Dear volunteers,

The fifth year of the field section of the project *Butterflies of Vietnam* has been completed. As the Principal Investigator of the project, and on behalf of the project staff, I would like to thank you for all your contributions. You were more than just support to our research project. We could not have carried out our research or gained the results that we did without your help and contribution of time and money. I am most grateful.

Your involvement has made it possible for us to develop a process for using butterflies as eco-indicators of habitat disturbance and monitoring butterflies. We were able to monitor the changes in butterfly species within the Tam Dao National Park over time. We have recorded data showing that forest disturbance made butterfly abundance seriously decline, especially forest butterfly species. You also helped to find life histories of butterflies such as food plants, caterpillars and pupa that are an important field of biology. Your participation assisted us in using butterflies to assess the success of conservation efficiency and find better solutions to conserving butterflies in Vietnam.

You are good, enthusiastic, patient, kind and generous people. We have learned much from you, and I hope that you have learned some things from the project as well. We had a wonderful time with you in Tam Dao. It is a beautiful and ideal site. You brought us your experience, nature, passion and joyfulness.

To all the Earthwatch volunteers, I cannot express in writing how delightful it was to work with you. The Earthwatch Institute brought us together from different nations and cultures in the world. We represented different ages and occupations. Our time together provided us with a unique opportunity to begin to understand each other. The Earthwatch Institute has made our Earth a smaller place and helps us to learn how to live peacefully in it. We were all in an international family.

Once again I would like to thank all of you who contributed time and money to help us carry out our research in Tam Dao National Park, Vietnam.

Sincerely yours,

Vu Van Lien

EARTHWATCH INSTITUTE FIELD REPORT

Project Title: Butterflies of Vietnam

Principal Investigator: Vu Van Lien

Position/Affiliations: Researcher/Vietnam Russian Tropical Centre

Research Site: Tam Dao National Park, Vinh Phuc Province, Vietnam. $21^{o}21'$-$21^{o}42'$N and $105^{o}23'$-$105^{o}44'$ E.

Local Management Status of the Research Site:

National Park of Vietnam

Key Research Objectives:

- Study the fluctuation of butterfly communities through months of the year and different years from 2002 to 2006; record the status of rare and endangered butterfly species of Tam Dao National Park.
- Study diversities and compositions of butterfly communities in different habitat types, from closed forest to agriculture area, to find which habitat is good for conservation of butterflies.
- Continue to identify and develop ecological indicators of butterflies that can be used as indicators to monitor and assess forest habitat disturbance in the Tam Dao National Park.
- Monitoring butterfly communities and species populations, especially forest butterfly species temporally along fixed transects in the park. The butterfly monitoring can provide real data over a long term to document the changes and trends in the butterfly populations and the causes for these changes.
- Looking for eggs, caterpillars, pupa and food plants of butterflies; raise butterflies.

Data Collection and Results

a) Give a concise account of the data you have collected during the past field season.
A total of 140 species and 6,300 individual butterflies were recorded in six different butterfly transects from May to November 2006.

b) What progress have you made towards achieving your original objectives?
We have collected data that primarily achieved our original objectives of documenting: the fluctuation of butterfly communities from 2002 to 2006, diversities and compositions of butterfly communities in different habitat types, the decline of butterfly abundance due to forest destruction, and butterfly species that can be used as indicators of forest health. Some information on butterfly biology such as food plants, eggs, caterpillars and pupa was revealed, especially information about red data-book swallowtail and birdwing butterflies *Teinopalpus aureus* and *Troides aeacus.*

c) Please provide a summary of your results (even if they are preliminary).
The research results indicated that butterfly abundance declined annually from 2002 to 2005, the lowest number in 2005, but increased and reached the highest number in 2006. The lowest butterfly number occurred in 2005 due to the destruction of vegetation along forest transects; construction work and trucks carried out on the new road; in addition, the vegetation along sides of the road was newly destroyed. These factors caused the butterfly abundance to decline in 2005. In 2006, there was less construction work than in 2005; in addition, shrub and grass along sides of the road recovered that supported more habitats than previous years and resulted in high butterfly numbers. The monthly fluctuation of butterflies occurred rather strongly from May to November. There are two butterfly abundance peaks. The first peak on Tam Dao Mountain was in June and the second peak was in October. The result also indicated that forest butterfly species have fewer generations per year than open-habitat species.

Diversity of butterfly communities is lowest in the natural forest, higher in the disturbed forest and highest at the forest edge, lower in the shrub habitat, and very low in the grass and agriculture land. Even though the natural forest has low butterfly diversity, it is very important for the conservation of forest restricted butterfly species. These species were not or hardly seen outside the forest. The forest edge is very important for conservation of a high diversity of butterflies. The grass and agriculture land has low butterfly diversity and all butterfly species seen in this habitat are common. Species composition in forests differed from the composition outside forests.

During the research period of five years in the park, four butterfly species were identified as ecological indicators of forest health. The indicator species are *Ragadia crisilda*, *Mycalesis misenus, Neope murrheadi* and *Stichophthalma howqua*. The presence and abundance of these species can indicate forest health. If these species are very abundant that can represent a healthy forest and vice verse.

Forest cut down in 2005 to make the new road severely impacted on the abundance of forest-habitat indicator species (figure 1). Their populations were not different from 2002 to 2004, but severely reduced in 2005 and 2006. Forest habitats were the same from 2002 to 2004 but destroyed in 2005 so that populations of forest species declined in 2005.

In contrast to forest butterfly species, open-habitat butterfly species (the species seen commonly outside forest) were not affected by felling of the forest (figure 2). The populations of typical open-habitat species were not different from 2002 to 2005 but all increased in 2006. The increase of populations in 2006 is due to the presence of more open space in the forest. Although more open space was created in 2005, the butterfly populations did not increase; the increase occurred in a year later. As indicated above, in 2005 the road was brand new, construction work and trucks conducted on the road that did not attract more butterflies than previous years. In 2006, shrub and grass along the sides of the new road recovered and there was less construction work on the road than during the previous year. This attracts more open-habitat butterflies that made their populations increase.

Figure 1. The fluctuation of forest-habitat butterfly species from 2002 to 2006

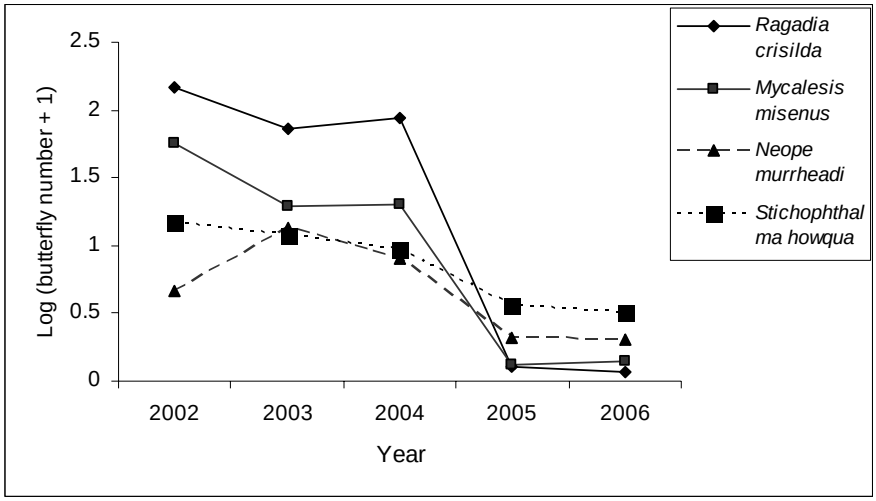
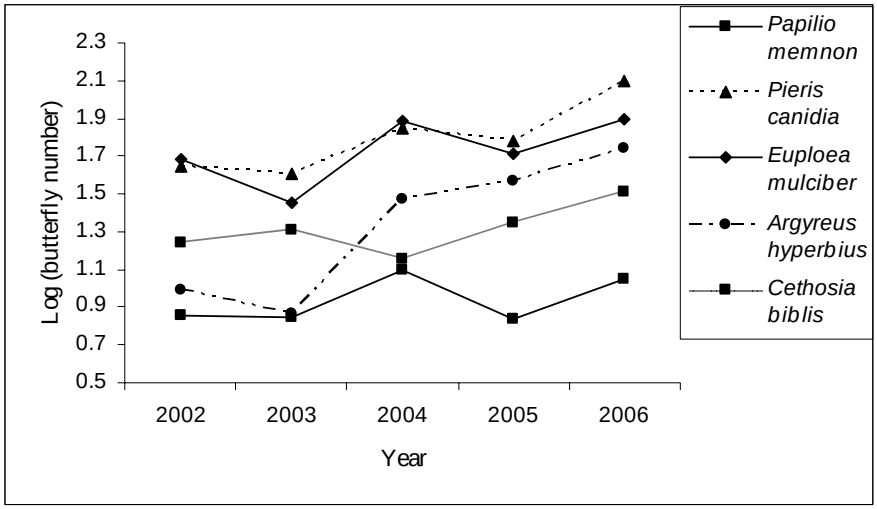


Figure 2. The fluctuation of open-habitat butterfly species from 2002 to 2006



Even though the habitat along the new road in 2006 was improved, populations of forest species were the same in 2005 (figure 1). These species only live under the forest canopy. Populations of forest species reduced in 2005 and 2006 but total abundance of butterfly communities increased in 2006 that due to the increased number was higher than the decreased number.

During the field season, life histories such as food plants, eggs, caterpillars and pupa of some butterflies were discovered for the first time in Vietnam. They are *Graphium chironides, Chilasa slateri, Papilio helenus, Papilio memnon, Papilio polytes, Papilio dialis, Atrophaneura sp., Troides aeacus, Cethosia biblis, Danaus chrysippus*, *Delias pasithoe, Euploea mulciber.* Some more information on the IUCN (International Union for Conservation of Nature) Red-Listed species *Teinopalpus aureus* was also documented.

By monitoring butterfly communities and species through fixed transects in Tam Dao National Park since 2002, we documented data that indicated that the abundance of butterfly communities reduced from 2002 to 2005 but increased in 2006 due to more open space in the forests. The research results also revealed the decline of populations of forest indicator species and increase of open-habitat butterflies due to the forest destruction. The indicator species can be used to monitor the effect of forest disturbance on butterflies and indicate the health of forests.

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)

Some butterfly species can be used as an ecological indicator that can be conducted by the park's staff to monitor the long-term change of butterflies to assess the success or failure of conservation work in the park. Life histories of butterflies were documented that are helpful to raise butterflies for conservation, tourism and education in the area.

- National

The negative effect of forest destruction on butterfly communities that can impact on scientists, managers and policy-makers of wildlife conservation in Vietnam. Indicator species can be used to monitor and assess the success of conservation programmes not only in Tam Dao National Park but also throughout Vietnam. The project is first in Vietnam so that some findings of ecology and biology such as life histories of butterflies, food plants of butterflies are helpful in breeding butterflies in Tam Dao and Vietnam.

- International

The project positively influences volunteers. Through the project they understand the butterflies, the importance of forests for butterflies, the relationship between forests and butterflies, the effect of forest disturbance on butterfly existence, conservation problems in Tam Dao and Vietnam. Volunteers understand these and may contribute to wildlife conservation action and environmental protection in their countries.

We hope our findings may contribute to management strategies and biodiversity conservation action from local to international level.

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

The findings of life histories of butterflies such as food plants, eggs, caterpillars, habitat preference, distribution and other information on butterflies are invaluable to conserve butterflies and especially help to breed butterflies in Tam Dao.

Dissemination of Results

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

- Scientific papers

- Biological characteristics of some butterfly species in Tam Dao National Park.
- The fluctuation of butterfly communities and some common species seasonaly in Tam Dao National Park, Vinh Phuc.

The papers are in peer review process of Journal of Biology and Journal of Science in Vietnam.

Volunteer Tasks and Accomplishments

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

They tried with their best skill and ability to contribute to our work. Volunteers also wanted to learn to identify butterflies to help the research. Almost all volunteers were willing to walk any transects in spite of slippery and steep paths and in so doing they encouraged us and other volunteers to work harder. We appreciated their contribution and their motivation as well.

b) How have volunteers helped you to achieve your research or educational objectives?

Volunteers were assigned to walk on different transects every day except rainy days to count, catch, identify, take photos and record butterflies on data sheets. Volunteers also looked for caterpillars, pupa and food plants of butterflies along transects and other areas as well. Teams were divided into two small groups to work in the field.

Teams contributed 1,150 working hours in the field and recorded a total of 140 species and 6,300 individual butterflies along six butterfly transects.

Project Development

a) What logistical or scientific challenges have you encountered in the past season and how will you address them during the next field season?

The biggest challenge we encountered in the field was climbing the local mountain peak of Tam Dao (the first of three peaks). Even though climbing the mountain peak was optional, volunteers liked to do that.

b) Have you used any additional methods/strategies to meet your research objectives?

In the last season, besides studying butterflies on different fixed transects, we carried out research into butterfly biology. We found eggs, caterpillars and pupa of butterflies. We also successfully raised some butterflies.

c) How will you develop your research in the coming field season?

We continue to monitor butterfly communities and species populations on different fixed transects to show the decline or increase of butterflies; find food plants, eggs, caterpillars and pupa of more butterfly species, especially rare species; raise butterflies in the area to reveal more information about butterfly biology.

Educational Opportunities

a) Does your project directly or indirectly involve the following groups in your research topic?
   - Local communities
   - Students
   - Early career scientists
   - Other groups

   Yes, the project involves the local community of Tam Dao, students, teachers and national park staff.

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

The research helps these groups better understand the conservation of a sustainable environment by:

Indicating to them the value of butterflies and their environment. Foreign volunteers took part in the research in the area and that attracts the attention and concern of local communities about butterfly study and conservation and other environmental problems in the area. It positively affects their attitude and awareness of protection of wildlife and the environment. Environmental awareness is quite low in Vietnam in general and in Tam Dao in particular which receives a lot of domestic tourists each year.

The research helped undergraduate students and staff from the Tam Dao National Park to familiar purposes, methodologies and plan of the research. Through the project they learnt to identify and record butterflies (different families and species); understand about the role and relation between the environment and butterflies; how and where to look for eggs, caterpillars of butterflies and raise them. They also can monitor butterflies and other creatures in protected areas.

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

The project helped lead to the completion of the graduate thesis of a student and to do the PhD thesis of the Principal Investigator.

Partnerships

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

Tam Dao National Park, local community of Tam Dao.

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

The park permitted us to carry out the research and also assigned some staff to learn how to monitor butterflies and also help the project.

Some local people in the Tam Dao community wanted to raise butterflies in the area for doing business. We worked in co-operation to find solutions to found insect farms in Tam Dao for conservation, tourism and trade.

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

The results of the project will be used in the report and conservation plan by the park to protect butterflies and their forest habitat; they want to use our monitoring methods to monitor other wildlife of the park in the future.

Acknowledgements

I thank very much our team leader and staff Mr.Dang Ngoc Anh, Vu Dinh Viet and others; Mr. Tien, the director of Tam Dao National Park for giving us permission to work in the park. Thanks go especially to the 37 Earthwatch volunteers. Thanks also to the Earthwatch Institute who funded the project.