



Ecosystem Invaders

BiO&WEBZiNE

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AUTUMN

SPECIAL ISSUE

**Alien Species or Ecosystem-
Disturbing Species? Our Attitudes to
Unfamiliar Species**

Soo-in Lee, Associate Researcher in
Invasive Alien Species Team at the NIE

BIODIVERSITY ISSUE

**Jaeyaksan Mountain and
Sajapyeong Plain Imbued with
Colors and Texture of Autumn**

BIO NEWS

**Latest Research
and Patents**

2025 AUTUMN

Vol. 13

National Institute of Biological Resources (NIBR)
National Institute of Wildlife Disease Control
and Prevention (NIWDC)
National Institute of Ecology (NIE)
Nakdonggang National Institute of Biological Resources
(NNIBR)
Honam National Institute of Biological Resources
(HNIBR)

A Joint Newsletter

Biowebzine is where the National Institute of Biological Resources (NIBR) under the Ministry of Environment, the National Institute of Wildlife Disease Control and Prevention (NIWDC), the National Institute of Ecology (NIE), the Nakdonggang National Institute of Biological Resources (NNIBR), and the Honam National Institute of Biological Resources (HNIBR) gather together and dream of a future of harmonious coexistence of all living things. Let us get useful information and knowledge about biodiversity, ecosystems, and wildlife diseases in Korea from Biowebzine!



A Joint Newsletter, *Biowebzine*

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Ecosystem



An aerial photograph of a river winding through a dense forest. The trees on the left bank are in full autumn foliage, displaying vibrant shades of orange, yellow, and brown. The river itself is a deep, calm blue, reflecting the sky. The right bank is also covered in trees, some of which are still green, creating a contrast with the autumnal colors. The overall scene is serene and captures the beauty of a seasonal transition in a natural landscape.

Invaders

A change in ecosystems is underway. This change might mean growth or extinction within the current ecosystems, but it could also be brought about by external impacts such as emerging new species. Alien or ecosystem-disturbing species are usually regarded as menacing invaders, but it may be we who bring the threats. Human activities change the composition of species in ecosystems, intentionally or unintentionally. Who are the true invaders causing disruption? Let us consider how to address disturbances in ecosystems and coexist harmoniously together.

Q & A for Alien Insects Invading Our Daily Lives, from Love Bugs to Termites

The daily discomfort and damage caused by the massive emergence and influx of alien insects that did not previously inhabit our country, such as love bugs and termites, are increasing.

Let us learn what kinds of characteristics they have and how they came to Korea.

Q. Love bugs had grabbed the headlines of news quite some time. What is the love bug?

A. Love bugs, known scientifically as *Plecia longiforceps*, get their nickname from their mating behavior when they fling into each other while flying. They are mostly distributed in China, Taiwan, and Okinawa, Japan. It is believed that they first came into our country through Incheon Port in 2015, began to settle in 2018, and have grown massively in number in the 2020s.

In some ways, love bugs can be helpful for the ecosystem. As they are big and move slowly, people might find them repulsive, but they are not poisonous, and they don't transmit diseases or harm crops. Rather, they decompose fallen leaves, make soil fertile, and help with the pollination of flowers.

Recently, however, as their population has increased rapidly, many people have been complaining about them. This summer, due to the unprecedented massive emergence of love bugs, their dead bodies

piled up around the trails and summit of Gyeongangsan Mountain, Incheon, resulting in serious inconvenience for the residents, including bad smells. To respond to this problem, the Ministry of Environment (the MOE), the NIBR, and other relevant organizations conducted pest control, removed their dead bodies, and cleaned up.

It remains unclear whether pest control through pesticides is effective against love bugs. Using too much pesticide can also have various side effects, such as harm to the food chain in the ecosystem. Therefore, to slow their massive population growth, we must use their natural enemies. As love bugs are relatively new to our country, we have to wait until our ecosystem fully adapts to them and reveals their predators.

Q. How harmful would alien termites be?

A. In March 2023, alien termites were found at a house in Gangnam-gu, Seoul, and became a huge



Plecia longiforceps



Termite

issue. According to the government-wide joint epidemiological investigation results, the termites in question were destroyed, and no spread to neighboring areas was confirmed. The termites were *kaloterms*, which presumably came into Korea hidden in timber or wood furniture and survived in warm indoor environments. Last year, *Coptotermes gestroi*, another alien termite, was also found. As growing numbers of termites are found, the Korean Heritage Service has been implementing cultural property protection and pest control measures. Termites are not directly harmful to human beings, but their gnawing on wood can damage old buildings.

Q. How do alien insects come into our country?

A. The exact influx route of love bugs has not yet been confirmed. According to the genetic analysis results conducted by the NIBR, they are most similar to those in the Shandong Peninsula, China. Therefore, it is likely that they could have come in through containers used for importing wood. We also believe that the influx of termites occurred through the import of woods, using construction materials or paper boxes as their vehicles. As such, the domestic influx routes of the alien insects are not clearly confirmed, but it appears that they mostly came here through imported goods.

Q. Could another massive emergence of other insects occur?

A. No one can say for sure. Some possible contenders for massive emergence include *Metcalfa pruinose*, an alien species like love bugs, and other native insects

such as *Ramulus mikado*, *Ephemera orientalis* McLachlan, and *Chironomus riparius*. We have been harmed by these species in the past, so organizations like the MOE have made efforts to respond properly to possible massive emergences in a timely manner, from the early stages of an outbreak, to minimize damage by checking and strengthening the response systems.

For this, the MOE, the NIBR, and the Seoul Metropolitan government will organize a consultative group together with neighboring local governments, prepare a round-the-clock response team, and apply the latest research results to outbreak sites as quickly as possible. In addition, the government plans to expand investments in research and development for mid- and long-term measures that can predict and manage massive outbreaks and pest control technology and equipment that are eco-friendly and customized to species.

Even though insects like love bugs do not harm people, if their populations grow rapidly to the extent of massive outbreaks, it could cause huge inconveniences. In this regard, the MOE announced that if massively emerging species appear, they will be controlled and managed, regardless of whether they are beneficial or harmful. Until recently, proper responses were not easy due to the lack of a relevant legal basis. In the near future systematic response measures will be prepared, including a determination of how to designate such insects as legally managed species, based on discussions with as many stakeholders as possible.

Wild Animal Disease Control: The First Step of One Health for Everyone's Health

**The health of human beings, animals,
and environments are closely connected and affect each other.**
How does the NIWDC control wild animal diseases for healthy ecosystems and One Health?

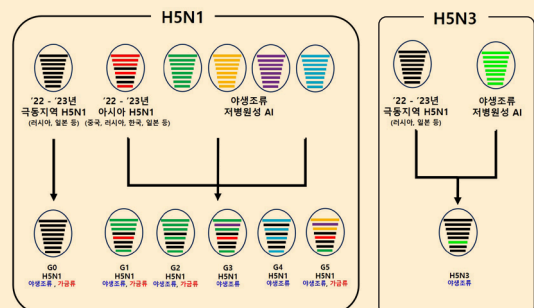
One Health Starts with Wild Animal Disease Control

Recently, highly pathogenic avian influenza (HPAI) was detected in dairy cows in the U.S. Since first being reported in March 2024, infections have been confirmed in 1,078 dairy cow farms in 17 states of America. Wild birds or infected environments are presumably the main causes. Until now, 70 cases of cross-species transmission from cows to humans have been confirmed, and the main cause is believed to be exposure to infected cows. The avian influenza virus, which once infected only birds and poultry, has mutated and infected mammals. Viruses can be transmitted from wild animals to domestic animals and humans, or domestic animals and humans can infect wild animals, too. Therefore, the One Health perspective that the health of humans, animals, and environments are closely intertwined has become more important.

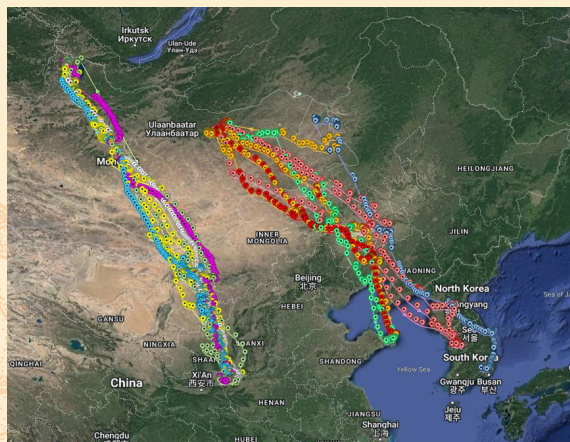
The NIWDC has made an effort to control wild animal diseases, to protect not only the health of wild animals but also the health of the entire ecosystem. The NIWDC has established animal disease control and monitoring systems and collaborated with relevant organizations such as the Korea Disease Control and Prevention Agency (KDCA) and the Animal and Plant Quarantine Agency (APQA). Furthermore, it has endeavored to realize "Global One Health" through international collaboration.

Wild Animal Disease Inspection System (WADIS)

In accordance with the Wildlife Protection and Management Act, the NIWDC diagnoses dead or sick animals. When relevant organizations such as local governments and environmental offices find sick or dead animals, they report when and where they were found, what species they are, and factors such as their sex and weight to the NIWDC and request disease screening. The NIWDC conducts the screening test and makes the results public on the Wild Animal Disease Inspection System (WADIS). You can find disease statistics and regional disease distribution based on the geographic information system (GIS). The general public can also visit the WADIS website (www.wadis.go.kr) to obtain information.



A Case of Genotyping Analysis on HPAI Occurred in Korea during the Winter Season of 2024 – 2025



Movement of the GPS Tracker-Attached Wild Birds



Early Detection Network for AI in Mongolia

Cutting-Edge Technologies Predicting Wild Animal Diseases

The NIWDC has adapted diverse cutting-edge technologies for monitoring and researching wild animal diseases. We use drones with thermal imaging cameras attached to monitor and capture wild boars. Such drones are mainly used to observe the movements of boars, which are active mostly at night, and to prevent safety accidents when using firearms. On sites where drone use is restricted for military reasons, we use vehicles with thermal observation devices (TODs) attached to check wild animals' populations and locations.

We conduct whole genome analysis using next generation sequencing (NGS) techniques, which can analyze more specimens in a shorter period of time than previous methods, so we can rapidly obtain sequencing information. We identify where the HPAI virus comes from based on NGS and epidemiological analyses and take preemptive measures, such as strengthening preventive observation in targeted areas. In addition, we attach GPS trackers to domestic and foreign wild birds at the wintering grounds and study them. By doing so, we monitor the movement patterns of AI-sensitive wild birds and evaluate the likelihood of domestic transmission. As such, the NIWDC has been actively adopting various technologies for wild animal disease monitoring and research.

International Collaboration to Prevent Wild Animal Diseases

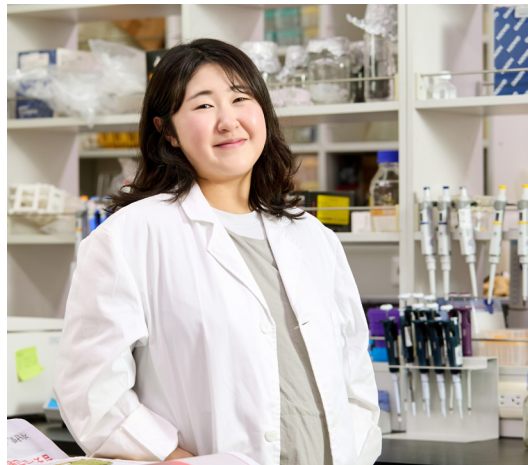
The NIWDC has held the Asia-Pacific Wildlife Diseases Joint Workshop with the purposes of sharing policies and regulations related to wild animal diseases and discussing collaboration on joint research every year based on the partnership with the United States Geological Survey (USGS) and the National Wildlife Health Center, which was formed in 2016. This year, 2025 Wildlife Diseases Research Joint Workshop, co-organized by Korea, the U.S., Japan, and Australia, was successfully held in Kagoshima, Japan, and it will be held in China next year.

The NIWDC conducts preventive observations on the HPAI virus which could spread to our country in the upcoming winter, and does global observations for early warning as well.

For example, for early detection of viruses spreading in the breeding grounds of wild migratory birds including Mongolia the NIWDC installs poultry farms near rivers to make the poultry become infected with the virus through indirect contact including water. As it is known that many wild migratory birds inhabiting the eastern part of Mongolia come to our country to spend winter, it operates an early detection network for avian influenza in the eastern part of Mongolia from July to September every year when the birds breed as one of the preventive measures.

As such, the NIWDC has been conducting various activities and research to control wild animal diseases in and out of our country more actively. It will continue with its efforts to protect health of wild animals and the ecosystem from the One Health perspective.

Alien Species or Ecosystem-Disturbing Species? Our Attitudes to Unfamiliar Species



Q. What is the difference between alien species and ecosystem-disturbing species?

Alien species managed by the MOE are divided into ecosystem-disturbing species, species with potential risks to the ecosystem, and species of concern for domestic inflow, which are managed in accordance with the Act on the Conservation and Use of Biological Diversity. Ecosystem-disturbing species can bring not only harm to the economy, human health, and society, including agriculture and fisheries, but also ecological damage, including a decrease in the populations of indigenous species and food chain disruptions.

Q. How does the NIE manage such species?

In accordance with Article 16-2 (Entrustment of Business Affairs) of the Enforcement Decree of the Act on the Conservation and Use of Biological Diversity, the NIE conducts risk assessments of species of concern for domestic inflow and alien species, and investigates and evaluates the impact of ecosystem-disturbing species on the ecosystem. Specifically, we divide the invasion of alien species

Soo-in Lee, Associate Researcher
in the Invasive Alien Species Team
at the NIE

into delivery, introduction, inflow, settlement, and spread, and manage them separately.

Q. Please introduce the Information of Korean Alien Species operated by the NIE.

The NIE has operated the system since 2018 for the rapid discovery of and quick responses to legally managed alien species and other alien species of concern for their impact on the natural ecosystem. It aims to relieve public anxiety about alien species. If you see species that seem to be legally managed alien species, including ecosystem-disturbing species, species with potential risks to the ecosystem, species of concern for domestic inflow, or other alien species with potential risks to the natural ecosystem that require a rapid response, you can report them to the "Alien Species Report Center" on the website (kias.nie.re.kr). Currently, you can also report them by phone (Invasive Alien Species Team at the NIE, 041-950-5407) or e-mail (kias@nie.re.kr).

Q. What should we do if we, as lay persons, find alien species?

If you find legally managed alien species, do not capture, deliver, or release them. Report their location to the district environmental office and the local government. Or, you can report them to the Alien Species Report Center I introduced earlier. According to the NIE's investigation and evaluation of the legally managed alien species based on the Act on the Conservation and Use of Biological Diversity, the NIE conducts a field investigation for rapid responses to alien species of concern for their



The NIE systematically investigates and manages alien species that did not previously exist in the Korean ecosystem. We asked Soo-in Lee, an associate researcher at the NIE, about what to do if we discover alien species, whether all alien species are harmful to the ecosystem, and more.

impact on our ecosystem, and informs the person who reported it of the results.

Q. What is the most frequently reported alien species?

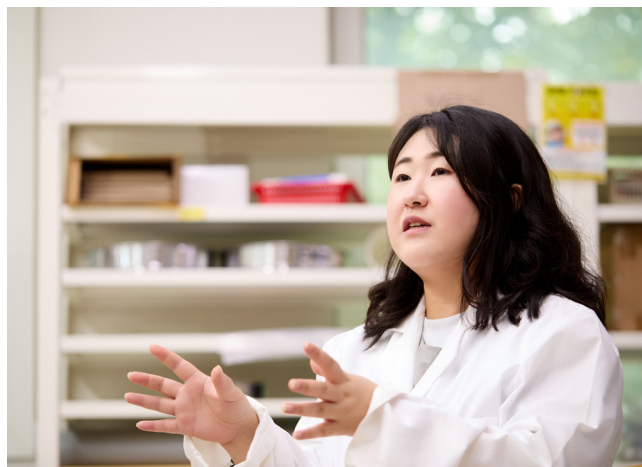
It depends on the seasons in which each species is active. For example, in spring, species that look like alien termites in wooden structures are frequently reported. In summer, the number of cases involving alien turtles including red-eared sliders (*Trachemys scripta*) increases because summer is their breeding season and they become more active outdoors.

Q. Which alien species does the NIE pay most attention to lately?

The NIE pays equal attention to every legally managed alien species. In particular, it actively responds to species distributed only locally to prevent their spread in the early stages. This year, the NIE has kept a close watch on an ecosystem-disturbing plant called *Spartina alterniflora*, which has been confirmed to grow only in Jindo, Jellanam-do.

Q. What kinds of technologies does the NIE use to monitor alien or ecosystem-disturbing species?

It depends on the target species. In general, we conduct both qualitative and quantitative investigations on site. For animal species, we conduct qualitative investigations, including direct observations and trace investigations, and capture investigations using traps, cast nets, skimming nets, and gill nets. For plants, to study population changes and companion species, we conduct vegetation and floristic surveys through quadrat sampling¹ and actual vegetation maps. Recently, we have been actively utilizing eDNA analysis, survey methods using drones and the geographic information system (GIS), and cutting-edge technologies such as estimating population sizes of mammals using



thermal imaging cameras, detecting alien ants using dogs, and using automatic identification technology for ecosystem-disturbing plants.

¹ Quadrat sampling: a method used to investigate the types and numbers of species in a certain size of quadrats.

Q. Could you tell us what kinds of common misunderstandings lay persons have about alien species, if any?

Although alien species are usually perceived negatively, they can be beneficial to crops, cotton, garden plants, zoos, and botanical gardens. However, alien species that negatively affect the natural ecosystem are defined as “invasive alien species,” which require strict controls internationally. The NIE controls and manages invasive alien species. I hope that you don’t think all alien species are bad. Some might be good, while others are bad. Sometimes, alien species that were once regarded as good create problems due to artificial factors like indiscriminate releasing. It is important to have a correct perception of alien species and to manage them responsibly.

The NNIBR, Which Keeps the Freshwater Ecosystem

Examining the Freshwater Ecosystem

Over the past 10 years, the NNIBR has kept discovering new and unrecorded species, obtaining specimens, and monitoring biodiversity of the Korean freshwater ecosystem. As a result, it has discovered more than 3,000 new and unrecorded species of animals, plants, algae, fungi, and prokaryotes. You might think that almost all plants and animals have already been discovered because we can easily see them with the naked eye, but this is not true. There are still many unknown species to be discovered, but not enough studies have been conducted due to a lack of domestic researchers. For example, Land planarians (*Bipaliinae/Microplaninae/Rhynchodeminae*) were first discovered in mountain valley wetlands, and *Sedum tricarpum* Makino, a plant in the Crassulaceae family that was only known to grow in Japan and China, was discovered in Korea for the first time and announced as an unrecorded species. Furthermore, freshwater animals such as *pseudocrangonyx* and *Bathynellacea* in the habitats for groundwater organisms like caves and hyporheic zones, which had not been found in Korea, were discovered and reported.

In 2023, the NNIBR conducted biodiversity monitoring near Bukcheon Stream in Sangju, where the NNIBR is located. It confirmed 17 fresh water species, including the diving beetle (*Cybister chinensis*) and far eastern brook lamprey (*Lethenteron reissneri*), which are endangered wildlife, and Korean

indigenous species *Zacco koreanus*, *Coreoleuciscus aeruginosa*, and *Microphysogobio yaluensis*. In addition, it discovered distributions of *Ambrosia artemisiifolia* L., *Sicyos angulatus* L., and *Humulus japonicus*, which are ecosystem-disturbing species, and bluegill (*Lepomis macrochirus*) and bass (*Micropterus salmoides*), which are alien species, near Bukcheon Stream, and wrote a press release about their potential risks to our freshwater ecosystem. Bukcheon Stream has high biodiversity even though it is a stream in a city area, and we confirmed that continuous monitoring and management of alien and ecosystem-disturbing species in the stream are necessary.

Freshwater Species Stored as Specimens

Investigation to collect freshwater species for specimens are conducted following a strict sequence of pre-investigation, collection on site, gene analysis, DB registration, preservation, and uses. First, we analyze the ecology and topography of the target area and select appropriate tools. During field investigations, we use collection tools such as fishing rods, cast nets, digging knives, and insect nets, according to the targeted group, and collect bio-samples. Then, we manufacture specimens following the corresponding manuals, identify the species based on morphological and genetic analyses in the lab, and put them in storage for long-term preservation after the NNIBR database



The year 2025 is the 10th anniversary of the NNIBR, which studies freshwater ecosystems and organisms and promotes public awareness of their importance. Celebrating its 10th birthday, let us consider the significance of the freshwater ecosystem, what the external risk factors to the system are, and how to respond to them.

registration.

The biospecimens and taxidermized specimens are shown at our permanent exhibition hall to teach the public and students the value of the freshwater ecosystem in Korea, and used as hands-on materials for our education programs. Specimens in unexplored taxa are the basis of research materials for international academic exchanges of research on new and unrecorded species. Recently, we have conducted research to improve information accessibility and utilization through biospecimen digitalization.

Invasions Threatening the Freshwater Ecosystem

The biggest threats to the freshwater ecosystem are habitat destruction, influxes of alien species, water pollution, and climate change. Due to river straightening, bank construction, and wetland reclamation, habitats have decreased, and alien fishes or mammals compete with and prey on indigenous species, disturbing the ecosystem. Furthermore, climate change has rapidly changed habitat environments, pushing some species to the brink of extinction. Against this backdrop, we desperately need efforts to fight such complicated threats.

When the NNIBR finds alien and ecosystem-disturbing species, it records and describes them in scientific papers or reports so that relevant organizations such as the MOE and local governments can respond to the situations. As such, the NNIBR has made an effort to lay the foundation for freshwater ecosystem conservation on a scientific basis, and has contributed to freshwater biodiversity conservation through continuous monitoring and recording.

Importance of the Freshwater Ecosystem and Freshwater Biodiversity

Freshwater ecosystems are essential to our lives because they are used for drinking water, agricultural water, and leisure activity destinations, and serve as homes to various species at the core of the ecosystem's health. Freshwater organisms have great future value, given that they are not only



Sedum tricarpum Makino



Pseudocrangonyx joolaei

important for maintaining the ecosystem's functions but also very useful for developing biologics, eco-friendly agricultural materials, and education and exhibition materials. Therefore, freshwater biodiversity conservation is critical for our quality of life and future.

Over the past 10 years, the NNIBR has played a significant role in establishing a database of national bioresources and securing bio-sovereignty by investigating freshwater organisms, discovering new and unrecorded species, and securing specimens. Amid the threats of climate change and alien species invasions, it will endeavor to connect policies related to freshwater ecosystem conservation and promote public awareness. As a field researcher, I will contribute to laying the foundation for freshwater conservation through meticulous investigation and recordkeeping.

Even though freshwater organisms are neither big nor glossy, they are precious future resources that are very useful in various fields including ecosystem circulation, water purification, biologics, and agricultural material development. In this regard, the NNIBR, as the research institute that is always open to the people, will keep promoting the value of bioresources and conserve them with the people.

Protecting Gohado from Alien Plants

Gohado, where the HNIBR is located, has been a starting point for island and coastal biodiversity research.

It is home to various native plants and has well-conserved biodiversity, but at the same time, there is a concern that its environment could be destroyed by tourists or by alien species that flow in.

Gohado Where Island and Coastal Biodiversity Research Begins

The HNIBR is a public institute that contributes to the early securing of national bio-sovereignty, preservation of biodiversity, and sustainable use of biological resources in islands and coastal areas by conducting investigations and surveys on island and coastal bioresources. It is located on Gohado, Mokpo-si, Jellanam-do, where historical value and ecological importance coexist. Admiral Yi Sun-sin stayed on Gohado during the Imjin War (the Japanese invasion of Korea) to re-brace after the Battle of Myeongnyang. He praised the geography and location of the island highly, calling it "Bowhado," which means a precious island like a priceless flower. Gohado is a strategic point that leads to the estuary of the Yeongsangang River and the breadbasket of the Honam region, connecting the southwest sea and the inland areas. During the Japanese occupation, Gohado was a testing area to cultivate U.S. cotton (upland cotton), and Mokpo had grown into the center of production and distribution of cotton.

Gohado has island-specific ecological traits and serves as a research base for island and coastal biodiversity based on its advantageous location, with easy access to the southwest sea and the southern coast, where many islands are densely located. Given the historical, geographical, and biological traits of this island, the HNIBR chose it as the most suitable location not only for establishing strategies for ecosystem study and biodiversity conservation but also for beginning island biodiversity research.

Small but Active Biodiversity of Gohado

In April 2025, the HNIBR announced its three-year

research on the vascular flora of Gohado, which started its inception. For the research, 17 field surveys were conducted by season after a literature review on the entire island was conducted. Its researchers collected voucher specimens on the plants that they found on the island, established accurate distribution data based on the GPS coordinates they recorded, and systematically documented the populations and distributions of endangered species by creating field survey cards.

The results confirmed that 431 taxa of vascular plants (105 families, 294 genera, 395 species, 7 subspecies, 27 varieties, and 2 breeds) were distributed on Gohado. Even though Gohado is a relatively small island (its total area is 2.99 km², ranking 114th among 465 inhabited islands in Korea), about 9.4% of vascular plants in the Korean Peninsula and about 15% of the island plants are found on this island. This illustrates that Gohado has a high level of biodiversity per area. In particular, the Class II Endangered Species of *Dendrobium moniliforme* (L.) Sw. and *Pelatantheria scolopendrifolia* (Makino) Aver., Korean native plants *Weigela subsessilis* (Nakai) L. H. Bailey, *Clematis brachyura* Maxim., and *Indigofera koreana* Ohwi, and rare plants *Albizia kalkora* Prain, *Bletilla striata* (Thunb.) Rchb. f., and *Mosla chinensis* Maxim. were found in great numbers, reaffirming that Gohado has great value for ecological preservation.

Alien Plants Threatening the Ecosystem of Gohado

Gohado is connected to land by a bridge, Mokpodaegyo, which allows easy access. It has beautiful natural landscapes and numerous tourist attractions, including Mokpo Marine Cable Car and Cotton Experience Park, which attract many tourists.

However, these are also risk factors that increase the likelihood of incoming alien species. Ninety-one taxa of the alien plants, which account for about 21% of the total plants found on the island, are concentrically distributed around tourist destinations, hiking trails, and roadsides. This figure is a huge increase from the 54 taxa confirmed in the 1995 survey, mainly due to external environment changes such as tourist site development and climate change.

Alien plants can spread rapidly based on their excellent propagation abilities and environmental adaptability while competing with native species. In particular, a number of studies show that some alien plants replace indigenous plants as the dominant species in plant communities, resulting in reduced biodiversity and negative impacts on plant-animal interactions.

On Gohado, seven ecosystem-disturbing wild plants (*Lactuca serriola* L., *Paspalum distichum* L., *Solanum carolinense* L., *Ambrosia artemisiifolia* L., *Hypochoeris radicata* L., *Solidago altissima* L., and *Humulus japonicus* Siebold & Zucc.) have been confirmed. Among them, *Solidago altissima* L., a perennial herb in the Asteraceae family originating in North America, was designated as an ecosystem-disturbing wild plant in 2008. This big plant grows so widely and densely that it takes over other plants' growth areas. In addition, it releases allelochemicals that can inhibit the growth of other plants. It has spread widely in Jeonnam, and on Gohado, its massive spread around hiking trail courses, open areas, and farmlands has been observed.

The HNIBR's Efforts to Protect Island Ecosystem

In island and coastal areas such as Gohado, core facilities that connect other areas, such as ports and airports, are densely located, so alien plants can be introduced unintentionally. In particular, because islands are geographically isolated and confined, if alien plants flow into them they can rapidly settle and spread, leading to a huge impact on local biodiversity.

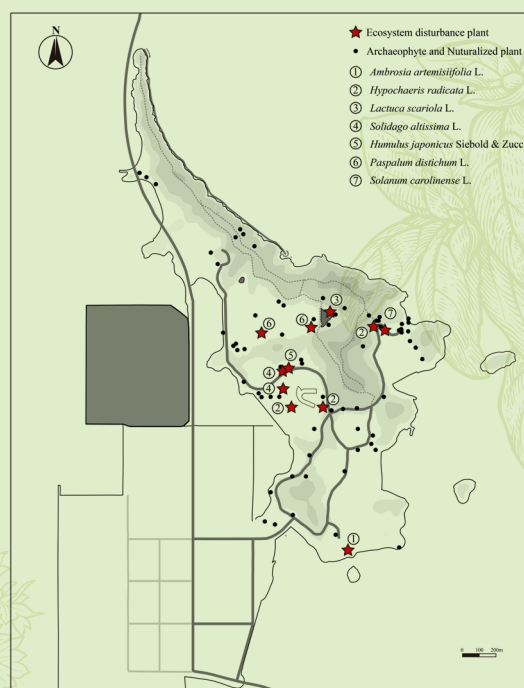
As the influx and spread of alien plants can affect local vegetational compositions and species diversity, continuous monitoring and data accumulation are critical. The HNIBR has conducted research and surveys on a regular basis and has focused on obtaining basic data, including the

distribution and morphological characteristics of those plants. The research results will be useful for developing management and countermeasures in the future.

As climate change and development have accelerated, island and coastal plants are quietly sending a signal for help. Warmer weather and changing rainfall patterns have provided a land of opportunities for alien plants, while pushing some indigenous plants to the brink of extinction. At times like this, we need to pay attention to slight changes around us and record them consistently. The best way to respond to these changes is to not miss minor signals. That's why the HNIBR goes to islands and calmly observes how the plants change.



Dendrobium moniliforme (L.) Sw., a Class II Endangered wild plant naturally growing on Gohado



Distribution Map of Alien and Ecosystem-Disturbing Wild Plants on Gohado



How to Live with Insects in the Climate Crisis Era

National Institute of Biological Resources (NIBR)

Insects, Small but Strong Reasons for Existence

Date: July 4, 2025 ~

Venue: Saengsaengchaem Special Exhibition Hall
at the NIBR

Recent urbanization and climate change have been pushing insects into either mass outbreaks or extinction. So, how do we coexist with insects? The NIBR's special exhibition, "Insects, Thriving or Disappearing," will help us understand insects correctly. You can observe 19 specimens of insects, including *Ephemera orientalis* McLachlan and *Plecia longiforceps* Duda, through a digital microscope, and meet the huge replicas of the species in the Red List and endangered species whose

populations have been diminishing. How about enjoying the "Immersive Media Space," in which you can experience how to live harmoniously with insects in a landscape featuring flying dragonflies and fireflies, which are rarely seen in cities? Let us reconsider what we can and should do for harmonious coexistence with insects while enjoying the exhibition.



AI-Imagined Ecosystems Are Coming to Us

National Institute of Ecology (NIE)

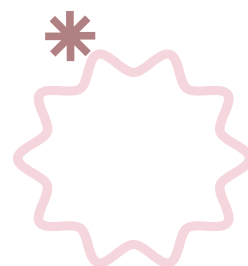
Exhibition of Imaginary Ecology with Generative AI

Date: July 22–October 12, 2025

Venue: Permanent Exhibition Hall I at Ecorium,
at the NIE

The NIE presents its special exhibition, “Paint Our Ecosystem with AI,” which visualizes imaginations using AI. The exhibition consists of △AI that Leads Ecological Research △From AI’s Perspective △AI Imagination Gallery △AI x Ecological Research △Ecosystem That I Create, and △Ecology Panorama Imagined by AI. In particular, the AI Imagination Gallery section presents the paintings of the winners of the “Ecology Drawing Competition with AI,” with the participation of NIE employees,

whetting our curiosity about how ecology experts paint their imaginations using AI. In addition, visitors can create ecology paintings using AI and watch immersive moving images on a large LED screen. Please come and experience the integration of cutting-edge technologies and ecology.



Meet the Freshwater Ecosystem of Korea in the Virtual World

The NNIBR has prepared a special exhibition, “Mystical Freshwater World,” using extended reality (XR) technology, an exciting opportunity to meet indigenous and endangered species in Korea’s freshwater ecosystem while walking, seeing, and listening. This exhibition represents the waterside ecosystem, the freshwater ecosystem, and the ecosystem at night in the virtual world. Visitors can meet living organisms in Korea’s freshwater ecosystem using XR gear. How about

Nakdonggang National Institute of Biological Resources (NNIBR)

Exciting Exploration of the Virtual Freshwater Ecosystem

Date: July 29, 2025–March 1, 2026

Venue: Lobby on the second floor of the Exhibition and Education Building at the NNIBR

joining the journey to complete the ecosystem restoration mission by finding endangered freshwater species—including golden frogs (*Pelophylax chosonicus*), the Korean stumpy bullhead (*Pseudobagrus brevicorpus*), and *Microphysogobio rapidus*—and making a digital illustrated book of creatures? It will make all visitors, from kids to adults, vividly understand the value of biodiversity in a unique way through digital ecology exploration.



Birds that the Gohado Expedition Meets in the Autumn: Passage Migrants

Gohado, where the HNIBR is located, is home to various living organisms. Gohado Expedition, the HNIBR's education program that participants can explore to experience bioresources on Gohado, will start a new island-themed class, *Birds That We Meet in the Autumn*, on Nov. 16 (upper grades) and 23 (lower grades). It will deepen your understanding of the importance of the *Getbol* (tidal flat) ecosystem and biodiversity by exploring diverse passenger migrant birds, such as plovers

Honam National Institute of Biological Resources (HNIBR)

Learn About the Biodiversity World from Nature

Date: November 16, 2025 (upper grades),
November 23, 2025 (lower grades)

Venue: Island and Coastal Biology Learning Center
at the HNIBR

and snipes, that come into our country every autumn. Up to 15 students can enroll in each three-hour class (one for lower grades and the other for upper grades) using the HNIBR's integrated reservation system on a first-come first-served basis, from Oct. 20 to Nov. 15. We encourage your full attention and participation in this special class, where you can feel nature in your whole body and explore the world of biodiversity.



Jaeyaksan Mountain and Sajapyeong Plain Imbued with Colors and Texture of Autumn

If we relax and enjoy the refreshing weather, autumn colors shining in every corner will enchant us. Autumn is such a special season that even with its own colors, we can vividly paint the landscape of silver grass shaken with wind. How about visiting Jaeyaksan Mountain and Sajapyeong Plain in Miryang, Gyeongsangnam-do, where we can feel the unique textures and ecology of this beautiful season?



Sajapyeong Plain

Yeongnam Alps Embrace Picturesque Beauty

Verdant nature is changing and revealing its colorful faces. To fully enjoy this season, there is no better recommendation than visiting mountains covered with colorful autumn leaves. How about enjoying the Yeongnam Alps as they show off their beautiful scenery? The Yeongnam Alps got their name because the mountains—located in the Yeongnam area where Gyeongsangnam-do, Ulsan Metropolitan City, and Gyeongsangbuk-do meet, at an elevation of more than 1,000 meters above sea level—are so majestic that they are comparable to the beauty of the Alps in Europe.

Not only do their colorful nature give us pleasure, they also have abundant ecological value. Their thick forests are home to various plants and animals, as well as alpine species rarely found in other places. Furthermore, as the Yeongnam Alps have many spots where waterways to the Nakdonggang River begin, they can be considered a repository of the ecosystem circulation in the Yeongnam area.

Colorful Faces of Nature Presented by Jaeyaksan Mountain

If you want to enjoy autumn mountain climbing while

visiting the Yeongnam Alps, Jaeyaksan Mountain in Miryang, Gyeongsangnam-do, is highly recommended. Jaeyaksan Mountain and Sajapyeong Plain, which are designated as ecotourism destinations, boast vivid colors and textures of autumn, from leaves tinged with warm colors to silver grass that completes a calm and peaceful landscape. In particular, Sajapyeong Plain has the largest silver grass field in Korea and is also the largest mountain wetland. Because it has developed a unique ecosystem as a mountain wetland, it is important for biodiversity conservation.

Jaeyaksan Mountain has several climbing routes with different difficulty levels, as well as a cable car that can be taken to the top of the mountain so climbers of all levels can enjoy it. The hiking trail usually starts at Pyochungsa Temple, located at the base of the mountain. Pyochungsa Temple was founded by Monk Wonhyo in 654. The mountain and temple are so beautiful and enjoyable all year that the four seasons of Pyochungsa Temple and the silver grass in Jaeyaksan Mountain were selected as one of the Eight Beautiful Scenes of Miryang.

Jaeyaksan Mountain has five ecotourism trails. While



Pyochungsa Temple

climbing to its summit, Sumibong Peak (1,119 meters high), you can encounter numerous magnificent waterfalls. Heungnyongpokpo Falls was named because its water, which falls vigorously onto two levels, looks like a black dragon flying up ("Heungnyong" refers to a black dragon in Korean), and Cheungcheungpokpo Falls' waterways flow through multiple tiers along the cliff. These are just two of the many marvelous and mysterious works of nature that you can see here.

Autumn Ecology Presented by Sajapyeong Plain

There are many stories about where Sajapyeong Plain's name comes from. Some say it comes from the Korean word for open plains; others say it is because there was a Sajaam Hermitage a long time ago, and still others claim that the mountain behind the plain and the silver grass growing there look like a lion ("Saja" means lion in Korean.) As the diverse stories show, this wetland has a long history. During the Silla Dynasty, it was a training site for Hwarang (an elite warrior group of male youth in Silla), and during the Imjin War at the time of the Joseon Dynasty, it was a

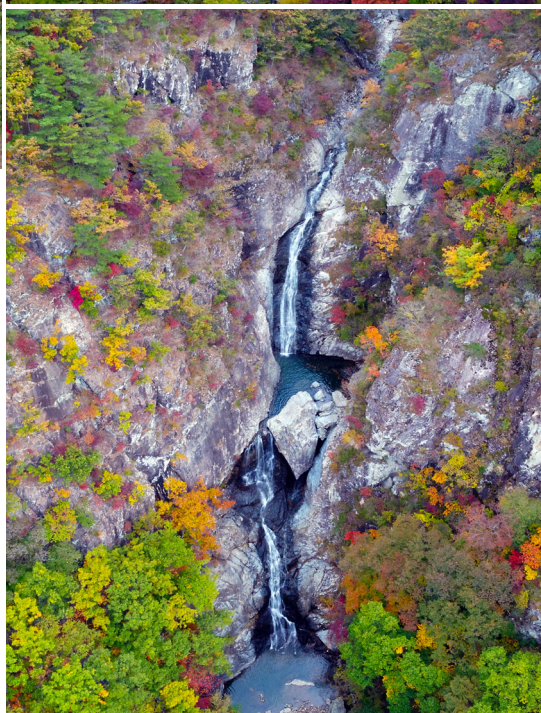
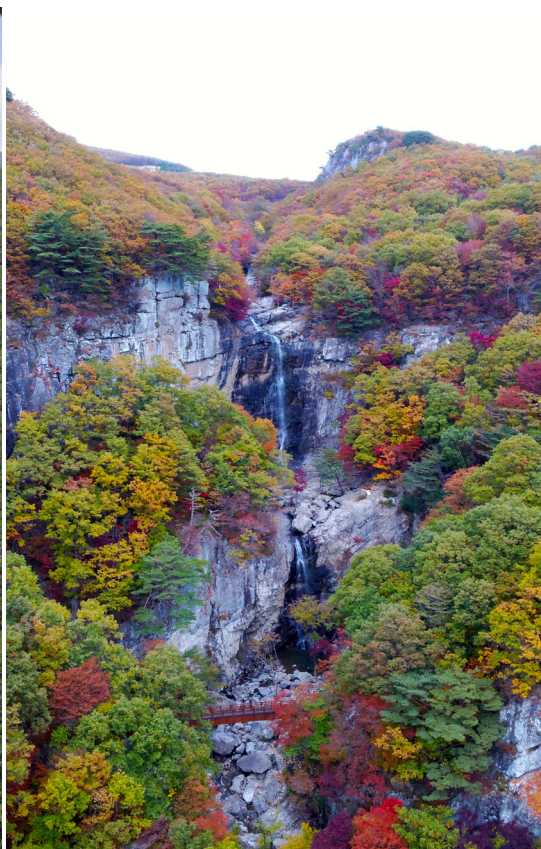
training site for monk soldiers. After the Korean War, slash-and-burn farmers who escaped from the war settled here and built villages, so even a branch elementary school was established. However, in the 1990s, the Korean government ordered them to move for ecosystem conservation, and the natural environment started to recover after all the local residents had left. In 2006, as this region was recognized for its ecological value, it was designated a Wetland Protection Area by the MOE.

The area of Sajapyeong Plain, located 800 meters above sea level, is about 580,000 m², making it the largest mountain wetland in Korea. The vast silver grass that spreads across the entire plain presents us with peaceful scenery and incomparable colors that we cannot find in any season other than autumn. However, this natural beauty would not be possible without help. In 2009, the city of Miryang began a restoration project, and then the Nakdonggang Basin Environmental Office of the MOE conducted a 4.5 billion-won ecological restoration project with 4.5 billion-won from 2013 to 2015. Thanks to the meticulous efforts, including renovating waterways and building ecological deck trails for wetland



Eoreumgol Ice Valley Cable Car in Yeongnam Alps

protection, Sajapyeong Plain could finally recover its picturesque scenery and rich ecology. The moment you encounter Sajapyeong Plain imbued with autumn colors, you will be overwhelmed by the beauty of nature. Beyond simple admiration, you might understand hidden history, unsung efforts, and numerous organisms living inside the beautiful landscape. Naturally, I hope that the ecosystem, biodiversity, and colorful nature here will not be depleted, like a mountain wetland that will never dry.

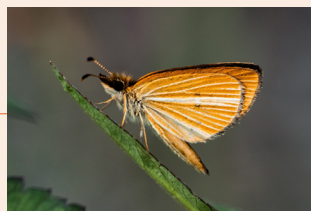


Heungnyongpokpo Falls and Cheungcheungpokpo Falls



① *Chrysochroa (Chrysochroa) coreana*

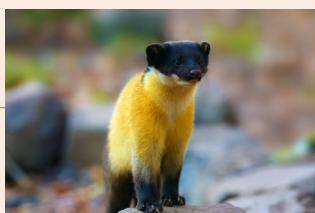
Chrysochroa (Chrysochroa) coreana, designated as a Korean National Monument, is a Class I Endangered Wild Species. Its body, which is 30–40 mm long, has a greenish metallic color, with two red lines each on the scutellum and the elytron. In the past, it was overcaught for ornamental purposes, leading to its near extinction. It inhabits mostly central and southern forests in the Korean Peninsula.



② *Leptalina unicolor*

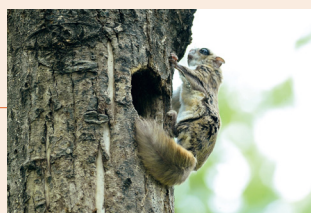
Leptalina unicolor, a Class II Endangered Wild Species in the Hesperioidea family, mostly feeds on leaves and inhabits wetlands or the grass near wetlands. The wingspan of adults is roughly 31–35 mm, which is smaller than most other butterflies. The front of their wings is blackish brown, and the back is dark brown. It has silver whitish horizontal lines in the center of its hindwings.

Endangered Species Inhabiting Jaeyaksan Mountain, Embracing the Mountain Wetland Ecosystem



③ *Martes flavigula*

Martes flavigula is a Class II Endangered Wild Species in the Mustelidae family. Its body length is 59–68 cm, two-thirds of which is a tail (40–45 cm). Its head, face, legs, and tail are dark brown, the back is light brown, and the belly is apricot. It inhabits thick coniferous forests in groups of two or three, and is found everywhere in the inland areas of Korea.



④ *Pteromys volans aluco*

Pteromys volans aluco, a Class II Endangered Wild Species and a Natural Monument in Korea, has a patagium, which is a membranous body part that assists it in obtaining lift when gliding or flying, stretching from the ankles of its front limbs to the knees of its hind limbs. It is nocturnal, mostly inhabiting broadleaf forests, and has big eyes and short ears. It is found everywhere in the inland areas, except Jeju.

National Institute of Biological Resources (NIBR)

Long-Term Changes in the Population Trends of Wintering Waterbirds in the Republic of Korea

The population changes in waterbirds are recognized as a global issue. Many waterbird species, especially migratory ones, are undergoing population changes. Monitoring these changes is crucial for waterbird conservation. However, the lack of data to quantify these populations hinders comprehension of the factors responsible for these changes. Although a few studies have investigated the long-term trends of waterbirds in the Republic of Korea, most have concentrated on a limited number of species and groups. Understanding these changes enables us to identify which species are vulnerable and develop more effective conservation measures accordingly. This study aims to investigate the population dynamics of waterbirds in the Republic of Korea from 2000 to 2024. We used data from the Winter Waterbird Census of Korea made by the NIBR to analyze trends across various waterbird groups and species. The results showed diverse population trajectories, with some species experiencing notable increases while others underwent severe declines. Among the observed trends, several globally threatened species, such as the white-naped crane (*Grus vipio*) and oriental stork (*Ciconia boyciana*), exhibited significant population growth for the 25 years. This is largely due to a testament to the effectiveness of direct conservation interventions aimed at these species. However, the study also identified population declines of some species, such as the tundra swan (*Cygnus columbianus*) and common pochard (*Aythya ferina*), indicating pervasive threats due to habitat loss and degradation. This study, with its comprehensive and detailed findings, reiterates the importance of long-term monitoring data for developing effective conservation measures.

Nam H. K., Hur W. H., Kim H. J., Kim D. W., Hwang J. W., Park J. Y., Kil H. J. and Choi Y. S. 2025. Long-term changes in the population trends of wintering waterbirds in the Republic of Korea. Bird Conservation International.

National Institute of Ecology (NIE)

Analysis of the Application of Phytohormone for *Abies koreana*'s Adaptation to Environmental Changes

Abies koreana, a plant species endemic to Korea, is sensitive to climate change. However, little is known about the molecular mechanisms underlying its environmental stress response. This study characterized the effects of exogenous abscisic acid (ABA) concentration, application method, and application duration on the expression of ABA-responsive genes in *A. koreana*. The leaves (needles) were treated with various concentrations of ABA (0.2, 0.4, and 0.8 mM), and the expression levels of AKNAC19 were measured according to treatment method (pressure method and dipping method). According to the results, 0.2 mM ABA was optimal for gene regulation, and the dipping method was slightly more effective than the pressure method in inducing gene expression. However, previous research (Hwang et al., 2018) has already confirmed that under high-temperature stress conditions, the transcription expression of eight types of genes in *A. koreana* increase. The genes AKERF4, AKNAC2, AkbHLH, AkEFP, AkHSP17.6, and AkMYB123 showed a positive response to ABA, and the optimal treatment duration for gene expression induction varied by gene type. However, the expression level of AkMPK6 did not show significant differences. Overall, these results suggest that *A. koreana* can adapt to abiotic environmental stress by upregulating the expression of ABA-responsive genes. This research can be used as basis data for further research on enhancing *A. koreana*'s ability to respond to climate change.

Lee D. Y., Kim D. W., Park D. Y., Park J. W., and Park H. C. 2023. Characterization of the effects of exogenous abscisic acid (ABA) application on the expression of ABA-responsive genes in *Abies koreana*. Plant Biotechnology Reports, 17(5):777-785

Nakdonggang National Institute of Biological Resources (NNIBR)

Novel Strain of the *Catenovulum* Genus That Produces Agar Oligosaccharides and Its Uses

This patent relates to a novel strain (6LW5-1) of the *Catenovulum* genus collected from Gyeongpoho Lake, Gangneung, and its uses. This strain shows stronger agarase activity than other strains and has advantages for industrial use because it can stably produce enzymes and its cultivation conditions can be optimized. By degrading agar, it can effectively produce agar oligosaccharide, which has various biological activities such as improving gut health, as well as anti-inflammation, anti-oxidation, and immunoregulation properties. Chemical methods or microorganisms with low biological activity have been used to produce agar oligosaccharide, but this strain can degrade agar in a highly efficient way and produce high-quality oligosaccharides. This opens possibilities for using marine microorganisms in new ways and overcomes previous technological limits. This strain can be used in diverse industries, including foods, cosmetics, and fodder.

Patent No. 10-2025-0083695

Applicants: Hyang-mi Kim, Hyun-ju Kim, Jae-duk Goh

Honam National Institute of Biological Resources (HNIBR)

Hydrogel Containing Chitosan, Genipin, and Alamethicin, and Method for Producing the Same

This patent relates to a hydrogel containing alamethicin, an antibacterial peptide derived from the fungus *Trichoderma viride*, collected from island and coastal areas; chitosan, a natural polymer; and genipin, a natural cross-linker, as well as its production method. *T. viride*, the fungus used in this research, is known to suppress bacteria that can cause plant diseases and promote plant growth, and the alamethicin extracted from this fungus is a natural antibacterial peptide that can be used to treat infections resistant to antibiotics and antimicrobials. It has been confirmed that this hydrogel can suppress bacteria in wounds and promote tissue generation and infectious wound healing with the cytocompatibility and anti-biofilm effect of the hydrogel. In particular, the hydrogel showed strong antimicrobial activity against methicillin-resistant staphylococcus aureus (MRSA), and proved to be highly biocompatible and safe through in vivo and in vitro tests. It can be widely used in medicine and bio-industry in diverse ways, such as infectious wound treatments, skin regeneration, and antibacterial products, and it can be developed in various forms, including scaffolds, hydrogel packs, and patches.

Registration No. 10-2817302

Applicants: HNIBR, CNU R&BD Foundation

Determining the Migratory Movement of the Summer Bird, Lesser Cuckoos, Who Flew to Africa

For the first time in the world, the NIBR confirmed 27,340 km of the migratory route of the lesser cuckoos (*Cuculus poliocephalus* Latham). These summer birds, which were born in Korea last year, flew to Mozambique, Africa to spend the winter and came back to Korea this year. The lesser cuckoo, which is mostly found in parts of East Asia including Korea, China, and Japan, is a species known for its unique behavior and brood parasitism, meaning it lays eggs in the nests of other birds and relies on the host birds to incubate the eggs and raise the young. In Korea, it is seen in every region of the country from May onward.

The NIBR has conducted ecological research on the migratory movements of birds to reveal their migration routes since 2010. Two lesser cuckoos to which the GPS tracking devices were attached on Jeju Island in May 2024 flew south around August or September 2024, crossed the Arabian Sea and the Indian Ocean through China, India, and Sri Lanka, and reached the African continent at the end of 2024. One of them spent the winter in Mozambique and then moved east in April 2025. The NIBR research team also confirmed the birds' homing behavior for the first time, as they returned to Jeju Island in early June via the same route. In particular, in spring, when they crossed the Arabian Sea and the Indian Ocean, they flew 4,180 km over six days without pause. It is the longest movement of mountain birds crossing oceans ever recorded.

Ho Yu, President of the NIBR, said, "This research is very meaningful in that it confirmed the migratory route of the bird using high-tech devices, including GPS trackers, for the first time in the world," adding, "We will keep strengthening international collaboration to obtain and manage basic data on their movements."



Lesser cuckoo with GPS tracker (May 14, 2024, Songdang-ri, Gujwa-eup, Jeju-si)

Successfully Inducing Stem Cells from Mountain Goats, an Endangered Species

The NIBR successfully reprogrammed somatic cells derived from the hair root of the mountain goat, a Class I Endangered Species, back to induced pluripotent stem cells (iPSCs)¹, embryonic stem cells, for the first time in Korea. In June 2025, the NIBR research team analyzed the cell morphology, chromosomes, and stem cell markers of the research subject by injecting reprogramming genes² into the cryopreserved hair root cells of the goats. The results confirmed that the subject was induced pluripotent stem cells, which can be differentiated into various cell types, including reproductive cells.

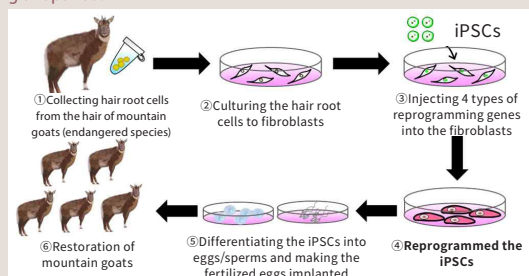
In this research, 27% of the hair root cells derived from mountain goats were reprogrammed to iPSCs, which is higher than 20%, the maximum inductivity rate of major countries³ that have conducted research on the iPSCs of endangered animals since 2010. It is the 12th successful case in the world in which stem cells were reprogrammed depending on the characteristics of wild animals, demonstrating that Korea has world-class technologies. In addition, the result was meaningful not only because it secured stem cell induction technologies but also because it opened possibilities for their practical uses as biotechnologies that can induce the reproductive cells of endangered animals, restore them, and obtain gene diversity.

Ho Yu, President of the NIBR, said, "We will use this technology broadly to conserve endangered wild animals, working with the NIE Endangered Species Recovery Center and the Korea National Park Service," adding, "The NIBR will actively implement cutting edge technology-based biodiversity conservation policies."

1 iPSC (Induced Pluripotent Stem Cell): A type of stem cell that is reprogrammed from adult cells already grown into a specific tissue to various embryonic-like state cells.

2 Genes that play a critical role in returning already differentiated adult body cells back to embryonic-like stem cells that can differentiate into any cell type in the body (e.g., Oct4, Sox2, c-Myc, Klf4).

3 (U.S.) An extinct in the wild species, northern white rhinoceros; (U.K.) An endangered species, chimpanzee; (China) An endangered species, giant panda.



Experiment Process of iPSC of Mountain Goats

Possibility of Restoration of *Cypripedium guttatum* Sw. is Proved after Its Successful Adaptation to natural Habitats for the First Time in Korea

The NIE announced that the captive-propagated *Cypripedium guttatum* Sw., a Class I Endangered Wild Species, had successfully adapted to natural habitats in Korea.

C. guttatum Sw., which is a perennial plant in the Orchidaceae family, is a rare plant that grows natively in alpine zone forests and grasslands at 1,000 m above sea level. It was once widely distributed in Seoraksan Mountain and Hambaeksan Mountain, but its population has decreased rapidly due to indiscriminate development and illegal plant poaching. Currently, it is only found in some areas of Hambaeksan Mountain, so it was designated a Class I Endangered Wild Species in 2012.

The NIE Endangered Species Recovery Center cultured and propagated seeds collected from natural habitats in 2021 in sterile conditions, and transplanted them one by one into the natural habitats in Hambaeksan Mountain in 2023 and 2024. In the spring of 2025, some of them sprouted, which is considered the first case in which captive-propagated *C. guttatum* Sw. successfully adapted to domestic natural environments. In particular, given that *C. guttatum* Sw. is a plant in the Orchidaceae family, whose germination conditions are very tricky and whose growth periods are long, this success can be seen as a meaningful achievement, earned through years of effort in cultivation, acclimatization, and growth management, and a practical turning point for ecological restoration technology.

Based on this result, the NIE plans to keep analyzing its optimal growth environments in natural habitats and to make efforts to restore the plant to a stable level and increase its population through additional transplantation and developing alternative habitats. Seung-woon Choi, Executive Director of Center for Endangered Species Restoration, said, "This successful case of adaptation to the natural habitats will be a significant milestone for research on the restoration of endangered plants," adding, "The NIE will do its best for sustainable conservation and the restoration of endangered species."



C. guttatum Sw., which adapted to natural habitats

The development of species identification technology for distinguishing between *Abies koreana* E. H. Wilson and *Abies nephrolepis* (Trautv. ex Maxim.) Maxim.

The NIE developed an identification diagnosis technology that can accurately distinguish between *A. koreana* E. H. Wilson and *A. nephrolepis* (Trautv. ex Maxim.) Maxim. —which look so similar that the differences between the two are barely recognizable to the naked eye—and applied for a patent recently. *A. koreana* E. H. Wilson, which is internationally called the "Korean fir tree," is native to Korea, inhabiting alpine areas (sub-alpine zones) such as Hallasan Mountain, Jirisan Mountain, and Deogyusan Mountain. It is popular as a Christmas tree. However, as its population has decreased due to climate change, it was listed as an endangered (EN) species in the International Union for Conservation of Nature (IUCN) Red List; consequently, research is required for its conservation and restoration. The identification diagnosis technology development was carried out as part of a study on of climate change response technologies for the adaptation and conservation of vulnerable ecosystems. The purpose of this technology is to distinguish coniferous trees like *A. nephrolepis* (Trautv. ex Maxim.) Maxim, which looks similar, with high specificity and sensitivity based on molecular markers. By doing so, a more accurate scientific judgment on protecting alpine ecosystems that are vulnerable to climate change would be possible. The NIE will submit this research paper to an academic journal, *Plant Biotechnology Reports*. Chang-suk Lee, President of the NIE, said, "The development of species identification technology for distinguishing between *A. koreana* E. H. Wilson and *A. nephrolepis* (Trautv. ex Maxim.) Maxim., and diagnosis kits will be our starting point to promote the public's understanding on restoration and conservation of vulnerable alpine ecosystems," adding, "In this regard, we will continue to conduct relevant research for the future."



Abies koreana E. H. Wilson in Hallasan Mountain
Abies nephrolepis (Trautv. ex Maxim.) Maxim. in Odaesan Mountain

The 10th anniversary of the foundation of the NNIBR

The NNIBR was established in June 2015, aiming to obtain national bio-sovereignty and realize the sustainable use of bioresources by surveying and discovering freshwater organisms. On June 17, 2025, the NNIBR celebrated its 10th anniversary and held a special event.

Over the last 10 years, the NNIBR has discovered 2,995 new and unrecorded freshwater species from rivers, wetlands, and other freshwater sources, and obtained more than 600,000 biospecimens of 14,600 species (64% of the species on the freshwater species list). In addition, it has made 140 patent applications and 41 cases of technology transfers, and laid the foundation for the industrialization of bioresources. To promote the importance of bioresources and the value of biodiversity, the NNIBR has launched various exhibition education programs and invited 1.7 million cumulative visitors, positioning itself as an exhibition and education institute for the people. This year, it published its "10-Year History of the Nakdonggang National Institute of Biological Resources," which describes its achievements over the past 10 years. (You can download it on the NNIBR Website (nnibr.re.kr).)

The 10th anniversary ceremony was held with the theme of "10 Years with Freshwater Organisms and Toward a Sustainable Future," reviewing the NNIBR's major achievements, including survey and research on freshwater bioresources and constructing the foundation for industrialization, and sharing its future development directions and vision. Seok-weon Yong, President of the NNIBR, said, "The 10th anniversary ceremony is a meaningful milestone to think about the path the NNIBR has taken and the one we will go down together," adding, "Based on what we have achieved, we will take a step further in strengthening expertise in freshwater bioresource research and our role as a public institute, and lead the sustainable future."



The 10th anniversary ceremony of the NNIBR

Developing a Microalgae Biomaterial that Can Grow Stably in the High Concentration Carbon Dioxide Air

The NNIBR has successfully developed a microalgae biomaterial that can grow stably by absorbing high concentrations of carbon dioxide emitted from industrial sites.

As microalgae can absorb carbon dioxide and produce oxygen through photosynthesis, they have drawn growing attention as core biomaterials to realize carbon neutrality. Specifically, technology that directly supplies massive carbon dioxide produced at industrial sites to microalgae so that they can absorb it has become spotlighted. Microalgae in general barely grow at industrial sites because emissions from these sites contain concentrations of carbon dioxide that are hundreds of times higher than the average (0.04%) in the air.

To tackle this problem, the NNIBR has conducted research on the improvement of microalgae tolerant of high concentrations of carbon dioxide since 2024, and has succeeded in developing microalgae that can grow stably even in air with high concentrations (30%) of carbon dioxide (approximately 750 times higher than the average).

The microalgae, an improved variety of *Chlorella sorokiniana* KGH2-7, can tolerate more carbon dioxide by using an adaptive laboratory evolution technique that makes microalgae adapt to an environment they are exposed for a long time. The NNIBR research team plans to develop it further so that it can actually be used at industrial sites.

Eui-jin Kim, Managing Director of the Bioresource Research Department of the NNIBR, said, "This development is a significant first step to realize carbon neutrality through biomaterials," adding, "We will endeavor to make it more practically useful at industrial sites."



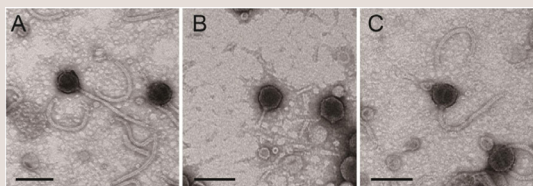
The carbon dioxide fixation per day of the improved variety is approximately 1.8 times higher than the fixation of the wild species.

Research on bacteriophages to control diseases in aquaculture farms was published in an international academic journal

The HNIBR isolated and characterized three novel bacteriophages that target key *Vibrio* pathogens. These research results were published in the international *Journal of Microbiology*, and their scientific validity was demonstrated. The HNIBR research team comprehensively analyzed the morphological features, genome compositions, and active infections of these three bacteriophages, isolated from the effluents in shrimp farms in Jindo, Jeollanam-do.

A bacteriophage is a virus that infects and kills bacteria, so it is called an enemy of bacteria. *Vibrio* bacteria are a major pathogen that harms species, including white leg shrimp, in aquafarms. As these new bacteriophages show a high level of growth inhibition against certain *Vibrio* bacteria, even at lower concentrations, they could be used as core resources for single or phage composition agent development. In this regard, the bacteriophages that the team obtained are expected to be commercially used as substitutes for antibiotics. The team applied for three patents on the basic technology adopted in the research in 2023 and has made an effort to develop eco-friendly agents for fisheries, such as alternatives to antibiotics and feed additives, after technology transfer for commercialization.

Sang-don Ryu, an associate researcher in charge of this project, said, "This research confirmed the possibility of effectively controlling pathogenic *Vibrio* bacteria by using bacteriophages isolated from indigenous sources," adding, "It is meaningful that we established the basis for eco-friendly biological disease control technologies that can respond to infectious diseases without antibiotics."



Transmission electron micrographs of the newly isolated *Vibrio* phages, MS01 (A), MS02 (B), and MS03 (C)

The HNIBR reveals the genetic diversity and differences in antioxidative components of *Boehmeria nivea* var. *tenacissima* (Gaudich.) Miq.

The HNIBR discovered that *B. nivea* var. *tenacissima* (Gaudich.) Miq., a Korean native plant inhabiting island and coastal areas, shows clear distinctions in genetic characteristics and functional components according to where and when it grows. This research result was published in an international journal, *Plant Genetic Resources*, in July 2025.

Boehmeria nivea (L.) Gaudich, a traditional fiber plant in Korea, is used in different ways in different regions. People in Hansan, Chungcheongnam-do, use it as a textile material and develop Hansan Ramie (*Hansan Mosi*), and those in Yeonggwang, Jeollanam-do, make ramie rice cake (*Mosinnipsongpyeon*) with it. *B. nivea* var. *tenacissima* (Gaudich.) Miq., which is a variety of *B. nivea* (L.) Gaudich., grows mostly in the south coast and island areas. As the leaves and stems of *B. nivea* var. *tenacissima* (Gaudich.) Miq. have abundant antioxidants that can reduce harmful oxygen in our bodies and protect our cells, it has received attention for its potential as a functional food or biomaterial.

This research also analyzed *B. nivea* var. *tenacissima* (Gaudich.) Miq. collected in island areas and coastal areas, and discovered that the genetic structure clearly differs according to where it grows, and the antioxidative components also tend to differ according to where and when it grows. All this scientifically demonstrates that the functionality of *B. nivea* var. *tenacissima* (Gaudich.) Miq. is not just determined by genes; it can also change by interacting with environmental factors.

Kyung-jun Lee, General manager of the Division of Natural Products, said, "The discovery we found that even an identical plant can show different genetic characteristics and functional reactions according to where and which year it grows illustrates that island and coastal bioresources have a huge potential not just as functional materials but as unique genetic resources," adding, "It is expected that this research result could provide a scientific basis to build systematic data information systems and lay the foundation to establish strategies for the effective use of island and coastal bioresources."



Boehmeria nivea var. *tenacissima* (Gaudich.) Miq.

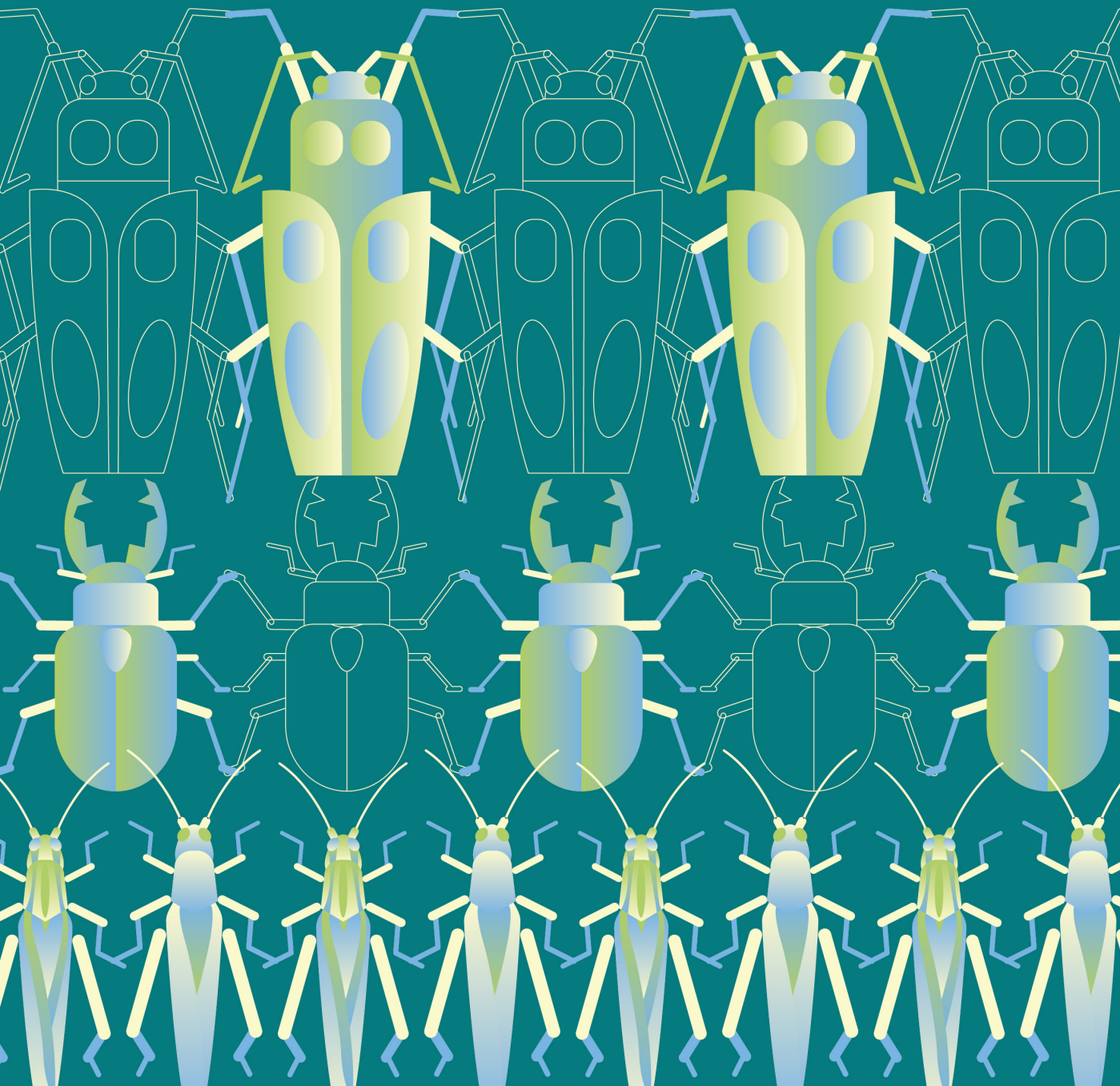
곤충 많아지거나, 사라지거나

Insects:
Increasing or
Disappearing

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환경부
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2025년 국립낙동강생물자원관 특별전

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