EARTHWATCH INSTITUTE FIELD REPORT

Project Title: Butterflies of Mount Fuji
Principal Investigator (s): Michihito Watanabe
Position/Affiliations: Director, Kawaguchiko Field Center & Lab. of Natural Science for Coexistence of Humans & Nature
Research Site(s) (geographic location, include coordinates if known, e.g. Lat/Long):

(1) Nashigahara; at the foot of Mount Fuji, about 100km west of Tokyo, typical "Satoyama" grassland situated at N35° 26′ E138° 49′, about 1020m in altitude and horizontally 11.6km northeast from the summit of Mt. Fuji.
(2) Minobu; Typical river bank environment made of concreted stones situated at N35° 25′ E138° 26′ ; about 200m in altitude, horizontally 34 km west from Nashigahara area.

(3) Kofu; Typical river bed environment made by natural sands & stones situated at N35° 39′ E138° 29′ ; about 300m in altitude, horizontally 27 km north from Minobu area.

(4) Tsuru: Typical "Satoyama" environment including river, spring, wetland, broad-leaved forest, grassland and cultivated land situated at N35° 32′ E138° 53′; about 500m in altitude, horizontally 14km NNE from Nashigahara area.

Local Management Status of the Research Site(s) (e.g. National Park, RAMSAR Site, World Heritage Site, IBA etc.):

(1) Nashigahara; The area used as the North Fuji training ground for Japan's Self-Defense Force. An area surrounded by Fuji Hakone Izu National Park.
(2) Minobu & Kofu; National-owned property under the jurisdiction of Ministry of Land, Infrastructure and Transport Japan.
(3)Tsuru: Hired private property area by Mr. Kitagaki (Cooperative researcher on Satoyama Environment with Michihito Watanabe) of Tsuru University.

Scientific names of primary species being studied (if appropriate):
Reverdin's Blue (*Lycaeides argirognomon praeterinsularis*)

Key Research Objectives (5-8 brief bullet points):
In order to know how to conserve endangered grassland butterflies we have been running ecological surveys on Reverdin's blue on the following aspects.
Metapopulation structure, Symbiosis between Reverdin's blue and ants, Seasonal fluctuation of local population, Displacement range, Survival rate

Date this report was completed: 10 Feb. 2009

It was a great pleasure for me and our staff to have the 2nd year Earthwatch International project with dedicated and high-levelled volunteers from US and Australia.

This year we could make only 1 team in late July, which have encouraged us to advance forward for next year. Also your activities in the project showed that our past survey on Reverdin's blue was useful in its conservational aspect.

We all know that the concept of how to conserve "Satoyama" environment is essential for the global environment. Although how to coexist with surrounding environment is commonly known, it is still a difficult problem around the world. The ancient wisdom of maintaining "Satoyama" environment sustainably will be the key to open new wisdom to conserve "Satoyama" environment.

Following the last year's project, I had a strong impression this year also that conserving "Satoyama" environment will be the key, not only for the nature conservation of whole Mt. Fuji but also for Japan as a whole. This concept of "Satoyama" environment conservation at the Asian Monsoon Region starting Japan will hold a key to the world's nature conservation. From this point as well, I believe that the research in conserving Reverdin's blue, which represents "Satoyama" environment has a significant value. The research on this habitat this year has progressed tremendously and I appreciate very much for your cooperation.

With my best thanks and regards

Michihito WATANABE

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Data Collection and Results

a) Give a concise account of the data you have collected during the past field season.

＊Nashigahara: in 2004 and 2005 research, we marked 1008 male and 380 female adults, recorded 1060 larvae or pupa of Reverdin's blue.(in 2006-2008 not summarized)

＊Minobu: in 2005 research, recorded 72 male and 61 female adults, 388 larvae and in 2006 research, recorded 132 males and 88 females as well as 533 larvae of Reverdin's blue.(in 2007 not summarized)

＊Tsuru: using line transect method, identified 41 species in 2005, 43 species in 2006 and 48 species in 2007, totally 63 species of butterflies in 3 years which is about 1/4 of whole butterfly species in Japan. In 2008, 3 species added, totally 66 species had been found in this area.

Research run at Earthwatch's International project in 2008.

Nashigahara: total 4 field researches and recorded 11 males and 2 females, 105 larvae of Reverdin's blue in 10 ha.

Minobu: 1 field research and recorded 3 males and 2 females, 101 larvae of Reverdin's blue in 1.3 ha.

Kofu: 1 field research and recorded 9 males and 2 females, 66 larvae & 3 pupae of Reverdin's blue in 0.5 ha.

Tsuru: made 1 field research and identified 22 species of butterflies (56 individuals) & 5 species of dragonflies (31 individuals) in 0.4 ha.

b) What progress have you made towards achieving your original objectives?

＊(1)From the survey conducted since 2003 on the symbiotic relationship between Reverdin's blue and ant, we observed 6 species tending to Reverdin's blue, but there is a difference in the intensity of symbiotic relationship with the species, populations, individuals or habitats of ants.

＊(2)In the local population and metapopulation of Reverdin's blue, there were considered to exist core and satellite habitat patches.

＊(3)From the result of over 1000 Reverdin's blue adults using mark and recapture method, only one female made over 1km displacement across the local populations, which may show that these adults were usually making short distance displacements in each local population.

c) Please provide a summary of your results (even if they are preliminary).

＊ To conserve Reverdin's blue habitats, it is important to maintain the sustainable environment of core and satellite patch network, where different types of ant habitats keep the strong symbiotic relationship with Reverdin's blue.

Significance/Benefits of Research

a) What is/are the significance/benefits of your research at the following levels?

- local (in the area of the research site)

It is becoming clear what environments or what human activities are important to conserve the endangered grassland butterflies including Reverdin's blue. We are making cooperative conservation actions for Reverdin's blue with Ministry of Land, Infrastructure and Transport Japan and Japan's Self-Defense Force. We'll make more efforts to advance cooperative conservation actions in other habitats in a future.

- national

Since the direction how to conserve Reverdin's blue and how to maintain the river bank environments is becoming clear by the cooperative managements with Ministry of Land, Infrastructure and Transport Japan, the research results from 3 areas, i.e. Nashigahara, Minobu and Kofu can be used as a model to consider the conservation policy of Reverdin's blue which is becoming endangered nationwide in other prefectures.

We have made cooperative survey on the cuticular hydrocarbons analysis both Reverdin's Blue larva and pupa & 4 tending ant species with Dr. Honda & Ohmura in Hiroshima University. 4 tending ant species exhibited species-specific chemical compositions of CHCs differ from Reverdin's Blue larva and pupa.

Our butterfly monitoring results from 2003 to 2008 in Tsuru, including this project's 1 day research, shows how important the "Satoyama" environment is in Japan's ecosystem. I think it may become one of the models how to conserve the "Satoyama" environments around us.

- International

In order to conserve endangered butterflies, our results of the Reverdin's blue study could be very useful for any other Lycaenid butterfly species, that have symbiotic relationship with ants, for example the critically endangered Miami blue which inhabits Florida USA.

b) How do your findings contribute to issues of sustainability?

The paper of new findings about the symbiotic relationship between Reverdin's blue and *Camponotus* ants in 2003 accepted by The Journal of Research on the Lepidoptera(as below). The research results from 2004 to 2006 will be contributed for some Japanese journals dealing with wildlife conservation in 2009.

Dissemination of Results

a) Have you provided details of results from your research to or within:

- Scientific papers (indicate status; e.g., peer reviewed or in progress/press)

"A newly observed form of symbiotic relationship between Reverdin's Blue (*Lycaeides argyrognomon praeterinsularis* (Verity), Lepidoptera: Lycaenidae) and *Camponotus japonicus* Mayr (Formicidae)" Journal of Research on the Lepidoptera 41:70-75.(first author & in press)

"Cuticular hydrocarbons of larva and pupa of Reverdin's blue (*Lycaeides argyrognomon*: Lycaenidae) and its tending ants."(second author & contributing to the Journal of the Lepidopterological Society of Japan)

- Presentations (given or planned)

In 2007 & 2008 , the presentations before these are written in the project briefing.

(1) ＊The Lepidopterists' Society 58th Annual meeting
(July 11-15, 2007 ;Bakersfield ,California, USA)
Poster presentation; (title) "The difference or similarity in symbiosis between Reverdin's blue and 6 different ant species"
(Presenter); Watanabe, Michihito (Laboratory of Natural Science for Coexistence of Humans & Nature, Kawaguchiko Field Center),
(Cooperative Investigators); Ohmura, Hisashi, and Honda, Keiichi (Department of Biofunctional Science and Technology, Graduate School of Biosphere Science, Hiroshima University)
(Audience); about 130 members of the Lepidopterists' Society

(2) ＊The Lepidopterological Society of Japan 54th Annual meeting
(Oct. 27-28, 2007: Niigata University, Japan)
Oral presentation; (title) "Fundamental surveys for the conservation of endangered Reverdin's blue. 4. The difference or similarity in symbiosis between Reverdin's blue and ants on the aspect of ant species or habitat.(in Japanese) "
(Presenters)Watanabe, Michihito (Laboratory of Natural Science for Coexistence of Humans & Nature, Kawaguchiko Field Center), Ohmura, Hisashi, and Honda, Keiichi (Department of Biofunctional Science and Technology, Graduate School of Biosphere Science, Hiroshima University)
(Audience): about 150 members of The Lepidopterological Society of Japan

(3) ＊Wildlife Conservation Society(Japan) 13th Annual meeting
(Nov. 16-18, 2007 : Edogawa University, Chiba, Japan)
Oral presentation; (title) "The difference or similarity in symbiosis between Reverdin's blue and 6 different ant species.(in Japanese)"
(Presenter); Watanabe, Michihito (Laboratory of Natural Science for Coexistence of Humans & Nature, Kawaguchiko Field Center),
(Cooperative Investigators); Ohmura, Hisashi, and Honda, Keiichi (Department of Biofunctional Science and Technology, Graduate School of Biosphere Science, Hiroshima University)
(Audience); about 120 members of Wildlife Conservation Society (Japan)

(4) ＊Wildlife Conservation Society(Japan) 14th Annual meeting
(Nov. 7-9, 2008 : Nagasaki International University, Nagasaki, Japan)
Oral presentation; (title) "Some Ecological Notes on the Larval Behavior of Critically Endangered Butterfly *Zizina emelina*" .(in Japanese)"
(Presenter); Watanabe, Michihito (Laboratory of Natural Science for Coexistence of Humans & Nature, Kawaguchiko Field Center),
(Cooperative Investigators); Kazuhiko Omata (Yamanashi University) and Yasunori Miyashita (Yamanashi Entomological Association)
(Audience); about 100 members of Wildlife Conservation Society (Japan)

- Books, chapters, illustrations

＊The research content of Reverdin's blue was posted in "The Book to Change the Viewpoint of Nature" published Dec. 13, 2007 by "Yama to Keikoku Publishing Co." and

edited by Nature Conservation Society of Japan, page 90 – 95, titled “Ants Care Reverdin’s blue to Adulthood. (written by Michihito Watanabe in Japanese)”

The Earthwatch international project of “Butterflies of Mount Fuji” was posted in “National Geographic Kids” published October 2007, page 29, titled “EARTH-FRIENDLY VACATIONS”

Volunteer Tasks and Accomplishments

a) How did the volunteers contribute ideas, skills, expertise and motivations beyond that which you anticipated?

Despite the number of total volunteers were less than last year, their capacity to understand was high and were eager to participate which made the research to be performed in a very good pace.

b) How have volunteers helped you to achieve your research or educational objectives? Please give specific and quantitative measures of the volunteers’ contribution to your data collection.

Most of the volunteers had high knowledge and were active, performed in the similar level with that of local discovery’s Japanese volunteers explaining in Japanese, and the research data gathered were very valuable.

Because the adult butterfly was small, marking was difficult which made the sharing of assignment of work to be performed automatically. The instruction display of GPS and digital camera were in English so that was easy for the volunteers to use.

This year all volunteers performed the research with more than my expectation. 3 out of 5 volunteers have climbed Mt. Fuji either after the project or during the off day at the middle of the week and they have even walked down until the foot of the mountain; the other 2 volunteers walked down to the foot of the mountain from the 5th station.

Educational Opportunities

a) Does your project directly or indirectly involve the following groups in your research topic?

- Local communities

It was a good opportunity to gain the awareness of the importance of research, the high conscious of Earthwatch volunteers by publicizing the progress report, as well as articles by Yamanashi Daily Journal. Because the activities of Laboratory of Natural Science for Coexistence of Humans & Nature are in step-by-step activities, this gave the opportunity to let people understand why the research on butterfly by this Laboratory is important.

This year, local Fujiyoshida CATV, who did not broadcast last year has covered the project and the interest was raised at the city of Fujiyoshida where an accommodations for the volunteers, Fuji Calm is located.

- Students

The observation events at Nashigahara were performed in targeting the local elementary and junior high school students at the natural observation classroom and the interest shown has increased more than ever.

It is a good educational material to tell about the actual research method and conservation at the lecture on “Ecology” at Tsuru University.

It is also an important educational material at the class of “Lesson for Yamanashi” which was requested by Yamanashi Gakuin University in 2007&2008.

- Early career scientists

The impact by the many graduate students who are the members of Wildlife Conservation Society of Japan were large and gave them a hope that this project was the first Japanese PI to run the international project. I hope to see a young researcher to develop and to be Earthwatch’s international project PI in the future. The sub-investigator Tsunoda in this project is one of them.

Since for the last 3 years, Kazuhiko Omata of Yamanashi University is studying the biological research (collaborative research) on endangered class I species of Lesser grass blue, and because the research method is basically the same as that of Reverdin’s blue, a modification to match Lesser grass blue will be the base for the monitoring research on the future conservation.

- Other groups

b) Please tell us the ways your research helps these groups better understand the conservation of a sustainable environment

The environment of Satoyama cannot be sustainable without the maintenance of human involvement. The survival of endangered butterflies such as Reverdin’s blue, plants and birds in the well maintained grassland environment show the catalyst of how to maintain what type of good grassland environment. Together with the research result from the Tsuru research site which is the typical Satoyama environment including 3 components: grassland, wetland, broad-leaved forest where research is done in parallel, to review the conservation policy of Satoyama environment.

As mentioned earlier, the knowledge (sustaining the Satoyama environment) to coexist with the Satoyama environment, which Japanese has unconsciously coexisted until recently, will be the model for the global sustainable natural conservation. I would like to observe the knowledge from our ancestors and study the best way, where and how to actually search for the Satoyama’s environmental conservation policy.

c) Has your project helped lead to the completion of Masters’ theses, or other educational research findings?

Since the data gathered are of yet the basic stage, the conservation model of endangered butterflies can be assured by comprehensive assessment of the data hitherto.

Partnerships

a) List partnerships or collaborations with other organizations that you have developed or maintained in the past season.

（１）North Fuji Training Ground of Japan's Self-Defense Force Administration Team, Fujiyoshida Onshirin Kumiai
（２）Ministry of Land, Infrastructure and Transport Japan, Kofu River and National Road Work Office
（３）Hiroshima University
（４）University of Yamanashi
（５）Waseda University
（６） Tokyo University of Agriculture and Technology
（７）Tsuru　University

b) How have these organizations contributed to your project objectives?

（１） Obtain entry permission to Nashigahara as well as cooperation to run a research in the training ground
（２） Receive cooperation in avoiding mowing of larval host plant of Reverdin's blue at river bed of Minobu and Kofu area as a part of grassland environmental management.
（３） Drs. Keiichi Honda and Hisashi Ohmura analyze the body surface substance of Reverdin's blue and symbiotic ant species in the aim to specify the sustaining substance of symbiotic relationship. The relationship between Reverdin's blue and ant species is considered significant factor in the declining of population.
（４） Dr. Mitsuru Hirata has supported by sending his graduate student to the research of two endangered butterfly species (Reverdin's blue and Lesser grass blue) at the river bed of Kofu area in the collaborative research.
（５） Dr. Kiyohiko Ikeda is helping in the research at Kofu area.
（６） Dr. Yutaro Senga supports the research by sending his graduate student to the Laboratory of Natural Science for Coexistence of Humans & Nature.
（７） With the collaboration from Mr. Kenji Kitagaki (special adjunct instructor, Tsuru University), research was performed in monitoring butterfly and dragonfly twice a month and at the same time to find out in collaboration research the impact of the difference of Satoyama management method.

How do you anticipate these organizations will use the results generated by the project, and in what timeframes?

（１）If the conservation method is recognized from the research results, I will request the Defense Force to consider at the time of training to maintaining the environment of habitat.

（２）Asking for the implementation of policy to coexist in maintaining habitat environment of Reverdin's blue or Lesser grass blue(*Zizina emelina*), and river bed management. Furthermore, request cooperation of long-term planning as a model for the nationwide river management.

（３）Last year's analysis result has been jointly announced at American and Japanese academic conference. Until we know how the impact of maintenance of population is determined, we will continue the joint research and analysis.

（４）～（６）Together with the joint announcement at the academic conference, request will be made for the transition of conservation activity in the habitat. Also, since the present grad student will graduate this year, I will ask for a further support of graduate student.

Acknowledgements

I would like to express my sincere appreciation first of all to the Earthwatch volunteers who have travelled long distance all the way from U.S. and Australia, then to Earthwatch Institute and their staff for this opportunity and grant, to Earthwatch Japan for their full support, to Fuji Calm and their staff in facilitating the accommodations and to all who have supported in implementing this project. But most of all a special deep appreciation to the staff, namely Takatori, Ninomiya, Miki, Miyashita, Tsunoda and Omata who have supported whole heartedly and without them this project would have not been successful.