



DIWPA News Letter

Office: Center for Ecological Research, Kyoto University, Otsu, Japan

No.29



From the Chairperson
Shin-ichi Nakano

Thank you very much for your supports concerning our DIWPA activities. Last March, Prof. Yoshitaka Tsubaki, the Chair of DIWPA, retired from CER. According to his retirement, he also resigned as the DIWPA Chair. So, Shin-ichi Nakano (myself) was elected to succeed Prof. Tsubaki as the new chairperson, and Prof. Atsushi Ishida was elected as the Secretary General to do Nakano. In addition, DIWPA Assistant was taken over from Mr. Takuya Tanaka to Ms. Akiko Seki.

Another thing, I have an important announcement to you. Some of you may already know that DIVERSITAS, together with IGBP, IHDP and WCRP, is going to make the transition into Future Earth (FE) which is a new 10-year initiative of integrated Earth system research for global sustainability.

<http://www.diversitas-international.org/activities/future-earth-1/future-earth-and-diversitas>

According to the URL above, our DIVERSITAS is going to be ceased by the end of 2014, and all projects and networks

DIWPA invites foreign students to International Field Biology Course 2013 in Japan

see the details on page 7

including DIWPA will keep a double label (DIVERSITAS and Future Earth) until Future Earth becomes fully recognized as the home of the biodiversity and ecosystem services in science community. So, we DIWPA Secretariat Office had discussions with DIWPA Steering Committee about the continuation of DIWPA, and we have come to the decision that we DIWPA continue our activities with the original name of "DIWPA" for the coming another 10 years, even if DIVERSITAS would be completely fused into Future Earth.

Biodiversity is a global property of tremendous value to present and future human well-being. However, the threat to species and ecosystems has never been so serious as it is today. We DIWPA will continue our efforts for coming to a higher level. Your comments and supports on our activities are highly welcome.



From the
Secretary General
Atsushi Ishida

As Prof. Shin-ichi Nakano mentions, I become the Secretary General in DIWPA. I have supported the DIWPA activity, such as the publication of DIWPA News Letters for the past three years. DIWPA activity is continued under DIVERSITAS, and the number of DIWPA members reaches 500 persons, including teachers, university students, NPO, and

policy makers in Western Pacific and Asia. We have developed a good network or a good communication tool in relation to biodiversity and its conservation, using DIWPA News Letters. Rich biodiversity gives us many ecological services, and we must make more effort to conserve the rich biodiversity for the next generation in the world.

A global science program, Future Earth, will start in the next year. Future Earth will include not only natural scientists, but also socio-scientists, to cope with various global issues, such as sustainable management of ecological service, global

warming, and risk management against natural disturbance and to propose the guiding principles for policy makers. DIVERSITAS will be included into Future Earth in the next year. Nevertheless, we would like to continue DIWPA activity. That is because we believe that our DIWPA activity will be valuable and become increasingly important. Unfortunately, I think that the accomplishment of goal of Future Earth will be an arduous task. However, if DIWPA News Letters are getting more exciting place for information exchange, DIWPA will be able to contribute to achieve the goal of Future Earth. We may need to further involve socio-scientists related to ecological services. To be more exciting place, send information and papers related to biodiversity, conservation ecology, and ecological services in your country to DIWPA Office. I am sure that your activity will grow the activities of DIWPA and Future Earth, and will contribute to handover rich biodiversity for the next generation. I believe that our network among researchers, NPO, and policy makers has an advantage to do it.

Specific interaction between plants and root-endophytic microorganisms under heavy metal-contaminated soils

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Japan islands have a wealth of vein deposits and lots of mines were operated to refine ores into metals in past times. Nowadays, many of them were stopped working and it is difficult to find where are the mine sites.

Specific vegetations were observed on the veins containing high concentration of heavy metals, because only plants with heavy-metal tolerance can grow there. The mechanisms of heavy-metal tolerance in plants can be separated into two categories: 1) aggressive exclusion of metals from plant cells and 2) detoxification of them in the cells by producing detoxicants. Native plants growing on veins and old mine sites are considered to show specific tolerant mechanisms and be able to survive severe environments. Recently, we have shown that the tolerance in several plant species growing at the mine sites could be enhanced by microorganisms growing in plant roots, root endophytes.

We would like to introduce our study site, Hitachi mine (36°37'N / 140°37'E). Hitachi mine is located in the northern part of Kanto region, Ibaraki prefecture in Japan. Hitachi mine started up in 1905 as a copper mine. After 2 years, in 1907, sulfur gas from the copper smelter seriously damaged the surrounding forests to be bare lands. In 1909, the tree-planting started to prevent the soil runoff. This was the toughest time in the history of Hitachi mine. Dr. T. Kaburagi moved



Photo 1 & 2 *Clethra barvinervis* Sieb. et Zucc. and the seedlings growing in the forest of Hitachi mine

ahead on his proposal, selection of tree species with high tolerance to sulfur gas at the mine sites. He examined native tree species growing in the Izu-ohshima Island, where sulfur gas eruption naturally influence plant growth. He finally selected sulfur-gas tolerant species in his laboratory, using sulfur-gas exposure machines. In 1915, a large chimney was established to diffuse sulfur gas up in the air. Since then, the mine sites have been successfully greened by planting of trees with sulfur-gas tolerance, such as, *Prunus speciosa* (Koidz.) Nakai, *Alnus fiem* Siebold et Zucc., *Pinus thunbergii* Parlat., *Chamaecyparis obtusa* Sieb, et Zucc. and *Camellia japonica* L. Nevertheless, the soil still contains high concentration of heavy metals, caused by the sublimations together with sulfur gas from the copper smelter.

Nowadays, in the forests of Hitachi mine, *Clethra barvinervis* Sieb. et Zucc. is easily found, although the trees were not planted as the woody plants with sulfur-gas tolerance (Photo 1 and 2). *Clethra barvinervis* seems to be tolerant to the high concentration of heavy metals, especially in

New Site



Photo 3.
Cicuta virosa L.(water hemlock),
pre-dominantly species growing in
the pond at Hitachi mine

Cu, Ni, Zn, Cd, and Pb. These metals are highly included in soil of Hitachi mine. It has been known that native *C. barvinervis* is growing in Ashio copper mine as well as Hitachi mine. Actually, via our chemical analysis, we clarified that *C.*

barvinervis contains high amounts of heavy metals in the cells. We also isolated three endophytes from mature-tree roots and these fungal strains were considered as the dominant root endophytes. Through an inoculation test using these root endophytes, we clarified that *C. barvinervis* seedling growth was enhanced and excess uptake of heavy-metals into plant cells was inhibited by root endophytes.

We would like to show the second example, the interaction between *Cicuta virosa* L. and root-endophytic bacteria in Hitachi mine. Autochthonous *C. virosa* (Apiaceae) grows as the predominant species in a small pond at the mine, and accumulates Zn at a high level in the roots. We isolated bacterial root-endophytes from *C. virosa* and 37% of them showed the activity of Zn-solubilizing from the mine pond soil. These results suggested that Zn uptake into *C. virosa* roots would be enhanced by the root endophytes with solubilizing Zn from the mine soil. The inoculation test using several bacteria to the plants under heavy-metal concentrated conditions showed that root-endophytic bacteria enhanced plant growth by increasing nutrient uptake and Zn, and enhanced the heavy metal tolerance of

C. virosa, likely by producing detoxificants in the plant tissues. The results surprised us because we set up the hypothesis that root endophytic bacteria enhance Zn uptake into the plant, but decrease the plant growth because of too much uptake of Zn. Although Zn is one of micro essential nutrients for plants, a high amount of Zn uptake inhibits plant growth. Here, we consider that Zn-solubilizing compounds produced by root endophytes can not only solubilize Zn from the mine soil, but also detoxify Zn in the plant cells. We precisely need to clarify the chemical function of bacterial metabolites via instrumental analyses.

Under severe environments, particular interactions between plants and root endophytes seem to be evolutionally contributed to each survival ability. Our laboratory has several study sites with other kinds of stressful environment, for example, sandy beach, serpentine soil, and Aluminum-concentrated soil. We are really interested in the reasons why several plants can acquire the abilities to survive environmental stresses. We hope to know various kinds of plant ability to survive severe environments in relation to mutualism between plants and microorganisms.



Green Anoles have invaded the protected area of the World Natural Heritage of the Ogasawara (Bonin) Islands

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Photo 1. Green anole (*Anolis carolinensis*)

Now, the nature of the Ogasawara (Bonin) Islands is in the state of emergency. What happened?

As introduced in DIWPA News Letter No.25:pp.6-7, the Ogasawara Islands, located 1000km south of Tokyo in the North-West Pacific Ocean, were inscribed as the 4th World Natural Heritage site in Japan in June, 2011. The value that the islands show an outstanding example of on-going biological evolution and adaptation was accepted. However, many alien plants and animals have invaded the islands, and gave much damage on the native biota. So, it is important subject how to eliminate them from native forests, and how to prevent from new invasion into small islands where they have not been found yet.

Elimination of feral goats (*Capra aegarus*) was carried out from the late 1990s, and they were swept away from the islands except for Chichijima island, the largest inhabited island. The project which exterminates black rats (*Rattus rattus*) also started recently, and extermination was successful on some small islands. As for exotic plants, such as *Pinus lutchuensis*, *Casuarina equisetifolia*,

Bischofia javanica and *Leucaena leucocephala*, elimination efforts have been steadily conducted since 2002. On the other hand, there is still no technology of extermination of green anoles (*Anolis carolinensis*) and predatory flatworms (*Platydermus manokwari*), so efforts have been poured in the preventive measure for them not to be carried into non-invaded islands (Photo 1).

On March 22, this year, green anoles were discovered in the south part of Anijima island, an uninhabited island locating north of Chichijima island. The nature of Anijima island has remained in a primeval condition, because it miraculously did not get a full-scale development in the past. As the island is covered with unique drought dwarf forests widely including many endemic plants, insects and land-snails, many of them are endangered now (Photo 2).

It is said that green anoles were brought to Chichijima island from abroad in 1960s and they were carried to Hahajima island in 1980s. Green anoles were living only in these two inhabited islands until recently. Since green anoles ate native insects completely, the insect fauna of these islands suffered from destructive damage. If green anoles spread widely in Anijima island, the insects would



Photo 2. Vegetation at Anijima island

Report

be eaten up, and the fragile ecosystem would collapse. Disappearance of pollinating insects may cause a decrease of seed production of plants and retard the regeneration of forests.

The way how green anoles attained to Anijima island is not known. Since a strait about 500 m wide lies between Chichijima and Anijima islands, a possibility that green anoles swam across the sea is low. As sightseeing boats approached frequently near the seashore where the invasion was first discovered, green anoles hidden by the boats may have escaped from them. Furthermore, an interesting idea is pointed out that endemic subspecies of Eurasian buzzard (*Buteo buteo toyashimae*) located at the peak of the food chain of the Ogasawara might have carried a living anole from Chichijima to Anijima islands to feed their chicken.

Moreover, another interesting idea is proposed. An extermination effort of black rats was conducted recently in Anijima island. Although it was not successful, there was a time when the number of black rats decreased temporarily. When black rats ate green anoles, the number of them was suppressed by the predation. When green anoles released from the rat's pressure, they increased rapidly and they became conspicuous.

In response to the discovery of green anoles in Anijima island, the Science Committee of the Ogasawara World Natural Heritage announced the emergency statement and the urgent proposal immediately. The Ministry of the Environment, the Forestry Agency, the Tokyo Metropolitan Government, Ogasawara Village, researchers, consultant companies, local NPOs and village people started collaborative investigation, how far green anoles have spread, and a capture work at a high-density region.

Contrary to our original expectation, the distribution of green anoles seems to be wide. Considering the high population density of Anijima island, it is presumed that several years have already passed since the initial invasion. In order to prevent further expansion to the northern part



Photo 3. The defence fence in Anijima island

of Anijima island, a defense fence is going to be installed in the forest before summer (Photo 3). In addition, a capture fence with many traps on the surface is also installed so that the high-density area is enclosed. Because a breeding season starts in the early summer, the installation of the fences would be a good time.

To our regret, we do not have the technology which exterminates green anoles once they invade the native forests. For the moment, the only method to capture green anoles is to set many traps with adhesive tapes inside a box on the places where green anoles prefer to appear (Photo 4). All things we can do now is gaining time to develop new technology of extermination, by stopping further expansion with the defense fence and by reducing the density with many traps inside the fence. If you have some good ideas which exterminate green anoles from the forests, inform its to us.



Photo 4. Anole traps with adhesive tapes

Kick-off Symposium of Trans-disciplinary science for society in harmony with nature

Shigeo Yachi

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A symposium entitled "**Kick-off Symposium of Trans-disciplinary science for society in harmony with nature**" was held at the University of Tokyo on 23 April, 2013. This symposium was organized to propose a collaborative project between ecology and social sciences in action towards realizing Nature-Harmonious Society. In Japan, there has been active cooperation between ecologists and social scientists in order to tackle practical problems in nature restoration and ecosystem management, and in the interdisciplinary research projects, e.g., conducted at Research Institute for Humanity and Nature (RIHN) in this decade. Another driver of this symposium is the rise of **Future Earth**¹⁾, ongoing major shifts in international global environmental research framework to be started from 2014. That is, this symposium was simultaneously aimed to activate the promotion of Future Earth from the field of biodiversity conservation and ecosystem sciences. About 90 participants including many young researchers gathered this symposium, which exceeded the capacity of the meeting room (80).

The program was based on the output "**Social Ecological model -A Strategic Proposal-**" from the three workshops on "**-Promotion of Experimental Study in Local Area Based on Biodiversity Science for Science Policy-**" in 2012 in Japan supported by Center for Research and Development Strategy, Japan Science and

Technology Agency (CRDS-JSTA). The opening speech by Dr. Yahara (Kyushu University) led the following talks and discussions. He focused on the transdisciplinarity concept of Future Earth and explained the current situation of it in the field of biodiversity and ecosystem research. In the part 1, two ecologists and a scientist from river engineering made presentations. Dr. Nakashizuka and Dr. Matsuda, leading ecologists in Japan, summarized current progress and challenges in designing sustainable ecosystem services and risk management, respectively. In the part 2, two environmental economists and an environmental sociologist presented as representatives of social sciences. In the part 3, two bureaucrats from Ministry of Education, culture, sports, science and technology (MEXT) and from Ministry of the Environment, a politician from local government, two from Industries, etc. presented from their standpoint of view. In my impression, the symposium was very successful and participants seemed to have felt that a new environmental research era is about to begin!

Key Reference

1) <http://www.icsu.org/future-earth>

Announcement

DIVERSITAS in the Western Pacific and Asia (DIWPA) is an international network for the promotion of cooperative studies and information exchange on biodiversity in the Western Pacific and Asia, under a close cooperation with its mother program, DIVERSITAS, organized by ICSU, IUBS, SCOPE and UNESCO. The term of "Western Pacific and Asia" is used in this proposal to intend to cover East Asia, South Asia, Southeast Asia, Melanesia, Micronesia, Australia and New Zealand. DIWPA aims to connect existing networks of people working on biodiversity and research projects in Asia and the Western Pacific. For more information, please visit our URL:

<http://diwpa.ecology.kyoto-u.ac.jp/index.html>

One of the main functions of DIWPA is “capacity building of scientists in particular young scientists

from developing countries”. In the autumn of 2013, the International Field Biology Course (IFBC) will take place in the Ogasawara islands, a World Natural Heritage site, in Japan. We introduced the islands on DIWPA News Letter No. 25. In this year, we will organize an IFBC in the field of plant eco-physiology at the beautiful island in the Pacific Ocean. In especially, we will make a plan for research in photosynthesis and water relation of woody plants. The islands have rich endemic species, but many alien species have invaded and they are expanding in the islands. In the islands, local and Japanese governments, researchers, and local people co-work to prevent alien species from further invasion and expansion and to decrease their numbers in the islands. You will be able to look such effort for conservation, as well. The details are as follows. Motivated students, who belong to DIWPA or whose supervisors are the DIWPA members, are highly welcome for applying.

Details

1. Date : October 2 (Wed) – October 10 (Thu) (9 days)

There is no airport in the islands. We can thus use only a ship in the passage between Tokyo and the islands. However, when a big typhoon is coming, the schedule of ship is frequently shifted. Therefore, you need to stay for 9 days included several days before and after of the ship schedule in Tokyo area.

2. Accommodation & Station: Chichi-jima island (Research station of Tokyo Metropolitan University)

3. Site: The islands are located in Pacific Ocean, 1000 km south of Tokyo. The climate is subtropical. The area of Chichi-jima island is 24 km². See DIWPA News Letter No. 25 in more details.

4. Financial Support: DIWPA provides stipends to limited numbers of participants to cover part of their expenses for accommodation and travel. The numbers of the participants depend on the financial situation of DIWPA.

5. Application: The participants of this course should be talented graduate students whose supervisor is the DIWPA member. Applicants should prepare the following documents.

1) CV (write the contact e-mail address of you)

2) A statement about their interests in the field of ecology

3) Recommendation letter written by the supervisor

6. Application deadline: Application must arrive by July 31, 2013.

7. Application submission:

Submit applications to DIWPA office by e-mail.

DIWPA Office : diwpa@ecology.kyoto-u.ac.jp

8. Others: It will take 26 hours in one way between Tokyo and Chichi-jima island by ship. There is a restaurant in the ship, but you need to pay some money when you use it. Some researchers and students will use the accommodation together. A shower room and a kitchen etc. are thus shared by the accommodation members. We are unable to guarantee 100% for sure to correspond his/her food restrictions or other matters for the religious reasons, though we would positively work on these matters as much as we could.

Only successful candidate(s) will receive the details by the mid of August through the internet.

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