DIWPA News Letter

Office: Center for Ecological Research, Kyoto University, Otsu, Japan No.32

Message *from the Chairperson*

Shin-ichi Nakano

Almost two years have passed since I was in charge of the DIWPA Chair. Prof. A. Ishida, who was elected as the new Secretary General to succeed me, has been making great efforts to bring DIWPA to a greater height as much as possible. I am very much appreciating for that. Our network has been spreading out mostly in Asia, providing biodiversity information to those countries through our newsletters, contributing capacity building through International Field Biology Course (IFBC) and supporting Asia-Pacific Biodiversity Observation Network (AP-BON). In addition, we send a DIWPA Secretary Member (Prof. Yachi) to IPBES as a member of the IPBES expert group on Deliverable 3(c): Policy support tools and methodologies for scenario analysis and modelling of biodiversity and ecosystem services. Further, we DIWPA will be a useful network for a master plan 2014 study entitled "Next generation monitoring of biodiversity and ecosystem toward further understanding of responses and improvement of resilience for ecosystem functions in changing", though the study has not yet had any financial support. During the last ten years, Japanese national universities have been having serious reduction of the budget allotment by our national government every fiscal year. This also makes the management of DIWPA stressful. However, we Secretary Office positively take care of our DIWPA as much as possible, hoping our members are conducing fruitful biodiversity research.

Message *from the Secretary General*

Atsushi Ishida

We held International Field Biology Course (IFBC) at the Kiso Biological Station in August 2014. Two young researchers from Philippines and a young researcher from New Zealand were enrolled in the IFBC, and we conducted monitoring of invertebrata and examinig algae in a mountain stream of the Kiso river in Japan. Their activity reports are published in this newsletter. Furthermore, DIWPA supported a domestic symposium in Kyoto in September 2014 for the general public. The topics of the symposium were related to ecology and biological conservation at the World Natural Heritage sites in Japan. At the symposium, I (Kyoto University) and Prof. Naoki Kachi (Tokyo Metropolitan University) talked about the drought adaptation and evolution of woody plants, and about interactions among livings and the countermeasure for alien species within the Ogasawara islands, respectively. Prof. Tohru Nakashizuka (Tohoku University) talked about biodiversity and ecological service in the Shirakami mountains. A report in the countermeasure for alien trees in the Ogasawara islands is also published in this newsletter.

Now it is a transition period to Future Earth for DIWPA. Future Earth will open a new era of integrative sustainable science between ecosystems and human society. DIWPA Newsletters will contribute to the new era. From this viewpoint, we need more information from your countries in relation to biodiversity and conservation. It is a pleasure to receive your papers for DIWPA (diwpa@ecology.kyoto-u.ac.jp).

Report 1

DIWPA International Field Biology Course (IFBC) 2014 Reflections from a New Zealander

Jeremy 'Jay' Piggott
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(New Zealand)

Participants at the front of the the Kiso Biological Station

I had the pleasure of joining the final two days of 2014 DIWPA International Field Biology Course (IFBC) at the Kiso Biological Station. The purpose of my participation in the field course was to conduct stream invertebrate sampling from 12 sites in the Kiso River catchment (Fig. 1), to complement comparative samples collected from 20 sites in the Yasu River catchment to study the genetic diversity and connectivity of Hydropsyche orientalis and Cheumatopsyche brevilineata (Fig. 2; two ubiquitous net-spinning Trichopterans) along a longitudinal gradient in multiply stressed streams in Japan.

On my arrival at the Kiso the rain was falling fastly and heavily, raising concerns that sampling may prove futile. Fortunately, Dr. Okuda's determination prevailed

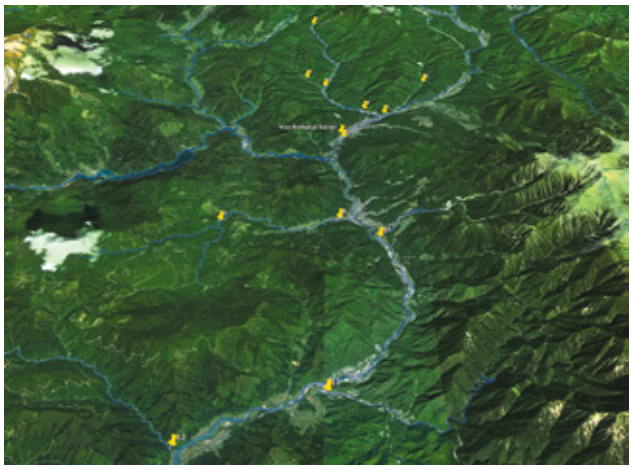

Fig. 1. Kiso River sampling sites (12 total)

Report 1

Fig. 2. *Cheumatopsyche brevilineata* (left), *Hydropsyche orientalis* (right)

Fig. 3. Jay Piggott collecting a kick-net invertebrate sample in 12 °C water (Photo: Noboru Okuda)

(despite his infliction of bronchitis) and we successfully sampled the majority of the sites and successfully obtained our target species in a number of these (Fig. 3).

On the final day of the workshop, all participants hastily prepared their oral presentations (Fig. 4). After that we celebrated the conclusion of the field course with a yakiniku party, where Christmas (a participant from the Philippines) inspired creative song among the participants.

Complementing our biological investigations, we were privileged to enjoy the local Obon festival in Kisofukishima township (Fig. 5) and the podiatric

Fig. 4. Jay Piggott presenting his research to field course participants (Photo: Noboru Okuda)

Fig. 5. Obon music and dance festival in the Kisofukishima town square (Photo: Noboru Okuda)

pleasure of the town's onsen foot spa (Fig. 6). Likewise, we relished the local soba delicacies, sake and delicious homemade food at the Biological Station.

The DNA from the samples collected during this field course is now being sequenced in Germany using both CO1 barcoding and next generation RAD sequencing to study the genetic structure, diversity and geneflow of each taxon in detail. This knowledge will be used to improve our understanding of the genetic basis of stream invertebrate species' resistance to stressors and the potential barriers to their dispersal.

Fig. 6. Participants enjoying the Kisofukishima onsen foot spa (Photo: Noboru Okuda)

I wish to extend my sincere gratitude to DIWPA, Profs Nakano and Tayasu, and Dr. Okuda for giving me the opportunity to participate in this international field course – for the good times, exciting science and new friendships.

Report 2

DIWPA International Field Biology Course Kiso River, August 9 to 16, 2014

Michael E. Salandanan
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Laguna Lake Development Authority
(Philippines)

The International Field Biology Course (IFBC) for young scientists was conducted last August 9 to 16, 2014 at Kiso Biological Station in Kyoto University composed of young scientists from different countries. The training course aims to promote cooperative studies and to exchange information on biodiversity from developing countries. The topic is on stream ecology, which includes basic limnology in streams, fundamental ecology and biodiversity.

The study site was established in the middle stream of Kiso River and riparian forest ecosystem. On August 10, 2014, the participants, together with the Professors and staff of Center for Ecological Research (CER), attended to the site for a briefing and demonstration of sampling methods and the use of other equipments needed for the said activities. Each participant conducted their own stream flow measurements (water current, velocity and water discharge), collected abiotic data using “in-situ” equipments and collected samples for Chlorophyll “a” concentration and benthic fauna. Participants were instructed to create their own research so as to present them on the last day of activity. They were also taught the details on how to analyze and process their own data with the supervision of the Center for Ecological Research personnel. On August 13, 2014, the group went to the selected sampling stations to collect samples and to gather necessary information for their topics. Participants were instructed to present their own reports on August 15, 2014 and the undersigned chose the topic “effect of flood in Chlorophyll “a” concentration and Algal Biomass in the River". The international summer course for young scientist was successful. Although it was a short-term program, participants were able to gain useful knowledge in their own fields of expertise.

It is highly recommended to participate in such

short courses, especially if it can be of great use to the Authority. New innovation learned from this short course can be applied to the laboratory. Center for Ecological Research conducted this summer course through the use of effective techniques to encourage participants to apply the learnings in their respective countries.

Acknowledgments

Attending the IFBC for young scientists could not have been possible without the effort and generosity of Prof. Noboru Okuda and other staffs of Center for Ecological Research, Kyoto University. Special thanks to the Research Institute for Humanity and Nature (RIHN) for providing financial assistance during my stay in the summer field biology course.

Report 3

2014 DIWPA International Field Biology Course in Japan: Summer monitoring program for young scientists in Kiso River
9-16 August 2014, Kiso Biological Station, Kiso-Fukushima, Nagano

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Being in Japan for more than a year, I appreciate and enjoy the natural environment and the ecosystems I observe every time I go out for a hike up the mountains and do bird watching.

I am a programme fellow at the Asia-Pacific Network for Global Change Research (APN) located in Kobe and I work towards enhancing the knowledge and understanding of global change of researchers and policy makers. I am handling various projects on global environmental change along with the Programme Officer and Head of the APN Communication and Scientific Affairs. Most of the projects are focused on a research using climate data, assessments of impacts of climate change and improvement of adaptation practices that the vulnerable communities use, and some are working on capacity-building of early career researchers or scientists within the Asia-Pacific region.

As a young scientist myself, I also aim to continually enhance my knowledge and skills and implement research related to my field of interest. Although I am working for APN, an intergovernmental network bridging science and policy towards a sustainable Asia-Pacific, my background is on biology and biodiversity conservation. Back in the Philippines, I have been involved in a number vof community-based resource management and local conservation programmes. I have a great interest in wildlife biology and biodiversity, and aspire to be a wildlife biologist implementing conservation programmes in protected areas and ecosystems that are vulnerable to climate change. I enjoy doing intensive field work in the forest and working with local communities. I can say that being a female is not a limitation for me when it comes to field research. My adventurous nature and my passion for biodiversity conservation make me as capable as the male counterparts.

Trying out my chances to join a field course

I learned about DIWPA and the International Field Biology Course while I was browsing through the website of Kyoto University's Center for Ecological Research (CER). I checked the announcement about the field course and read through the details on how to apply. It entails eight days of intensive field work in Kiso-Fukushima, Nagano, where the Kiso Biological Station is based.

The international field course is a part of the Joint-Use and Cooperative Research Program by CER and it also serves as a curriculum for students of Kyoto University. The aim of the project is to monitor the long-term dynamics of riparian ecosystems under ongoing anthropogenic disturbances, such as eutrophication, river improvement and global climate changes. One of its objectives is to train young

Report 3

researchers as new-generation leading ecologists who can manage international projects. Hence, when I sent my application for the workshop, I received acceptance to participate as the field course provides capacity building for young researchers.

Knowledge gained and lessons learned

The fieldwork familiarized me with basic stream ecology and trained me on assessment and monitoring of riparian ecosystems, and identification of aquatic macroinvertebrates, and on laboratory techniques. I am very elated every time I look a collected individual for identification through the microscope. At first, I find it hard to do the task at hand as identification of aquatic insects is not within my expertise. I have not taken a course on terrestrial and aquatic insects during my undergraduate years and therefore, it was a challenging experience to properly identify the collected individuals. Without the help and support of the other members of the team, I would not be able to finish my part.

I am grateful to get a hang of how on-site research is conducted in Japan. Also, I can say I am proud of myself to be the only female participant. I believe I have shown to the team that field research knows no gender. I have also done what the male participants are capable of doing such as going into the water when the river is on the rise and currents become speedy because of the heavy rain, carrying bulky tools from one station to another, waking up at midnight to check driftnets and collecting macrobenthos, among others. All for the sake of science.

It was a fascinating experience to be involved in this project alongside the researchers from Kyoto University and other institutions who work on different fields/ disciplines. I have gained new knowledge on terrestrial and aquatic ecosystem interactions, assessment of epilithic algal biomass, behavioural adaptations of aquatic insects, and of course, the standard procedures in handling laboratory tools and equipments.

Immersion with local culture

Staying in Kiso, I had the chance to experience and enjoy a tour at a local sake brewery. Along with other team members, we were oriented with a variety of raw materials (biological resource) used in producing sake and observed the production facility.

Kiso town is popular for its sake as well as for its soba. It must be because of the healthy environment that provides resources and paves the way for the production of good sake and soba. Indeed, local biodiversity is important as it offers people with diverse ecosystem services.

On the second last day of the workshop, we decided to enjoy a local summer festival. It was an unforgettable experience as I joined in the traditional dance along with the local people. Almost all of the members of the team danced and enjoyed the festivities. On our way back to our research quarters, we passed by a hot spring and soaked our tired feet. It was a rewarding time for us after days of field and laboratory work.

Zest for environment and scientific insights

Working with the team and being part of the workshop was an awesome experience. It was something different for me as it was my first time doing a field work in Japan. The team was very helpful and

Report 3

(Photo: Noboru Okuda)

supportive in guiding us along the way. My loquacious nature helped me gain a lot of skills from the mentors. I think it really helps to ask when you are not sure of something. On the other hand, it is also good when you try first and do it yourself. “Once all your ideas and resources are exhausted, that is the time when you ask and seek help.” I am quoting this line because this is one of the valuable lessons I have learned in the workshop. Something a student may not learn within the confines of the university building.

Going back to May 2013 when I was writing my research proposal as part of the requirements of MSc Wildlife Studies at University of the Philippines Los Baños (UPLB), I am passionate on habitat and species distribution modelling of the critically-endangered Palawan forest turtle (*Siebenrockiella leytensis*) and since then, I know for sure that my interest lies on conservation science. I feel one with nature every time I am out in the woods and I have the zest working for the environment. My energy is unrelenting and a bumpy trail does not always seem to falter me. Because of the field experience I had in Kiso, I became interested to explore my options in conducting my research in Japan and contribute to the efforts in sustainably managing the country’s ecosystems. At the moment, I am looking for possibilities to get admitted, receive a scholarship and do further studies focusing on the relationships among ecologically-important indicator species and species threatened or at risk to climate change, the habitats, and human systems in Japan. It was truly rewarding to be part of the 2014 DIWPA International Field Biology Course.

Acknowledgments

I would like to take this opportunity to thank the following people who inspired me to do my best: Dr. Noboru Okuda. Dr. Shin-ichi Nakano, Dr. Ichiro Tayasu, Dr. Jun-ichi Okano, Dr. Hiromitsu Kamauchi and Mr. Shohei Fujinaga.

Report 4

Countermeasure against alien trees in the Ogasawara (Bonin) islands, a World Natural Heritage site, in Japan

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The Ogasawara (Bonin) Islands are oceanic islands, located about 1,000 km south of Tokyo in a subtropical climate region. The fauna and flora of the islands are unique. For example, approximately 94% of land snails and approximately 70% of tree species are endemic in the islands. To conserve the unique ecosystems, the islands have been inscribed on a World Natural Heritage Site from June in 2011 (see more details No. 25 in DIWPA Newsletter). However, in the present, the forest ecosystem has been threatened by many invasive, alien species of animals and plants. Since the start of immigration in the middle of nineteenth century, many species were introduced by human into the islands for various purposes (Table 1). Some alien species have expanded quickly in the islands, and the habitants of some native species have been suppressed. (see more details No. 29 in DIWPA Newsletter). Therefore, we have many critical issues to protect the unique ecosystems, as follows; 1) how to prevent the invasion of new species, 2) how to exclude invaded alien species, and 3) how to regenerate ecosystems after the elimination of alien species. Many alien species became deeply embedded in the function of ecosystem. Thus there is a possible risk that the ecosystem is changed by the elimination of alien species.

Feral goats are also a troubling species in many oceanic islands. The grazing by them gives the

Table 1. Four major alien tree species in the Ogasawara (Bonin) islands, and its introduced years and the purposes.

Species	Year	Purpose
Bischofia javanica	1905	fuelwood
Casuarina equisetifolia	1879	timber, ornamental, tannin source, greening,windbreak, sand arrestation
Pinus luchuensis	1899	greening, fuelwood
Leucaena leucocephala	1862	greening, green manure, feedstuff,

Fig. 1. Rapid invasion of *Casuarina equisetifolia* trees in the northern part of Ani-jima island. When feral goats were eliminated in April 2007, the vegetation cover was very poor. However, during only six years from 2007 to 2013, invasive *Casuarina* trees rapidly covered in the area.

Report 4

vegetation severely damage in the Ogasawara islands. Bare grounds were sometimes created at many places in the islands, and resulted in the soil erosion. In the 2000s, all feral goats had been eliminated in all Ogasawara islands, except for Chichi-jima that is the main island with the largest area. After the elimination of goats, the vegetation was recovered by native or endemic tree species at some places. However, in the other cases, the vegetation was quickly covered by alien tree species (Fig. 1). For example, the rapid expansion of alien trees has been found in Ani-jima island (Fig. 2). The natural vegetation in Ani-jima island are predominated by many endemic or native trees adapted to drought environment, and the unique forests, called dry dwarf forest, are developed. Thus the vegetation in Ani-jima island is recognized as a very important region for the endemic species. The island is very valuable not only for conservation but also for research related to adaptation and evolution of animals and plants. To prevent the expansion of alien tree species and to conserve the natural vegetation and ecosystem, many efforts have been conducted by Forestry Agency, Ministry of the Environment, and Tokyo Metropolitan Government. Consequently, the elimination of many alien trees has been strongly conducted in the Ogasawara islands.

In the present, some alien trees with fast growing and vigorous fecundity, such as *Bischofia javanica* Blume, *Casuarina equisetifolia* L., *Pinus luchuensis* Mayr, and *Leucaena leucocephala* (Lam.) de Wit, are regarded as major invasive alian trees in Chichi-jima island or the group islands. The area of their distribution is still wide and it is still in the outside of human management.

The main objectives of ongoing project are to restore the native forest ecosystem. Therefore, various monitoring activities have been conducted to detect the impact of the extermination. Before the extermination of alien trees, the survey of vegetation, insects, land snails, land water animals, and birds are conducted in and around the target area. After the extermination, such survey is repeatedly conducted at several-years interval.

Currently, the herbicide injection treatment is used as a major extermination technique to kill alien trees at the field. Since 2008, the technique has been applied to the national and public lands in the islands. The type of herbicide and the procedure of the method are described, as follows. As herbicide, Roundup Maxload (Nissan Chemical Industrial Ltd., Tokyo, Japan), including 48% Glyphosate-potassium are used. The amount of herbicide used to a tree is dependent on the diameter of the target tree and tree species (Table 2). In the procedure for injection, at first, the number of holes for herbicide injection is determined based on the diameter of the main stem at 30 cm high. After that, we drill holes at an interval at 30 cm high of the main stem, inject 1 ml of Roundup Maxload in each hole,

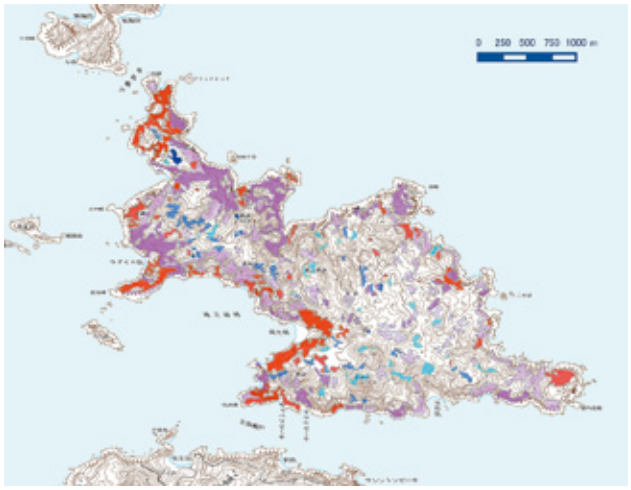

Fig. 2. Distribution map of alien trees in Ani-jima islands. The blue color shows the area where invasive of *Pinus luchuensis* was confirmed, and the red color shows the area where invasive of *Casuarina equisetifolia* was confirmed in the early the 2000s. The dark blue and red colors show the area predominated by alien trees. The white color show the area predominated by native trees.

Table 2. Applied amount of herbicide (Roundup) to provide effective killing in invasive *Bischofia javanica* trees (left column) and in the other invasive trees (right column).

Diameter at 0.3m height (cm)	Drug injection (ml)	Diameter at 0.3m height (cm)	Drug injection (ml)
4-10	2-3	4-10	2-3
12-20	4-8	12-20	4-9
22-30	9-13	22-30	9-13
32-40	13-17	32-40	13-17
42-50	18-21	42-50	18-21
52-60	22-25	52-60	22-25
62-70	26-29	62-70	26-29
72-80	30-33	72-80	30-33
82-90	34-38	82-90	34-38

Report 4

Fig. 3. The procedure of the herbicide injection treatment for killing of alien trees.
(1) Drilling: Making holes for herbicide injection at 30 cm high above the ground
(2) Drug injection: Injection of 1 ml of herbicide (Roundup) in each hole
(3) Plugging: Bunging up the holes with wood plugs to prevent leakage of herbicide

and finally bung up the holes with wood plugs (Fig. 3).

In order to confirm the impact of the using of herbicide on the ecosystem, chemical analyses of soil and water have been conducted after the herbicide-injection treatments. As the results, at the present, residual constituent compounds of herbicide have rarely been detected from the soil and water, but its concentration was very low. Furthermore, the death of adjacent trees has also never observed except for the case that the treated trees are connected to the adjacent trees in the same tree species.

Using this technique, we have succeeded the elimination of hundreds of thousands of alien trees in the islands (Fig. 4). As a result, the habitat of the native and endemic species has been greatly expanded. However, in the empty sites after the elimination, not only native tree species but also alien tree species have established. Yearly maintenance would be needed to restore native vegetation after the elimination. Canopy-gap formation caused by the elimination of big trees will largely change the environments in the understory. In greenhouse experiments, it has been shown that

Fig. 4. A typical vegetation (called dry dwarf forest) in Chichi-jima island taken in July 2014. The conspicuous dead trees with white color were killed by the herbicide injection treatment. (Photo: Atsushi Ishida)

Report 4

Fig. 5. Small stations to brush shoes and remove seeds attached on clothes, using adhesive tape (left). Some goods for cleaning are equipped in the box. He is cleaning the bottom of his shoes on the brushing mat (right). (Photos: Atsushi Ishida)

the growth of invasive *Bischofia javanica* seedlings is superior to that of native trees especially in under changing light and soil nutrients (Yamashita *et al.* 2000, Yamashita *et al.* 2002, Osone *et al.* 2014).

To prevent the seed dispersal and re-invation of the alien trees, extermination of all alien trees in the islands will be acquired. If we permit the invation of new species into the islands, we have to pay to restore the original ecosystem. Therefore, to prevent new invation into islands or into areas in the islands, we set several rules. When we enter the islands or areas, we have to brush or wash shoes, and to remove seeds attached on clothes, using adhesive tape. Small stations are set at the gates of trekking roads and the adequate goods are in the equipped box (Fig. 5). To maintain the native vegetation in the islands for a long time, it is necessary to continue the long-term and wide-range activities not only for the nature but also for inhabitants and visitors.

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New Site

Tolbachik eruption in 2012-2013 in Kamchatka, Russia

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Fig. 1. Tolbachik volcano. Blocky lava flows introducing in the forest belt in winter.

Fig. 2. Lava flows moving into the forest igniting standing trees only in the front of the flow. (Photo: D.Melnikov)

Tolbachik (N55° 49'51", E160° 19'33") is a volcanic complex on the Kamchatka Peninsula in the far east of Russia. It consists of two volcanoes, Plosky (flat) Tolbachik (3,085 m ASL) and Ostry (sharp) Tolbachik (3,682 m ASL). In the late November 2012, a major volcanic eruption started in the northern part of Tolbachinsky Dol (the central part of the Kamchatka Peninsula) (Fig. 1). Tolbachinsky Dol is in Holocene lava plateau, having an area of approximately 900 km^2 (Fedotov S.A. 1984). As the result of eruption, the vast area of Tolbachinsky Dol has been covered by extensive lava flows over tens of square kilometers. The unpredictable event gives us important information for the study of succession and dynamics of plant cover and wildlife following the eruption. To examine the successional process, a group of seven researchers with different specialties was formed within Institute of Biology and Soil Science (IBSS FEB RAS, Vladivostok, Russia). We aim to conduct an integrated research to understand more detailed process in terrestrial ecosystems following volcanic events. We have started the research: 1) to detect the extent of ecosystem change from ground-based observations and satellite data, including identification of the areas of different vegetation types (forests, elfin, grasslands, mountain tundra, and others) buried by lava flows and of distribution of deposits of volcanic ash, 2) to identify the impact of the eruption on the terrestrial ecosystem including the soil, the higher and lower plants, fungi, and animals, as well as the transformation of biogeochemical cycles of elements within the ecosystem, and 3) to bookmark the sites recorded by GPS for a long-term monitoring of ecosystems following the eruption. To achieve the objectives, the volcanic impacts have been examined at five thematic clusters, as follows: 1) vegetation, 2) soil-pyroclastic cover, 3) biogeochemical aspects in the formation of the territory, 4) living components of soil (especially in algae, fungi, and nematodes), and 5) wildlife (especially in small mammals). Before the eruptive event of 2012-2013, eruptions occurred in 1941 and in 1975-1976 in the twentieth century. Since 1976, researchers of IBSS FEB RAS have studied the vegetation and soil cover area, and the impact on them of the eruption (Grishin 1992 and 1994, Grishin & Shlyakhov 2009, Grishin *et al.* 2013). Because flora, vegetation, and soils have already examined before the eruption in 2012-2013, we have some information in the previous conditions in forest ecosystems.

The latest eruption began suddenly on November 27

New Site

Fig. 3. The side of cooled lava flow, covered with detritus. Trees without contact with lava were not injured. (August, 2014)

in 2012, without almost seismic activity. Moderate ash fall was observed only at the beginning of the eruption. According to satellite imagery, fine ash was deposited toward a northwesterly direction with a distance of about 85 km and a width of 10-12 km. The thickness of ash deposits did not exceed a few millimeters. Based on the weak toning of snow covered by dark tephra, during the winter and spring in 2012-2013, the ash fall was rare and small and an impact was detected on only the sparse vegetation in the mountainous area.

Lava flow from the two centers of eruption located at approximately 1,800 and 1,500 m ASL, rushed to the south and then turned to west in the early days. The lava flow from the northern center moved on only the first day (on December 1) of the eruption, reaching an altitude of about 700 m ASL and passing about 10 km. The lava flow from the southern center effused particularly and intensively during the first 2-3 weeks. They passed more than 15 km through the alpine zone of volcanic desert, semi-desert, and subalpine zone. Furthermore, the lava flow intruded deeply in the forest area, passing in it 8 km and reaching an altitude of about 300 m. Due to frosty winter and snow cover, forest fires did not arise, but trees caught on fire when they contacted to red-hot lava (Figs 2, 3). The width of lava flow was 1,500 m in average. In the mountainous part of the Dole (1,100-1,600 m ASL), an extensive lava field was formed over 5 km in length and 2.5-3 km in width. The field was completely filled by new lava, and a few old cinder cones remained standing. During the eruption new lava layer overlapped, consequently the thickness of lava layer reached several tens of meters.

Following the cessation of the first stage of eruption (the end of 2012), the activity was still observed only in the north-eastern sector of the Dole. At the second stage of the eruption (first half of 2013), a vast lava flow was formed, reaching up to 4 km in length and up to 3 km in width. In August 2013, the lava flowed to channels and tunnels, located under the cover of hardened lava, and passed several kilometers down from the crater in the active zone. The lava squeezed on the surface looks like red plastic "pillows". Its temperature measured with a pyrometer at a peripheral point of the lava was 650-700 ° C (Fig. 4). Squeezed out lava flowed slowly (approximately 1 m / h) with burning and burying the vegetation (Fig. 5). Based on satellite images, the area overlapped by the lava flows reached approximately 35 km^2 in June 2013. The study sites where vegetation succession was examined in 1995 and 2006 (Grishin *et al.* 2013) were covered by lava.

By surveying of the area in eruption and its impact with satellite images, we identified land area covered by lava flow of 2012-2013 into six major categories in lands: 1) volcanic badlands in the alpine and subalpine zones (800-1,800 m ASL) covered with very sparse grasses and vegetation with moss and lichen, 2) old-lava flow land with approximately 1,000 years old, with a partially formed grass-shrub vegetation at altitudes of less than 1,400 m; they have areas with relatively narrow (300-500 m in width), but long (up to 12-15 km) bands, 3) cinder deserts near the eruption area, consisted of two major fields with outcrop of lava and petrophytic plants, 4) areas of

Fig. 4. Temperature at a point in red hot lava measured with an emission pyrometer was 650-700 °C.

New Site

Fig. 5. Squeezed lava slowly (about 1 m / h) advancing to the adjacent territory while burning and burying the vegetation.

subalpine elfin wood trees and meadows, growing alder (*Alnus fruticosa*) and Japanese stone pine (*Pinus pumila*), interspersed with grassy meadows and scoria wastelands; the vegetation of the areas was impacted by heavy ash fall of 1975, 5) forest fragments of birch *Betula ermanii* (in the range of 600-900 m ASL); the upper parts of the forests are limited by sparse forest stands, and 6) larch forests growing *Larix cajanderi* (less than 600 m ASL) and sparse larch forests (in the range of 600-900 m ASL). Almost all area covered by new lava flows had volcanic landscape with poor vegetation (No. 1-3 in the above land category). Their total area exceeds 20 km^2. Forest vegetation, the most productive component of vegetation of Tolbachinsky Dol, was destroyed in the ares about 8 km^2. Importantly, that duration of succession on lava of the Dol is very long: the mature forests growing on old lava in this area have developed during the periods about 2,000 years (Grishin 1992 and 1994). The area covered by lava flows of 2012-2013 is close to the area covered by lava of southern vent of Great Tolbachik fissure eruption of 1975-1976 (36 km^2) (Fedotov & Markhinin 1984). These areas are major centers of the largest lava effusion in the recent history (from the end of the XVII century) of the Russian Far East. Lava flows of other major eruptions were significantly smaller in size.

Relief at the northern part of the Dol dramatically changed; the vegetation was destroyed by lava flow over a large area. Surprisingly, despite the very large lava flows, the effect of this eruption on the environment was very small outside the lava cover. In trees growing at a meter from the side of the lava flow, we could not find any oppression caused by the lava flow. Furthermore, we did not see there not only damaged vegetation, but also mass death of animals. According to our short-term observations, small animals, such as red and reddish-gray vole, stoat and hare, have developed new habitats on the sides of cooled new lava flow (where it is still hot and saturated by gases in the depths) and the safety surrounding areas. Moderate ash falls gave vegetation some impact locally in the mountain (above 1,600 m ASL), mainly to the east of the active crater. There was redeposition of fresh tephra caused by blowing out and flushing. As a result the tephra was accumulated in some depressions over the area. Vegetation was buried in such sites, their size generally less than 100-200 m in diameter. However, in vegetation in the adjacent areas, only minor damage was found. Certain change in forest ecosystems may occur at several years after the eruption, according to observation after 1975-1976 eruption.

We sampled in the eruption's area more than 100 kg of volcanic deposits, soil and plants, to analyze the elements et al. at the laboratories of IBSS FEB

Fig. 6. A heavy scoria field formed locally near the active crater.

Fig. 7. Dr. Takashi Nakano on cooled surface of lava. (August, 2014)

New Site

Fig. 8. A field base camp on the edge of the scoria desert near the cooled side of lava flow.

RAS and the other institutes (Fig. 6). To examine the change of vegetation and ecosystem following volcanic activity, beside the field work on Tolbachik, our expeditionary team continues yearly field research at Kamchatka's active volcanoes, Sheveluch and Kluchevskoy. In 2014 we went there again. That was a small team, but a Japanese co-researcher, Dr. Takashi Nakano, also joined us (Fig. 7). He has studied vegetation change at Mt. Fuji, a famous volcano in Japan (see his report in DIWPA Newsletter No.24 in 2011).

We have studied change of vegetation on lava flow. However, there is few study in Tolbachinsky Dol area. The eruption destroyed not only vegetation, but also infrastructure. The lava covered two of three base camps that are capable to use for a year. Furthermore, the road between the eruption area and Kozyrevsk village was also destroyed. Only source for drinking water was also filled with lava. However, since the beginning of the eruption at Tolbachik, many visitors including tourists, photographers and researchers, have visited to look at the erupting volcano. They come not only from Kamchatka, but also from many other regions of Russia and other countries. Because this is a rare chance for observation of recent impacts of active volcano, the number of visitors will increase yearly. The vast landscape caused by the following eruption and lava flow and the subsequent change of vegetation and ecosystems are very interesting aspects for scientific research, as well as for many people with great interest for eco-tourism (Figs 8, 9).

Fig. 9. Evening bonfire at a field camp with the eruption in the background.

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