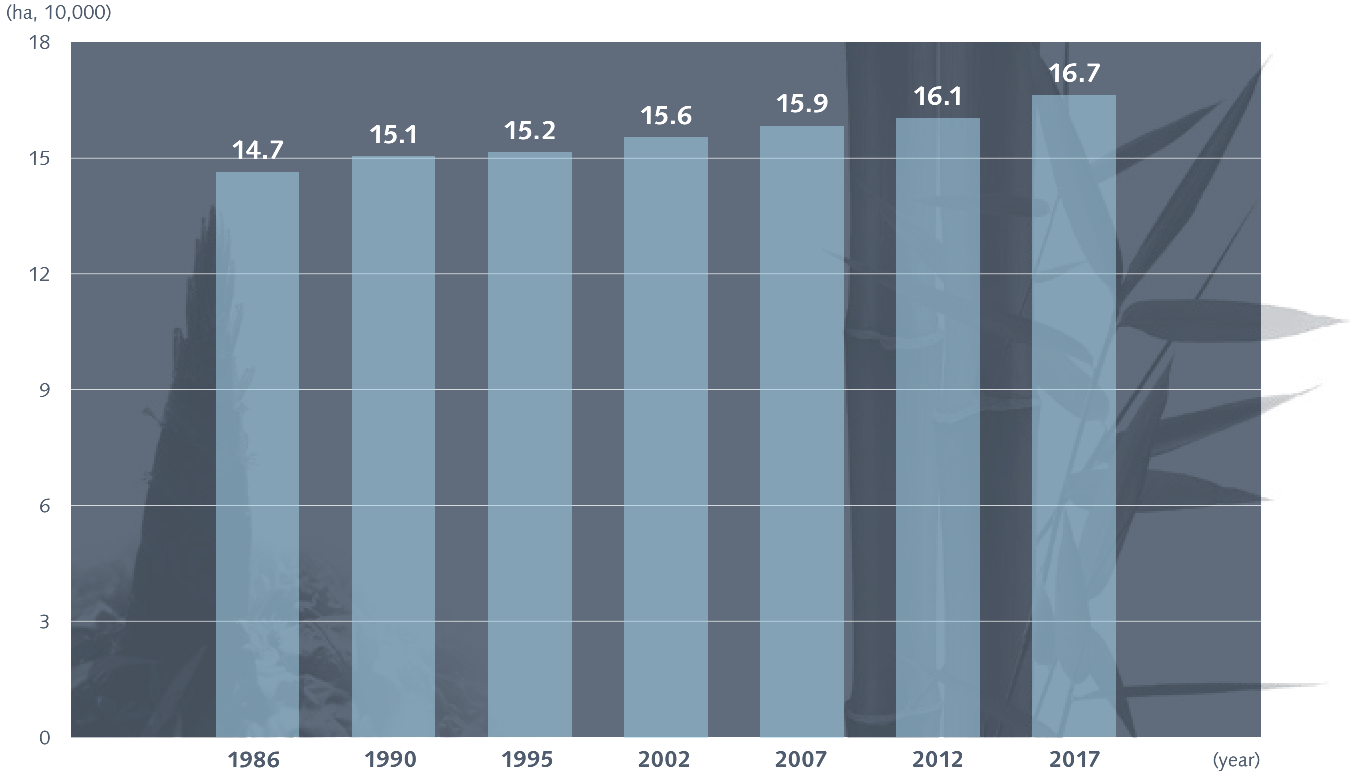
FACT 11 ➤ To the ACTION 11

Bamboo groves encroaching across Japan: Official count: 170,000 ha; however, “encroaching groves” —forests where encroaching bamboo represents at least 25% of growth— ▷ Might total 250,000 ha

In the 1980s, there were approx. 150,000 ha of bamboo grove in Japan. Since then, the square footage dedicated to bamboo production has continued to plummet; however, left to their own devices, existing bamboo groves have expanded unchecked. Production of bamboo in Japan has cratered due to an increase in cheap foreign imports and the spread of plastic products. The area of land dedicated to the growth of bamboo shoots is leveling off from this drastic decline, but many bamboo groves are indeed being abandoned and growing on their own.

Left alone, bamboo groves will begin to encroach on the surrounding forests. Bamboo's underground stems can grow several meters annually, then send out shoots capable of towering over 20 m in a mere two to three months. Forests newly invaded by bamboo will decay as the shoots block light from reaching shorter trees; eventually, they are completely overrun. The 20,000-ha increase on the graph is the result of this encroachment. According to Japan's Ministry of Agriculture, Forestry and Fisheries, the area covered by bamboo groves where encroaching bamboo represents at least 25% of growth is increasing; the Ministry estimates that the total amount of land covered by encroaching bamboo in Japan is approximately 250,000 ha. Without appropriate countermeasures, the day may not be far off when bamboo encroachment is all-encompassing. Furthermore, bamboo's shallow roots increase the risk of landslides and slope failures when bamboo encroaches on steep slopes, requiring emergency action.

Estimated area of bamboo



Total area 100% dedicated to bamboo growth; over 30 years, it has increased by only 20,000 ha—or so one might think. However, this might omit some 250,000 ha of “encroaching” bamboo.

Source: Drafted from data in Ministry of Agriculture, Forestry and Fisheries, State of Forest Resources

FACT 12 ➤ To the ACTION 12

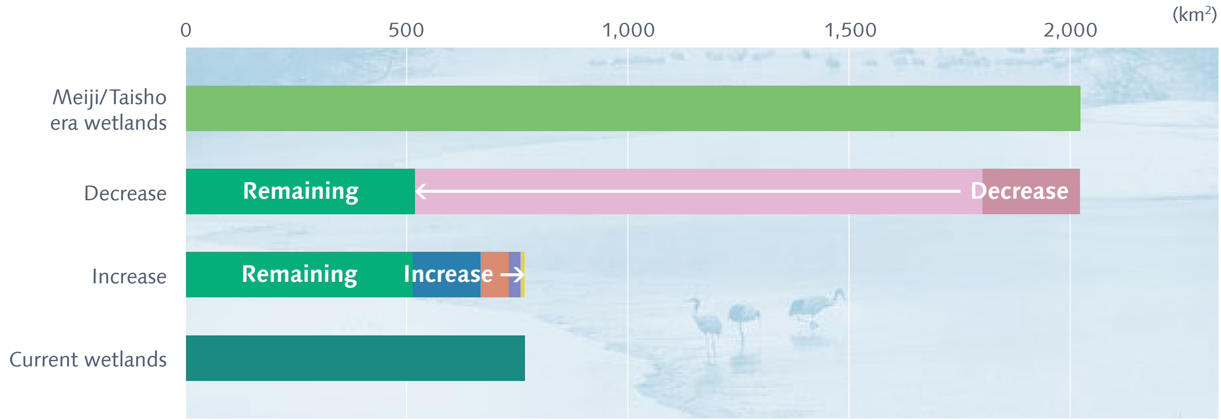
Japan's vanishing wetlands and marshes: ▷ Estimated 61% lost over 80 years

To understand the state of Japan's wetlands and marshes, the Geospatial Information Authority of Japan conducted a survey from 1996 to 1999. The results, compiled in a report released in 2000, confirm that in the Meiji and Taisho periods (1868–1912 and 1912–1925 , respectively), Japan had a total of 2,110.62 km^2 of wetlands; however, in 1999, this fell to 820.99 km^2. That is a loss of approx. 1,290 km^2, or 61.1%, over 80 years.

Hokkaido accounted for 1,771.99 km^2, or approximately 84%, of Japan's wetlands in the Taisho period. By 1999, this percentage was almost unchanged at approximately 86%; however, the actual area dropped to 708.67 km^2. That is a loss of 1,063.32 km^2, or approximately 60%. That is also approximately 82% of the total amount of change in Japan's wetlands—the largest decrease in Japan. The second-largest decrease was in Aomori Prefecture, where wetlands plummeted from 80.78 km^2 in the Taisho period to 12.18 km^2 in 1999.

To protect the diversity of life that depends on Japan's vanishing wetlands, initiatives such as a large-scale switch to organic farming methods and winter flooding of rice paddies are extremely important. However, in 2021, Japan's amount of arable farmland totaled 2.366 million ha. This has also fallen from its peak of 3.441 million ha in 1963—an approximately 31% drop.

Changes in wetland area between the Meiji/Taisho periods and today by classification



Survey of increases/decreases in wetland area from the Meiji/Taisho periods to 1999, compared via range of wetland symbols on 1:50,000 topographic maps

■ Marshlands, Meiji/Taisho periods ■ Marshlands, today ■ Extant from Meiji/Taisho period
■ Lost (from development) ■ Lost (natural) ■ Increase (discovered after) ■ Increase (water level decrease)
■ Increase (water level rise) ■ Increase (fallow paddies)

Source: Drafted from data in Results of Survey of Changes in Wetland Area in Japan, Geospatial Information Authority of Japan (https://www.gsi.go.jp/kankyochiri/diagram_5.html)

Raising awareness for peatland preservation

Peatland and watershed conservation activities in Scotland (Photos by Alistair Longwell)

Massive amounts of CO_2 are released from peatlands as they dry out.

Eroded areas and ditches are filled in and leveled off to help restore wetland health.

Wetland creatures begin to reinhabit the restored wetlands.

FACT 13 ➤ To the ACTION 13

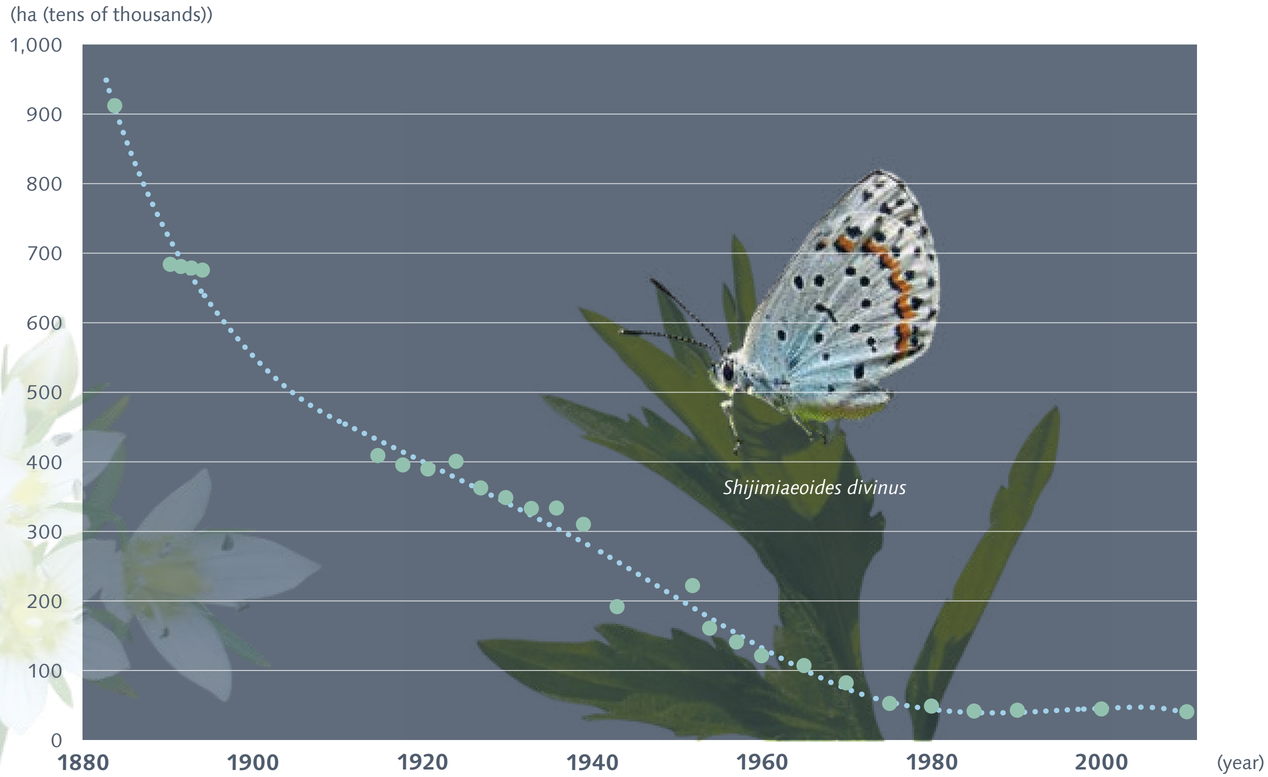
In the modern era, ▷ Over 90% of Japan's grasslands have vanished

There are issues with calculating the total area of grassland in Japan; for example, the definition of "grassland" has changed from era to era. However, after excluding statistical data that has clear issues and revising data predating 1940 as appropriate, a best fit curve (Jun'ichi Ogura, 2012) revealed that over 90% of Japan's grasslands have indeed vanished since the Meiji era (beginning in 1868).

Furthermore, according to the results of historical estimates of grassland area in Japan based on genetic analysis of vegetation presented in 2019 by the Forestry and Forest Products Research Institute, four grassland plant species familiar and dear to the people of Japan—green gentian, fringed *nadeshiko* pinks, golden lace, and great burnet—have seen their populations fluctuate from 0.5 to 2 times their pre-Meiji numbers, though their populations have been largely steady over the past 100,000 years. The rate of disappearance of Japan's grasslands has also undergone rather drastic changes when viewed from a geological time scale of tens of thousands to hundreds of thousands of years.

With the loss of grassland comes the loss of habitat for species that make grasslands their home, leading to an extinction crisis. For example, the *Shijimiaeoides divinus* butterfly, which once had a habitat range from the Tohoku region to Kyushu, now has a confirmed presence only in parts of Nagano Prefecture and Kyushu and has been listed as endangered.

Estimated grassland area since the Meiji period



At the start of the 20th century, grasslands accounted for approx. 13% in Japan (50 million hectares); now, they account for only approx. 390,000 ha—less than 1% of land.

Source: Drafted using data from Jun'ichi Ogura, *A History of the Forests and Grasslands* (Kokon Shoin, 2012)

FACT 14 ➤ To the ACTION 14

Raptor diversity is proof of a healthy, biodiverse environment

Raptors sit at the peak of an ecosystem's food chain; not only are their numbers relatively low but they are also acutely susceptible to the impact of environmental pollutants and the condition of the organisms that compose the rest of the ecosystem's pyramid. A richly diverse ecosystem fosters the presence of multiple raptors, but drastic environmental changes accompanying abrupt post-WWII shifts in lifestyle have had a massive impact on raptor habitats. Protecting raptors means not only protecting one target species but also protecting the larger environment itself—an environment whose natural resources can be used in a safe, sustainable manner.

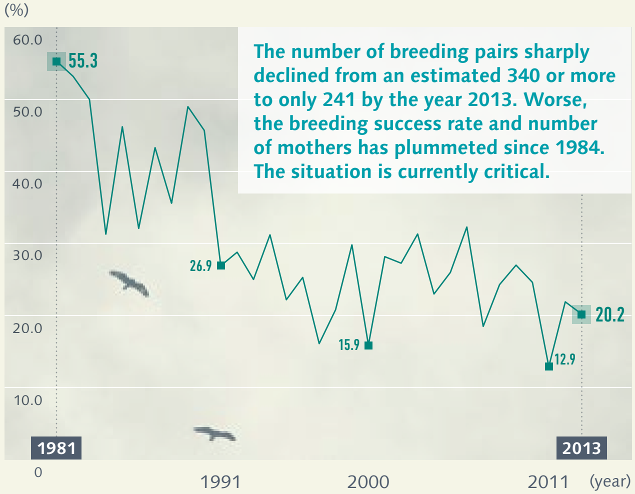
Toru Yamazaki
President, Asian Raptor Research and Conservation Network

Raptors—birds who prey on other animals—inhabit an assortment of ecosystems in a variety of forms. However, being at the top of the food chain makes them strongly susceptible to environmental changes; raptors feel these changes before anyone else. This means that raptor conservation is important not only because these animals are endangered but also because their presence is closely entwined with their ecosystems' stability, security, and biodiversity.

The environmental changes to which humans contribute also greatly impact raptor habitats. Large-scale planted forests produced by expanded post-WWII forestation policies and a shift toward propane gas as a source of fuel have caused an upheaval in the forest landscape, drastically transforming the Golden Eagle's and the Mountain Hawk-eagle's habitats. Planted forests account for approximately 40% of Japan's forests; this has dealt a serious blow to the Golden Eagle, which needs open land to hunt. Its breeding success rate has plummeted since 1984 and has remained below 30% since 1991. From 1981 to 2015, approximately 30% of breeding pairs have been lost. For the Golden Eagle, clear-cutting of mature planted forests and the continuous creation of open land with new growth is essential to its survival.

For the Mountain Hawk-eagle, the early days of expanded post-WWII forestation saw the number of pairs unable to build a skyrocket as the large-diameter trees they favored were harvested. However, as the prevalence of planted cedars grew, the number of large-diameter trees that remained unselected for culling increased. As a result, the population of Mountain Hawk-eagles nesting in cedars has risen drastically since 2012; in many areas, cedars are the hawk-eagle's only choice for nesting. Thus, balanced, sustainable usage of forest resources will maintain a rich, biodiverse ecosystem in which both the Golden Eagle and the Mountain Hawk-eagle can thrive.

Golden Eagle breeding success rate (trend over 33 years)



Breeding success rate (extant pairs only)

Source: Drafted from data from the Society for Research of Golden Eagle Japan homepage

Raptors, like the Grey-faced Buzzard, have habitats that transcend borders, and their breeding grounds, wintering spots, and stopovers are impacted by changes to their environment. As their primary breeding grounds lie in rice paddies in Japan's mountainous regions, Grey-faced Buzzards have seen their numbers decrease with the high rate of abandonment of rice cultivation. In 2006, Grey-faced Buzzards were put on the endangered species list. However, this is not the only danger they face.

A 2013 field survey through the Asian Raptor Research and Conservation Network clarified that Grey-faced Buzzards breeding in Japan were migrating to the northern Philippines to winter. However, poaching is traditionally practiced among locals in that region, and the survey revealed that 5,000 Grey-faced Buzzards were being shot annually by spring.

A project was launched in 2015 to eradicate poaching. Thanks to local lectures, as well as publicization of the fact that Grey-faced Buzzards prey on the scarab beetles that consume the coconut palms upon which local livelihoods depend, the project found success in 2017, saving the birds from extinction.

Protecting raptors leads to the protection of ecosystems that are safe and sustainable for humans. It is vital that we realize this connection.

Toru Yamazaki
After learning a degree from Tottori University in veterinary medicine, he went on to study avian ecology at Shinshu University. While managing government animal husbandry and disease prevention issues as an employee of Shiga Prefecture, he encountered his life's work: research into the ecology and life habits of the Golden Eagle and the Mountain Hawk-eagle, as well as nature conservation. In 1999, he became president of the Asian Raptor Research and Conservation Network, where he collaborates on initiatives throughout Asia to study and conserve raptor populations.

FACT 15 ➤ To the ACTION 15

North American bird populations have decreased by 29% (3 billion) over 50 years

An article in the journal Science on bird populations has caused a sensation: it reports that the number of birds in the North American bird population has decreased 29% since 1970 (Rosenberg et al., 2019). The cause is thought to be the reduction in pasture and grasslands due to the expansion of farmland; similar trends are also evident in Japan.

With the help of related groups throughout Japan, certified NPO Bird Research conducted a five-year survey (from 2016 to 2021) of bird breeding and distribution in Japan, released as the *National Bird Breeding & Distribution Report*. The same survey was also conducted in the 1970s (1974 to 1978) and the 1990s (1997 to 2002) by the Ministry of the Environment's Biodiversity Center of Japan as part of basic research for the Nature Conservation Act. Comparing the results, the total number of such familiar birds as the sparrow, starling and swallow—birds that live in open areas—has experienced a sharp decrease.

The plunge in sparrow and starling populations is considered to be potentially connected to a decrease in insects due to the homogenization of agricultural environments and the use of pesticides and other agricultural chemicals. The decrease in swallows (which forage in flight) is attributed to the decline in insect populations connected with the devastation of grasslands. Conversely, populations of forest birds have jumped, indicating a cutback in the culling of planted forests and an increase in forest stock.

Population changes (total number of birds)

Name	1997–2002	2016–2021	Change
Tree sparrow	31,159	20,627	–10,532
Barn swallow	14,978	8,987	–5,991
Night heron	6,197	738	–5,459
Black kite	7,021	2,401	–4,620
Gray starling	12,155	7,729	–4,426
House martin	7,855	4,002	–3,853
Black-tailed gull	5,562	2,048	–3,514
Rock pigeon (domestic pigeon)	6,031	2,539	–3,492
Cattle egret	3,591	239	–3,352
Meadow bunting	13,987	10,830	–3,157
Little egret	3,488	510	–2,978
Slaty-backed gull	3,470	780	–2,690
Long-tailed bushtit	6,778	4,440	–2,338
Carrion crow	10,060	8,012	–2,048
Japanese bush warbler	25,025	23,422	–1,603

Species with a confirmed population decrease based on the results of surveys in the 1990s and 2010s at 1,947 locations along approx. the same route

Source: Drafted from the Bird Breeding & Distribution Committee's *National Bird Breeding & Distribution Report*

➤ To the last page of ACTION

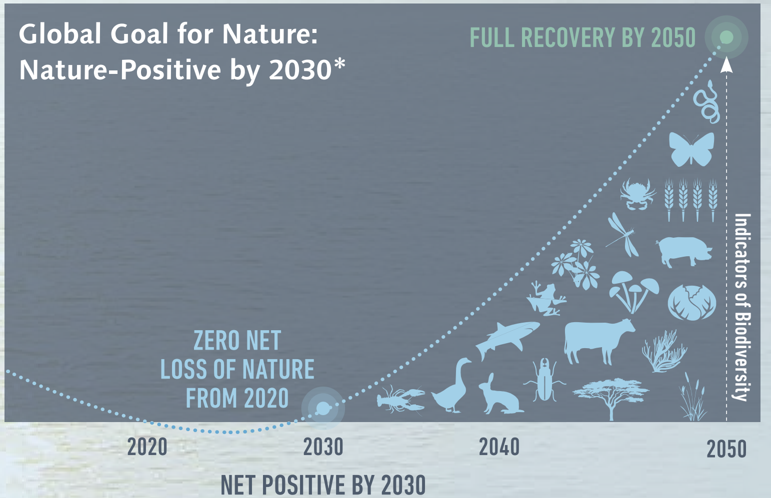
Naoki Adachi, PhD
CEO & Founder, Response Ability, Inc.

Nature-Positive 2030

From water source recharge to biodiversity and ecosystem restoration

I believe everyone knows by now that we share the vital goal of carbon neutrality by 2050 as a global society. It is because further climate change will have devastating impacts on human society; we are facing a climate crisis. To the same—or actually even greater—extent, we are also facing a biodiversity crisis: one that threatens our very existence and sustainability of society. We therefore need to devote ourselves to the new goal, nature-positive: to create a world with greater, not lesser, biodiversity by the year 2030, and to restore nature to the extent needed to support our life and society by 2050.

The world is in the midst of a rapid about-face toward recovering nature, as world political and business leaders now realize that practically our entire life and global society depend on healthy biodiversity.



* Based on data from "A Nature-Positive World: Global Goals for Nature," World Business Council for Sustainable Development

Suntory's initiative to conserve and restore the Natural Water Sanctuaries was founded its early recognition that water is its lifeline. I think it is splendid that Suntory recognized this much earlier than others and has taken actions to conserve and cultivate Natural Water Sanctuaries—and it is particularly important that it chose to act based on science. That is why the Natural Water Sanctuary Initiative is not limited to just preserving forests; its goal is to restore their biodiversity. Suntory's Natural Water Sanctuaries are exactly of the kind of initiatives the world is undertaking to achieve nature-positive.

Business needs to minimize its impacts on biodiversity and also to restore and regenerate ecosystems and their services. Such actions will make our way of life and society sustainable, moreover it will help mitigate the climate crisis. However, implementing these initiatives is not easy. The goals are quite ambitious; we may need to review the way of our business and even transform it. However, without these initiatives, both our business and our life will not survive. There are no other options. Suntory's recent project to restore peatlands in Scotland is a perfect symbol of this: Without peat, there is no aromatic scotch. Without strengthening the ecosystems, climate and local biodiversity crises will never be solved.

Suntory promptly recognized this relationship and took actions. It is my hope that moving forward, Suntory will in every aspect of its operations continue its efforts to conserve biodiversity and restore the ecosystems that underpin its business—and that in doing so, it serves as a shining example to the world of how business can coexist with biodiversity.

Naoki Adachi
Received his undergraduate degree and doctorate from the University of Tokyo's School of Science. Serves as CEO of Response Ability, Inc.; Executive Director of Japan Business Initiative for Biodiversity (JBIB); and Sustainability Producer for Sustainable Brands Japan. Renowned as one of Japan's leaders in sustainable procurement and for business and biodiversity.

SUNTORY

Suntory Natural Water Sanctuaries:
Biodiversity restoration report ACTIONS

Suntory Natural Water Sanctuaries:
Biodiversity restoration report FACT & DATA

Date issued: Sep. 20, 2022; first ed.

Issued by: Suntory Holdings, Sustainability Initiative Office
Tamachi Station Tower N, 3-1-1- Shibaura, Minato City, Tokyo 108-8503
TEL: 03-5579-1000 (main) URL: https://suntory.jp/