# ogasawara Ogasawara Islands

a World Natural Heritage

On-Going Nature Conservation Efforts in the Ogasawara Islands

## The Ogasawara Islands

**OGASAWARA** 

The Ogasawara Islands are a group of more than 30 small subtropical islands in the northwestern Pacific Ocean, located approximately 1,000 km south of Tokyo Bay. The Ogasawara Islands extend about 400 km from north to south and consist of the Ogasawara Archipelago (the Mukojima, Chichijima, and Hahajima Island Groups), the Kazan (Iwo) Island Group, and isolated islands in the surrounding area such as Nishinoshima.



Ogasawara, 1,000 km south of Tokyo Bay

Islands of the Ogasawara Archipelago

The Ogasawara Islands are traditionally said to have been discovered in 1593 by a man named Sadayori Ogasawara. The islands were uninhabited until 1830 and thus came to be called the "Bonin Islands" ("bonin" is derived from a Japanese word "Munin" meaning "no people"). Today, there are approximately 2,600 residents on Chichijima and Hahajima Islands.

There is no airport on the Ogasawara Islands. The journey from Tokyo's Takeshiba Pier to Chichijima Island takes about 24 hours each way on a regularly scheduled liner, the Ogasawara Maru. Attracted by the beautiful sea and diverse ecosystems, approximately 20,000 people visit Ogasawara every year.



The Ogasawara Maru



Heart Rock (Chihiroiwa) and submerged karst

## Nature of Ogasawara

### History of the Earth's evolution

The Ogasawara Islands are a valuable place where the processes of island birth and growth can literally be observed. Rare types of rock that are usually concealed at the bottom of the sea are visible aboveground and enhance our understanding of continent formation during the Earth's evolution.

Approximately 48 million years ago, the Pacific Plate began to subduct below the Philippine Sea Plate. The volcanic eruption of magma produced directly beneath the plate gave birth to the Chichijima and Mukojima Island Groups.

Boninite rocks formed as the erupted magma cooled and solidified. Boninite contains minerals that are found in meteorites and are extremely rare on Earth. Boninite was named after the "Bonin Islands" because it was first discovered in Ogasawara.

As subduction of the cold plate continued, the temperature in the shallow part decreased, and the location of magma production moved deeper and to the west. The composition of this new magma was different. As a result of volcanic activity, the Hahajima Island Group was born approximately 44 million years ago.

Subduction has continued to the present time. The location of magma production moved further to the west, creating the Kazan Island Group, which has currently active volcanoes.







Islands created in this manner connect to one another over a long period of time and eventually become a continent.

Geological and geomorphic features to be seen on the Ogasawara Islands



"Uguisu Suna," oriole green sand of boninite Pillow lava



Submerged karst landform (around Minamijima Island)



Sea cliff (Chichijima Island)

### Nature of Ogasawara

**OGASAWARA** 

### The unique ecosystem of Ogasawara

The Ogasawara Islands are "oceanic islands" and have never been connected to the continent. Because animals and plants could not reach the islands only species that were able to fly or swim could find their way to the Ogasawara Islands. Among them, only those suited to the islands' environment survived and evolved in a unique manner by adapting to specific environmental niches.

Land snails belonging to the *Mandarina* genus\* adapted to the ecotypes of their habitats such as treetops and ground level, evolving and diversifying into many species of different colors and shapes.

\*Mandarina: A representative genus of endemic land snails on the Ogasawara Islands. Its Japanese name "Kata-maimai" means "hard-shelled land snails". Within this group, there are large variations, for example in size, color, and height, and these snails are still in the process of evolution.

Sclerophyllous scrub woodlands cover large areas of Chichijima and Anijima Islands. Within these woodlands grow endemic plants that have evolved in response to the dry island environment, through adaptations such as changes in leaf shape.

On the other hand, Hahajima has large areas covered by forests of tall trees called a subtropical rainforest, which favors rain and humidity. Many endemic species like snails and insects were nurtured in the different environment varying from island to island.



Evolution of Mandarina genus

### Varieties of Melastoma genus on different islands

Varieties of *Melastoma* genus endemic to the Ogasawara Islands vary from island to island in the color of flowers and the number of petals.



Melastoma tetramerum (Chichijima Island)



Melastoma tetramerum var. pentapetalum (Hahajima Island)



*Melastoma candidum* var. *alessandrense* (Kita-iwoto Island)

The Ogasawara Islands are a "laboratory of evolution" where on-going evolutionary processes can be witnessed and processes of species diversification are well preserved.

As a result of their unique evolution, a large number of endemic animals and plants are found only on the Ogasawara Islands. The endemic ratios of native vascular plants, insects, and land snails are 37%, 28%, and 94%, respectively.



Endemic subspecies of Eurasian buzzard (*Buteo buteo toyoshimai*)



Bonin white-eye (Apalopteron familiare)



Ogasawara Greenfinch(Chloris sinica)



Bonin flying fox (Pteropus pselaphon)



Boninthemis insularis



Endemic weevil (Ogasawarazo mater)



Hirasea operculina



Cyathea mertensiana



Rhododendron boninense



Sedum boninense



Elaeocarpus photiniaefolius

## Areas Registered as a World Heritage Site

In June 2011, the Ogasawara Islands were inscribed as the fourth World Natural Heritage site in Japan, following Yakushima, Shirakami-Sanchi, and Shiretoko.

From the north, the Mukojima, Chichijima, and Hahajima Island Groups, Kita-iwoto and Minamiiwoto Islands of the Kazan Island Group, and Nishinoshima Island are designated as a World Heritage Site, including some marine areas near Chichijima and Hahajima Islands. The village areas on Chichijima and Hahajima are not included.

A large number of endemic insects such as bees and longhorn beetles can be seen in the Mukojima Island Group. Ototojima Island provides habitats for all five endemic species of dragonflies (Boninagrion ezoin, Indolestes boninensis, Rhinocypha ogasawarensis, Hemicordulia ogasawarensis, Boninthemis insularis) in the Ogasawara Islands.





## World Heritage Inscription Process

In January 2010, Japan submitted to the IUCN a nomination dossier that summarizes the unique geological and biological history of the Ogasawara Islands.







After that, based on the evaluation results by the IUCN, the World Heritage Committee made a decision in June 2011 to register the Ogasawara Islands as a World Natural Heritage site.



## Efforts to Protect the Original Ecosystem of

When people began to live on the Ogasawara Islands in 1830, alien species came along with them in luggage or as food or pets, and thrived in the wild. The introduction of alien species has changed the original ecosystems of the Ogasawara Islands, as alien species have preyed on endemic species or taken over their habitats. Many of the animals and plants endemic to Ogasawara are vulnerable to these alien species, and have been strongly affected.

Plants on Nakodojima Island of the Mukojima Island Group were eaten by introduced feral goats, and the exposed soil ran off into

the sea.



(): Elimination completed

Chichijima Island, the gateway to Ogasawara, has been invaded by the largest number of alien species. For example, endemic land snails and insects have been devastated and have disappeared because of the alien predatory flatworm and green anoles. Some of the garden plants have also grew in the wild and expanded their distribution.



Exposed soil surface on Nakodojima

Land snail being eaten by predatory flatworm (Chichijima Island)



Thriving and expanding *Lantana camara* var. *aculeata* (garden plant)

On Anijima Island, green anoles were found in 2013, and since its negative effect to endemic insects has been confirmed, measures for elimination have been implemented.



Green anole

## the Ogasawara Islands



Wedge-tailed shearwater

To protect the original ecosystems of the Ogasawara Islands, current efforts have focused on eliminating alien species having huge impacts and conservation of endemic species that can survive only on these islands.

The conditions of endemic species and the invasion status of alien species varies between different islands of Ogasawara. Therefore, specific targets have been identified on each island.

The elimination of alien species must be conducted in a manner that prevents the spread of other alien species and minimizes the impact of sudden changes on native species. Attention must be paid to the relationships among various species and the overall stability of the ecosystem.

The efforts to protect the original ecosystems of the Ogasawara Islands are explained in the following pages.

### Efforts to Protect the Original Ecosystem of the Ogasawara Islands

## Elimination of feral goats

#### Background

Goats were brought to the Ogasawara Islands as food. By feeding on plants and exposing bare soil through trampling, feral goats have had strong impacts on the islands' vegetation and overall ecosystems.

On Nakodojima Island in the Mukojima Island Group, feral goats cleared plants and the unstable soil ran off into the sea, severely damaging coral reefs and other marine ecosystems.

#### Responsive action

The eradication of feral goats in the Ogasawara Islands was first achieved by the Tokyo Metropolitan Government on Minamijima Island, followed by Higashijima, the Mukojima Island Group, Nishijima, Anijima, Ototojima, and other islands.

Eradication work on Chichijima Island has been conducted by the Tokyo Metropolitan Government in colaboration with the Ministry of the Environment and Ogasawara Village.

On Minamijima and Mukojima Islands, where the goats have been eradicated, the recovery of endemic plants such as Ixeris longirostra, Cirsium boninense, and Hedyotis grayi has been observed.

In the future, following the eradication of feral goats on Chichijima Island, the restoration of island vegetation will be considered.



Feral goats



Elimination by a hunter











Feral goats fed on endemic and alien plant species, thereby suppressing the increase of alien plants.

The recovery of endemic plants has been observed on islands where feral goats have been eradicated. Increases in alien plants previously eaten by feral goats have also been reported, necessitating continued attention in the future.



### Capture of feral cats

#### Background

Cats are originally brought to the Ogasawara Islands as pets or to control rats, but eventually many became feral.

They prey on terrestrial birds such as the endemic Bonin white-eye (*Apalopteron familiare hahasima*) as well as seabirds such as the brown booby (*Sula leucogaster*). Chichijima and Hahajima Islands are the two main habitats of feral cats, but they also used to live on the uninhabited island of Ototojima.

#### **Responsive action**

In Ogasawara, the government, NPOs, and veterinary medical associations are working together to promote integrated management of household cats and feral cats.

In 2005, capturing feral cats was started at Minamizaki on Hahajima Island (a breeding ground of seabirds) and at Mt. Chuosan-Higashidaira on Chichijima Island, a breeding site for endemic subspecies of Japanese wood pigeon (*Columba janthina nitens*). The capture operation is now conducted over the whole area of Chichijima and also Minamizaki and mountainous area on Hahajima.

The installation of feral cat-proof fences and the capture operation have resulted in the resumption of wedge-tailed shearwater (*Puffinus pacificus*) breeding at Minamizaki. Capturing feral cats have been conducted also on Ototojima Island since 2007, resulting in no feral cats confirmation after February 2010.

On Chichijima Island, the population density of cats throughout the island is declining as the capture operation has moved onward since 2005. Consequently, the number of birds including the Japanese wood pigeon (*Columba janthina nitens*) is recovering.



Feral cat attacking a brown booby



Captured feral cats become household cat and being cared.



As a result of measures against feral cats, the number of Japanese wood pigeons (*Columba janthina nitens*) is recovering.





### Efforts to Protect the Original Ecosystem of the Ogasawara Islands

### Elimination of black rats

#### Background

Black rats were probably introduced to the Ogasawara Islands via ships. Black rats have been an adverse effect on the vegetation of the Ogasawara Islands, as they feed on the seeds and fruits of plants. Black rats also occasionally prey on animals, causing detrimental effects in various ways. For example, black rats attack the nests of Bulwer's petrel and the wedge-tailed shearwater on Higashijima Island while they prey on endemic land snails on Anijima Island.

#### Responsive action

In 2008, the Ministry of the Environment has conducted to eradicate black rats on the islands of Anijima, Ototojima, Higashijima, Nishijima, and Mukojima, by broadcasting toxic bait from helicopters. On Higashijima Island, the prevalence of *Lobelia boninensis*, previously gnawed by black rats, has increased and breeding of Bryan's shearwater observed only there in the world has been confirmed after the extermination.

Because of the large area of Anijima and Ototojima, and the complexity of their topography and vegetation, the existence of rats has been reconfirmed and ongoing efforts have been carried out since then.

In order to eliminate black rats that prey on endemic land snails in Anijima, aerial application was conducted in 2016 and 2021 to control the density of black rats.

#### Correlation chart surrounding Eurasian buzzards and black rats

- The Eurasian buzzards feed on black rats and endemic birds.
- The removal of black rats is likely to result in reduced numbers of the Eurasian buzzards or increased numbers of birds eaten by the buzzards, as the buzzards will have insufficient food sources.
- However, before black rats were introduced, the Eurasian buzzards were preying on native birds. Black rats are considered to have huge impacts on birds. efforts are made to remove the impacts of black rats, with the aim of creating the natural environment where the original ecosystems of the Ogasawara Islands including birds are recovered and buzzards can survive without being dependent on black rats for food.



Black rat



Bulwer's petrel attacked by a black rat



Using a helicopter to disperse toxic bait



### Measures against Green Anoles

### Background

On Chichijima and Hahajima, where the green anoles were spread all over, the insect fauna of the islands was destroyed by the predation pressure.

In March 2013, green anoles were found on Anijima, where a rich insect fauna remains. There is concern that it may seriously damage the insect fauna of Anijima.



Green anole preying on an endemic cicada Meimuna boninensis

#### Responsive action

In 2008, the Ministry of the Environment designated protected areas at Shin-yuhigaoka and Minamizaki on Hahajima for threatened insects such as the endemic lycaenid butterfly, for which there are concerns about the effects of predation by green anoles.

Based on the knowledge obtained, fences preventing further distribution of green anoles were installed in Anijima by the Ministry of the Environment and the Tokyo Metropolitan Government, along with intensive capture of green anoles with sticky traps.

In addition, adhesive traps are placed around the ports of Chichijima and Hahajima to catch green anoles, so that they don't get onto other islands via boats.



Fences to prevent green anoles extending its distribution on Anijima



Captured Anole by the sticky trap



## Efforts to Protect the Original Ecosystem of the Ogasawara Islands

### The predatory flatworm (Planarian)

#### Background

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In Chichijima, the number of endemic land snails has been drastically reduced by introduced alien predatory flatworm *Platydemus manokwari*. On the other hand, snail-eating planarian *Bipalium vagum* is possibly affecting endemic land snails in Hahajima.

There are very little habitats of land snails left on Chichijima and preservation of habitats, captive breeding programs as well as translocation programs are required. Currently, the same measures are considered for land snails on Hahajima Island.



Predatory flatworm Platydemus manokwari

#### **Responsive action**

The Ministry of the Environment developed a captive breeding program for *Mandarina* on Chichijima since 2010. To avoid the risks of extinction, the Tokyo Zoological Park Society started captive breeding programs on the mainland from 2017.

In 2020, a translocation plan for *Mandarina* was designed following IUCN guidelines for reintroducion. With the special care not to introduce parasites, eggs and hatched individuals of *M. hirasei* and *M. chichijimana* were released on the island of Tatsumijima.

It is necessary to maintain these efforts in the future while measures against alien predatory planarians need to proceed further in order not to spread them outside of the habitat range.



Captive breeding of Mandarina



Rearing work of land snails in captivity



Outdoor breeding facility (open type)

### Elimination of Bishopwood

#### Background

Bishopwood was brought to the Ogasawara Islands for use as firewood and as material for charcoal. This tree is extremely resilient and grows rapidly. As a result, the habitat of Bishopwood is expanding, suppressing the endemic trees of the Ogasawara Islands to grow.

#### **Responsive action**

Bishopwood has been distributed on Chichijima, Hahajima, Ototojima, and Hirashima Islands. The elimination of mature Bishopwood trees has been completed on Ototojima and Hirashima Islands.

Currently, measures against Bishopwood are being conducted by the Forestry Agency and the Ministry of the Environment working together. These efforts are focused on Hahajima Island, where severe damage has been caused by the expanding forested area of this alien plant. Bishopwood and other alien plants have also been eliminated on part of Chichijima Island.



Young Bishopwood trees covering the ground



Bishopwood shoots develop after cutting

### Elimination of Casuarina

#### Background

Casuarina is suited to dry conditions and can grow even in poor soils. Its thick leaf litter covers the ground and inhibits the germination and growth of other plants. This alien tree is distributed widely in the Chichijima and Hahajima Island Groups.

### **Responsive action**

On Anijima Island, the elimination of Casuarina was initiated by the Ministry of the Environment and was continued by the Forestry Agency. On Chichijima and Nishijima Islands, an NPO is also working on Casuarina elimination.







Fallen Casuarina leaves covering the ground

### Efforts to Protect the Original Ecosystem of the Ogasawara Islands

## Creation of new breeding sites for albatrosses

#### Background

Short-tailed albatrosses (*Phoebastria albatrus*) previously inhabited the Mukojima Island Group, which was also a breeding site for the black-footed albatross (*Phoebastria nigripes*). However, overexploitation in the 1930s led to the disappearance of the breeding site.

In the 1970s, the black-footed albatross and the Laysan albatross (*Phoebastria immutabilis*) began to breed again. Since the 2000s, the short-tailed albatross has also been flying to this island group once again.

The only known breeding sites of the short-tailed albatross in the world are on Torishima Island of the volcanic Izu Islands and on the Senkaku Islands. However, Torishima Island, the largest breeding site, is an active volcanic island, so that it is necessary to secure a new breeding site for this albatross.



Laysan albatross



Black-footed albatross



Decoys and a chick being reared (center)



A chick translocated from Torishima Island to Mukojima Island

### **Responsive action**

The Ministry of the Environment of Japan, the US Fish and Wildlife Service, and the Yamashina Institute for Ornithology have worked together on a project to restore the breeding ground for the short-tailed albatross in the Mukojima Island Group.

Decoys and audio-mimicking devices were installed in order to attract the short-tailed albatross, and some of the chicks hatched on Torishima Island were transferred to Mukojima Island with the hope that the chicks fledged from Mukojima would return to where they were raised.

The chicks that were successfully reared on Mukojima Island have been found flying northward over the Pacific Ocean like other albatrosses and reaching as far as the Kamchatka Peninsula and Alaska. It was confirmed that they have been returning to Mukojima Islands since 2011.

Since 2012, the Tokyo Metropolitan Government has taken over the project and survey, and by 2020, seven albatrosses have fledged from the pairs, including at least one of which left Mukojima.

## Protection of endemic dragonflies (Ototojima Island)

#### Background

All five endemic species of dragonfly are still present on Ototojima Island even though they have disappeared from Chichijima and Hahajima Islands. However, there used to be alien species (i.e. bullfrogs and feral pigs) inhabiting only on Ototojima. Both bullfrogs and feral pigs were brought to the Ogasawara Islands as food. Bullfrogs preyed on dragonfly nymphs. nymph, while feral pigs fed on various plants, fruits, insects, and snails, and destroyed dragonfly habitat by digging up the earth.

#### **Responsive action**

The Ministry of the Environment began the elimination of bullfrogs and feral pigs in 2004 and 2005, respectively. These species have not been spotted on Ototojima Island since 2008, indicating their eradication has been accomplished.

In addition, artificial ponds have been built in various locations on the island to provide stable breeding sites for dragonflies, and maintenance such as the removal of fallen leaves is carried out on a regular basis.

In the future, it is expected that these endemic dragonflies, which can now breed steadily, will spread to re-inhabit other islands.



Feral pigs and bullfrogs have been eradicated.



Dragonfly pond built on Ototojima Island



Hemicordulia ogasawarensis





## Efforts to Prevent the New Introduction and Spread of Alien Species

To protect the ecosystems of the Ogasawara Islands for future generations, it is important to prevent the introduction of new alien species, which could have severe impacts on the existing ecosystems, and to prevent the spread of alien species to mountainous areas and other islands, where large numbers of endemic species exist.

Passengers on the Ogasawara Maru are advised not to bring plants, animals, soil, or any goods with soil attached to them onboard.

On Chichijima and Hahajima Islands, special measures have been taken to prevent the spread of alien species to mountainous areas and other islands.

- At the Takeshiba passenger ship terminal and the ports of Chichijima and Hahajima, brush mats have been placed to remove soil from shoe soles to prevent the introduction of the predatory flatworms and new alien species.
- At the entry points of walkways on Chichijima and Hahajima, sticky rollers and brush mats have been placed to remove small insects, seeds, and soil that may be attached to shoe soles, clothes, and other belongings.
- On Hahajima, efforts to eliminate alien species such as the predatory flatworm introduced to the island with soil-attached seedling have begun, preparing hot-bath facilities.
- Public works are necessary to secure the living environment on the islands. However, because such works may have negative impacts on endemic animals and plants or may bring in alien species, thorough consideration must be given to the natural environment.

In FY2004, the Tokyo Metropolitan Government developed guidelines for environment-friendly public works and has closely followed them. Currently, utilizing these guidelines to promote environmental considerations in projects and research activities conducted by other administrative agencies is being developed.



Brush mats for cleaning off soil when getting off Hahajima Maru



Equipment to remove alien species at the starting point of a trail on Chichijima Island



Bathing device for soil-attached seedlings

## Ecotourism

The Ogasawara Islands meet the conditions sufficient to develop ecotourism owing to their characteristic ecosystems and landscapes. On the Ogasawara Islands, its value as a natural resource is well understood, and in 1988, Japan's first ecotourism centered on whale watching was started. In order to continue using this valuable natural resource with care, various rules, including voluntary rules, are in operation. As a result of these efforts, there are no significant impacts on the island's natural environment through tourism.



Ecotourism for students



Rulebook

## Lifestyle in Harmony with Nature

On the Ogasawara Islands, the valuable natural environment and people's lives are closely related to each other. Therefore, cooperation with and understanding of the people living on the islands is essential in order to proceed nature restoration efforts.

We are exploring ways to deal with nature and life in Ogasawara through opportunities such as volunteering, environmental education, and discussion meetings with villagers.



Discussion meeting with villagers



Volunteers working to eliminate Bishopwood

## Management System of the Ogasawara Islands, a World Natural Heritage site

Since FY2006, the Regional Liaison Committee and the Scientific Council have been held to discuss issues and future directions for the management of the Ogasawara Islands as a world natural heritage. Proper conservation and adaptive management of the valuable natural environment will be conducted mainly by the committee and the council as well as the management authorities (secretariat): Ministry of the Environment, Forestry Agency, Tokyo Metropolitan Government, and Ogasawara Village.



Provides necessary advice based on the scientific knowledge Administrative agencies that conduct the management of the heritage areas (the Ministry of the Environment, the Forestry Agency, the Tokyo Metropolitan Government, and Ogasawara Village)

## For More Information about Ogasawara

We have the official web page providing comprehensive information on the management of the Ogasawara Islands as a World Natural Heritage site. This Web page provides basic information about the natural environment of the Ogasawara Islands, activities for World Heritage inscription and nature conservation, and guidance for tourists. Pamphlets and other publications issued by related organizations are also available as free downloads.



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