

# **SMITHSONIAN COLLABORATIONS IN MYANMAR**

**A compilation of projects and  
activities between 1994 - 2003**



**Prepared by  
Drs. Chris Wemmer, W. John Kress, and George Zug**

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### **Introduction**

Smithsonian (SI) scientists initiated scholarly research in Myanmar in the late 1970s. Though the Union of Myanmar limited foreign visits to seven days, Myanmar's cultural and biological diversity was still a powerful attraction. The availability of Public Law 480 funds to defray costs of travel and research was a strong additional incentive. Thomas Soderstrom, a botanical curator at the National Museum of Natural History, was among those scientists who visited Myanmar. Myanmar has over 100 species of bamboo, and Soderstrom was an expert on this group of economically important plants. Michael Robinson, from the Smithsonian's tropical research institute visited to investigate spiders, and Herndon Dowling did a quick survey of snakes. One of the more intrepid researchers was Russell Ciochon, who undertook his first trip in 1975 as a graduate student. During the next 13 years he spent over 5 months investigating Eocene primate paleontology in the Ponnyadaung Hills and Ayeyarwadi river drainage. The most intensive study during this period, however, was Dr. Chris Lehman's research on the dialect of King Theebaw's court. For a year he lived with his family in Mandalay and documented the language among a small group of Theebaw's relatives.

In 1985, Myanmar's Department of Forests sent two of its staff, Daw Myint Myint Oo and Daw Pyone Pyone Aye, to attend a training course in Wildlife Conservation & Management organized by Dr. Rudy Rudran at the National Zoo's Conservation & Research Center. In May 1988, three National Zoo staff members visited Myanmar to discuss collaboration in wildlife conservation, but four years passed before these discussions resumed and bore fruit. Chris Wemmer, Rudy Rudran and Mitch Bush then met with officials of the National Commission for Environmental Affairs (NCEA) and the Nature and Wildlife Conservation Division (NWCD) during a needs assessment workshop. This marked the beginning of a series of collaborative projects centering on biological exploration, in-service training of Myanmar nationals, and long-term ecological studies.

Over 80 scientists and educators have participated in this highly diversified program. They come from many institutions in ten countries around the world. In the following pages each collaborative project is briefly described with reference to scholarly outputs and other measures of success. A list of training courses presented in Myanmar, is also appended with summarizing statistics. Most of these activities fall into five major programs.

- **Biodiversity Conservation of Chatthin Wildlife Sanctuary** (National Zoological Park, Smithsonian Institution, Nature and Wildlife Conservation Division, Ministry of Forestry, Myanmar)
- **Botanical Survey of Myanmar** (Department of Botany, National Museum of Natural History, Smithsonian, Forest Department and Forest Research Institute, Ministry of Forestry, Myanmar)
- **National Survey of Reptiles and Amphibians of Myanmar** (Department of Reptiles and Amphibians, California Academy of Sciences, San Francisco, Department of Herpetology, National Museum of Natural History, Smithsonian, and Nature and Wildlife Conservation Division, Ministry of Forestry, Myanmar)
- **Conservation and Management of the Asian Elephant in Myanmar** (National Zoological Park, Smithsonian Institution, Nature and Wildlife Conservation Division, Myanmar Timber Enterprise, Ministry of Forestry, Myanmar)
- **Graduate Education in Conservation Biology and Wildlife Management** (University of Yangon, Smithsonian Institution, California Academy of Sciences with participating foreign academic institutions)

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<sup>1</sup> Prepared by Drs. Chris Wemmer, W. John Kress, and George Zug with the aid of participating scientists and staff.

### **Coordination**

Wildlife biologists from both Myanmar and abroad have generated ideas for projects, and have shared in supporting the costs. Coordination within the Smithsonian and its collaborators, such as the California Academy of Sciences (CAS) is informal. SI scientists work for different scientific bureaus, and share information as colleagues. A large number of foreign scientists have been invited to participate as training course instructors and research scientists. This was advisable because a large scope of taxonomic expertise is needed for biodiversity exploration, and conservation work requires many specialists from many disciplines.

### **Funding**

Seventeen major sources of funding have made it possible to conduct the projects listed in this document. No project has been funded from a single source, and with the exception of the Asian Elephant Conservation Fund and the National Science Foundation, all sources have been non-federal. Individual grants for specific projects have ranged from several hundred dollars to \$350,000. Several scientists have used personal trust funds, such as honoraria for lectures, book royalties, and fees paid for professional services to finance construction of four guard posts in Chatthin Wildlife Sanctuary. Others have donated personal funds to the staff welfare fund at Chatthin Wildlife Sanctuary. There is no central account of expenditures for the many projects in Myanmar. They have been supported by scientists of the Smithsonian and their associates from partner institutions, such as the California Academy of Sciences and the Vienna Natural History Museum. We estimate that about \$1 million has been spent to make these projects possible. This does not include the salaries of our staff while they were involved in the projects.

### **Guiding principles**

Our science and conservation projects in Myanmar have been guided by the belief that no single institution by itself can answer all of the questions. Conservation issues are complex, and their solution usually requires a broader range of expertise than any one organization can offer. Even a large organization like the Smithsonian, with 700 scientists, seeks cooperation and assistance of partners, both colleagues and other organizations. Collaboration between organizations, however, may challenge the organizational identity of the different players. For that reason, partnerships between organizations

are the best way to secure the human resources needed to address complex issues. Smithsonian and collaborating scientists work under the assumption that trans-national collaboration requires joint planning, good will between cooperators, realistic common goals, and outputs that are meaningful to Myanmar. In all of our projects, education, through training courses, and mentoring of field teams of Myanmar nationals has been a key activity.

### **Measures of Success**

Numerous achievements mark the past nine years of work in Myanmar.

- ◆ Building Professional Capacity: More than 200 staff of the Ministry of Forestry have participated in 15 training courses taught by 25 instructors from 12 countries. More than 60% of all current protected area wardens have participated in at least one SI training course. Our scientists have assisted three NWCD staff to enroll for graduate degrees, and are currently mentoring three graduate students from the University of Yangon. Forty projects have been carried out, including the national survey of reptiles and amphibians, expeditions, and national surveys. Many projects have taken place in three protected areas—Chatthin Wildlife Sanctuary, Alaungdaw Kathapa National Park, and Htamanthi Wildlife Sanctuary.
- ◆ Foreign scientists have mentored 121 forestry department staff (19 women and 102 men) as the members of project teams. Staff learned to collect and analyze data using a variety of approaches. They have received a total of 236 years of mentored training. The average length of individual mentoring is 1.9 years, but ranges from 11 days for some members of the elephant survey teams to 8.4 years for members of the bird team in CWS.
- ◆ Finally, our institutions and scientists have funded study tours of Myanmar colleagues to the California Academy of Sciences, National Museum of Natural History, and the National Zoo's Conservation & Research Center. We have also sponsored consulting visits to neighboring countries. In 2002, we funded the participation of four Myanmar colleagues in the Society for Conservation Biology's annual conference at the University of Kent in Canterbury, U.K. There they gave presentations at a Symposium on biodiversity



Kyaw Kyaw Moe, Khaing Khaing Swe, and Thida OO, the Attitude Survey team, and its mentor, Teri Allendorf (photo: Carl Hansen, SI)



Tagondai camp guard house (photo: C. Wemmer)

conservation in Myanmar jointly coordinated by SI and WCS.

- ◆ **Biological Discovery:** Our colleagues and associates have discovered about 50 species of animals and plants that are new to science. This growing list includes at least 40 species of reptiles and amphibians, 6 birds, 4 species of insects, and two species of plants. Over 3000 new records of existing plants have been added to Myanmar's flora as a result of collaboration among botanists of the Smithsonian and Department of Forests. The indispensable role of colleagues in Myanmar has been recognized in co-authorships in nearly all of these papers (see List of Publications).
- ◆ **Infra-structure Development:** Scientists from the Vienna Natural History Museum, the California Academy of Sciences and the Smithsonian have provided specimen cases, air conditioner, and supplies to develop a Myanmar Biodiversity Museum at Hlawga Wildlife Park. The Museum houses voucher specimens of vertebrate and invertebrate species. In Chatthin Wildlife Sanctuary, our scientists funded the construction of four guard posts, and two bungalows with laboratories, and they equipped the education center in the town of Chatthin.
- ◆ **Diffusion of Knowledge:** Scientists and colleagues have published over 60 scientific and popular articles about Myanmar's flora, fauna, and ecosystems. Myanmar field biologists have co-authored over a third of these technical papers. Our scientists have also assisted Myanmar colleagues to write

and publish their own findings in international peer-reviewed journals. Three field guides and one book have been produced (see List of Publications)

- ◆ **Protected area conservation:** Our scientists have contributed two-four-wheel drive vehicles, two boats, 12 computers, scientific equipment, and supplies estimated to exceed \$250,000 to the various projects. Many Myanmar colleagues are now skillful users of radio-telemetry equipment, animal capture technology, Global Positioning Systems, microscopes, and computer software.

#### ***A Vision for Meeting Future Challenges***

Our scientists and colleagues who have had the good fortune to work in Myanmar, share a commitment and enthusiasm to continue and expand initiatives in science-based conservation. Foreign and Myanmar collaborators will continue to co-direct a variety of projects. Over the years, their perspectives regarding future needs for conservation, science, and education in Myanmar have converged. A progressive and integrating vision, founded on mutual trust and cooperation, is emerging that promises major advances in environmental conservation. The major program areas are:

- education and building of professional skills and capacity,
- biodiversity exploration and surveys, and
- protected area and community-based conservation

### **Education and building professional capacity**

The need for greater educational breadth and opportunity for university students and in-service ministerial staff will grow as the complexity of Myanmar's environmental challenges increase. The demand for special training and higher education in the natural sciences already exceeds the supply of educational programs. Within the environmental ministries educational opportunities for the rank and file are limited. We are using an integrated approach to address the deficiency.

- A counterpart fellowship program will accelerate graduate education. It will offer opportunities for cross-cultural learning of foreign and Myanmar graduate students pursuing related field projects at the University of Yangon. Foreign and Myanmar scientists already co-advise a small number of students. The program is currently embraced by an MOU between the University of Yangon, California Academy of Sciences and Smithsonian, but it will require external support to gain participation of foreign conservation and environmental NGOs.
- Protected area personnel will continue to receive first-hand field experience by serving as field assistants to graduate students of the counterpart program. We hope to collaborate with the Ministry of Livestock and Fisheries in a similar capacity. This will increase dialogue between academics, and protected area managers and staff.
- Awareness of foreign academic developments will be fostered by guest lectures given at the University by visiting scientists. We are hopeful that a proposed *Conservation Biology Newsletter* will communicate conservation-related activities within Myanmar more widely. Such a mechanism is needed to share news, discoveries, and activities among university faculty and students, collaborators from cooperating ministries, and overseas organizations, such as the Smithsonian, California Academy of Sciences, Harrison Institute, Birdlife International, Wildlife Conservation Society, and others. Finally, we hope to find support for the University of Yangon to host an annual conference on science and the environment that will cement relationships and cross-disciplinary understanding within Myanmar's environmental community.

These initiatives are based on the University of Yangon's recognition that a coordinated effort must be made to build an integrated conservation biology curriculum that provides practical experience, has relevance to environmental issues, and is based on standards of excellence.

### **Biodiversity exploration and surveys**

Myanmar's largely unexplored biological diversity is a key feature of relevance to science and human welfare. Scientific exploration has been a central theme of many of our projects, and future efforts will focus on three interrelated areas.

- First, scientific exploration should continue through inventories, expeditions, and status surveys of specific taxa. New collaborators from other nations, such as the UK and Japan, will be sought in addition to the existing associates of this program. Teams of para-taxonomists in the NWCD, trained by our staff and colleagues, will continue to be central to the success of these efforts. Graduate students will be encouraged to focus on taxonomic research on plants and animals of special interest, and critical issues threatening the survival of endangered species.
- Second, biological collections and Myanmar's new taxonomists must find productive roles to play within Myanmar's developing society. The departments within the Ministries of Forestry, and Livestock and Fisheries are the logical holders of museum collections, but we will also encourage the universities to develop biological collections so that taxonomic training and research can be incorporated into the graduate curriculum. We will continue our efforts to ensure that the Botanical Garden in Pyin-oo-lwin and the Forestry Herbarium at Yezin achieve their full potential as scientific and cultural institutions.
- Third, we will encourage the development of products from biodiversity exploration that are meaningful for decision-making and management of environmental resources. These include field guides, taxonomic keys, symposia, educational compact disks, and protected area manuals.
- Last, to pave the way for the introduction of eco-tourism, the knowledge and interpretation skills of park guides and naturalists must be improved. The products described above will be key to success. Though tourism and eco-tourism in particular is absent in Myanmar's protected areas, a ready source of qualified





Tin Myat Soe of the Thamin Ecology Team, 1996 (photo: C. Wemmer).

staff must be available when eco-tourism becomes a reality. The Wildlife Division should take the lead in training its staff in this area. We are prepared to assist by developing professional qualifications for park naturalists based on qualifying exams. The Wildlife Division employs several outstanding young para-taxonomists who could train staff.

**Protected areas and community-based conservation**

Myanmar's protected areas will become secure environmental assets only when the ecology of local communities is factored into their management. We envision three necessary steps to address this daunting challenge.

- Dialogue between communities and park management must increase, but park managers generally lack the requisite knowledge and facilitation skills to deal with these complex problems. We plan to fortify the human resources by offering specialized training. A staged series of courses is needed to meet the challenge. The first should be a protected areas management course for Range Officers, that is, those protected area staff destined to become the next generation of park wardens.
- Financial resources will be needed to implement the newly acquired skills of protected area staff. Seed funding will be critical to successfully initiate projects in buffer zone development, community forestry, and alternative income-generating activities. We plan to work closely with other organizations to address this humanitarian need in a small number of protected areas, including Chatthin

Wildlife Sanctuary, where we have concentrated our past efforts.

- Economic self-sufficiency is key to the long-term viability of Myanmar's protected areas. We would like to work with NWCD to develop successful models of park support, which foster community integration, staff welfare, and a commitment to environmental stewardship. Every park has unique qualities and issues, and there is no universal model in existence to put in place. Therefore, the effort will be experimental and limited to a small number of protected areas. However, protected area managers have already devised modest but successful mechanisms, such as staff welfare funds, which give hope for the future. This is the final step needed to transform Myanmar's protected areas from tenuous and under-funded way stations to self-sufficient parks with a future.

Achieving these goals will require the participation of competent but non-political external scientific and conservation organizations. For nearly a decade, the Smithsonian and its organizational partners have served as a gateway for colleagues and other organizations to participate in these programs. We plan to formalize this function in the near future to effectively muster support from the growing number of potential partners who wish to contribute to Myanmar's environmental future.

**Acknowledgement**

We acknowledge the assistance of U Thein Lwin, U Than Nwai, U Uga, and U Khin Maung Zaw, as directors of the Division of Nature and Wildlife Conservation; and Dr Kyaw Tint and U Shwe Kyaw, Directors General of the Division of Forestry, and the responsible officials headed by the Managing Director of Myanma Timber Enterprise. We greatly appreciate the support of the Ministers of Forestry, General Chit Swe and U Aung Phone, for supporting cooperation. Dr Soe Yin and Dr Tin Nwe have strongly supported SI participation in graduate training at the University of Yangon, and Ambassador U Linn Myaing has aided communication between our organizations on various occasions.

**Smithsonian collaborations in Myanmar**  
**A compilation of projects and activities between 1994-2003**

**1) The ecology and conservation of the thamin or Eld's deer (*Cervus thamin eldi*) (1995-2003)**

**Myanmar Counterparts:** Myint Aung, Maung Win, Sein Htun, Thin Thin Yu, Aung Than (Gyi), Aung Than (Lay), Tin Mya Soe, Khin Lay Win, Khin Mya Thin, Thin Thin Naing, Than Htun

**U.S. Counterparts:** Wm. McShea, Steve Monfort, Chris Wemmer

The goal of the project is to provide information on the ecology and status of the endangered thamin in Myanmar. Chatthin Wildlife Sanctuary was the focal area for ecological studies that lasted for 5 years and resulted in two major publications (Aung et al, 2001, McShea et al. 2001), and an M. Sc. degree for the warden of the sanctuary, U Myint Aung. The project also had a landscape ecology component that integrated surveys of thamin with forest cover throughout the central dry zone and indaing habitat (McShea et al 1999, Koy 2002). The project resulted in



The thamin, or Eld's deer, a native of Myanmar (photo: Lisa Ware)

a Population and Habitat Viability analysis in 1999, conducted by Susie Ellis (CBSG), and recommendations for conservation and management were handed over to the Division of Wildlife and Nature Conservation. The project provided CWS staff with technical skills in wildlife research, including wildlife survey techniques, plant phenology and radio-telemetry. The project continues under the leadership of Bill McShea and U Myint Aung, with range wide surveys in

Myanmar, and new activities in Thailand and Indochina in collaboration with WCS. A cooperative planning workshop is scheduled in Thailand in 2003 with the involvement of WCS and the National Zoological Park.

Funding: Friends of the National Zoo (FONZ), SI endowment funds, National Geographic Society

**2) Oozie elephant relations in Sagaing Division (1995-96)**

**Myanmar Counterparts:** Myo Thant (MTE)

**U.S. Counterparts:** Chris Wemmer, John Lehnhardt

We compiled data on command language (the number of words/signals used to command timber elephants), oozie demography and practices, and the body condition and morphometrics of elephants. We also conducted performance trials to measure the responsiveness of elephants to their oozies' commands. The project developed as a follow-up activity from the training course on body condition assessment and morphometrics of domestic elephants given to MTE elephant veterinarians by Wemmer in 1994. Similar data have been collected in India and Sri Lanka, as part of a long-term ongoing study.

Funding: FONZ

**3) Reproductive cycles of thamin (*Cervus eldi thamin*) at the Yangon Zoological Garden (1996-1998)**

**Myanmar Counterparts:** Kyaw Nyunt Lwin, Khin Maung Win, Su Su Aung

**U.S. Counterparts:** Steve Monfort, Kendall Mashburn

The goal of this project was to determine the estrous cycle and the length of the breeding season in thamin living within the range country and normal latitude of the species. Fecal samples were collected year-round from six individually-identified individuals of each sex, but fecal steroid analysis did not prove to be useful for delineating seasonal changes in gonadal steroid excretion. Procedural and/or technical errors may have accounted for the lack of clear-cut results.

Funding: Reproductive Physiology Trust funds

**4) Environmental Education in Chatthin Wildlife Sanctuary (1996-1997, 1998-1999).**

**Myanmar Counterparts: Myint Aung, Hazel Thwinn, Maung Win, Nyunt Thaung, Than Than Aye**

**Foreign Counterparts: Chris Wemmer, David Jenkins**

This two-year project was undertaken early in the history of the thamin ecology project to address the need for environmental education in villages and monasteries in and around CWS. The goal was to enlist support for thamin conservation by working directly with school teachers, monks, and school children. The project, headed by Khin Ma Ma (Hazel) Thwinn and a small team of park staff, visited schools and discussed the activities of the thamin ecology project, and the role of the park administration in protecting the thamin. Hazel conducted an essay contest (as a substitute for the traveling puppet show that was originally planned), and four winners were selected. A poster and slide show were also produced and distributed. In 1998, NZP reactivated education activities when David Jenkins worked with Daw Than Than Aye, CWS staff and local school teachers to develop an education center at a Forest Department bungalow in the town of Chatthin. The National Zoo donated supplies and equipment and the many of the collections of flora and fauna were transferred from CWS to the new facility.

Funding: FONZ. Abbott Restricted Endowment Fund (SI)



**The Environmental Education Team – Mya Thanda Nyein, Lwin Lwin Myint, Myo Khaing, Maung Win, Aung Moe, Khin Saw Win, Tin Moe Swe (Phone: C. Wemmer)**

**5) Ecological Studies of Jackals in CWS (1997-1999)**

**Myanmar Counterparts: Myint Aung, Myo Nyunt, Zaw Min Htun, Tin Maung Soe, Aung Naing Win**

**Foreign Counterparts: Bill McShea, Duggin Wroe**

To investigate the predators of thamin in CWS, Bill McShea and Duggin Wroe attempted to trap wild dog (*Cuon alpinus*) and jackals (*Canis aureus*). Though CWS staff had witnessed isolated incidents of wild dog predation of barking deer and thamin, no wild dogs were caught during this study. Jackals however, were quite common, and six individuals were collared and tracked, and scat was collected for dietary analysis. McShea is working on the data.

Funding: Abbott Fund

**6) Phylogeography and conservation genetics of the Eld's Deer (*Cervus eldi*) (1998-2002)**

**Myanmar Counterparts: Kyaw Nyunt Lwin, Khin Maung Win, Su Su Aung, Myint Aung**

**U.S. Counterparts: Chris Balakrishnan, Steve Monfort, Michael Sorenson**

We analyzed variation in the mitochondrial DNA (mtDNA) control region for representatives of all three Eld's deer subspecies to gain a better understanding of the genetic population structure and evolutionary history of this species. A phylogeny of mtDNA haplotypes indicated that the critically endangered and ecologically divergent *C. eldi eldi* is most closely related to *C. e. thamin* than either is to *C. e. siamensis*, a result that is consistent with biogeographic considerations. Diversity indices suggested that managed breeding programs helped to maintain genetic diversity in captivity. These data were used to suggest that the three Eld's deer subspecies be managed as distinct and evolutionarily significant units (ESUs).

Funding: Reproductive Physiology Trust funds.



**7) Attitudes and socio-economic surveys toward wildlife and protected areas: Chatthin Wildlife Sanctuary and Alaungdaw Kathapa National Park (1998-2003)**

**Myanmar Counterparts:** Khaing Khaing Swe, Thida Oo, Kyaw Kyaw Moe, Myint Aung, Thein Shwe

**U.S. Counterparts:** Teri Allendorf, Karen Eberhardt, Peter Leimgruber and Chris Wemmer

This effort began as an extension of the thamin ecology project in CWS, and had the specific goal of understanding the underlying attitudes of local villagers toward the protected area. The project resulted in the training of 3 school teachers from the vicinity of Chatthin in methods used to survey community attitudes, and it provided the wardens of these 2 protected areas with information about attitudes toward park management and resources needs. Teri Allendorf is preparing a paper on the results. The continuing work of Daw Khaing Khaing Swe will concentrate on Htamanthi and Shwe-U-Daung Wildlife Sanctuaries, hopefully leading to a masters degree in the conservation biology program at the University of Yangon. More recently, CARE collaborated with the Wildlife Division and the SI elephant ecology project to conduct socio-economic surveys of AKNP and Htamanthi Wildlife Sanctuary.

**Funding:** FONZ, Asian Elephant Conservation Fund (USFWS), Disney Conservation Fund, Christensen Fund

**8) Chatthin Market Survey (1998-1999)**

**Myanmar Counterparts:** Myint Aung, Aung Moe, Thida Swe, Lwin Lwin Myint, Mya Thandar Nyein and Khin Mar Thin.

**Foreign Counterparts:** Chris Wemmer

This project was undertaken to better understand the economics of wildlife and forest products in the largest rural *manet zay* or morning market in the vicinity of CWS. The study took place over a one-year period during which vendors were interviewed on weekly (Sunday) visits. The findings, currently being prepared for publication, revealed that the vendors from 31 villages lived as far as 20 miles away (modal age: 16-20 years), and sold 12 animal products, and 15 forest plant products. Rabbit meat (*Lepus peguensis*) was the most common wildlife product sold. Some species, such as the frog *Glyphosglossus*, is disproportionately represented in the market in comparison to its abundance in nature.

Seasonality of availability ranged from three weeks/year to year-round.

**Funding:** FONZ

**9) Small mammal ecology of Chatthin Wildlife Sanctuary (1998-2002)**

**Myanmar Counterparts:** Myint Aung, Myo Nyunt, Zaw Min Htun, Tin Maung Soe, Aung Naing Win, Lwin Lwin Myint

**Foreign Counterparts:** Bill McShea, Melissa Songer,

Small mammal communities were surveyed in 4 habitat types at Chatthin Wildlife Sanctuary using live-traps, kill-traps and pitfalls. Tree shrews captured at one site were fixed with radio-collars and located daily. These animals were also fixed with spool-in-line collars for short periods to map their microhabitat use. Species identification of small mammals is still being completed.

**Funding:** Abbott Fund Restricted Endowment (SI)



The morning market is a window into the use of local crops and forest products (Photo: C. Wemmer. SI)

### 10) Chatthin Agriculture and Forest Use Survey (1998)

**Myanmar Counterparts:** Myint Aung, Khaing Khaing Swe, Thida Oo, Kyaw Kyaw Moe, Aung Than Gyi

**Foreign Counterparts:** Christopher R. Duncan (NMNH)

This ethnographic survey of CWS's surrounding communities resulted from the community relations workshop of 1999 and consisted of two parts. The first part dealt with agricultural practices, and gathered information on crops, farm labor, livestock, land ownership and productivity. The second part covered patterns of resource use within the park, and examined fuel wood consumption, hunting, fishing and gathering. The study showed that the most significant threats to the park are the collection of firewood and livestock grazing. Some of the results of Duncan's unpublished report were incorporated in a paper submitted to the Journal of Environmental Conservation (Aung, et alia) in 2002.

Funding: FONZ

### 11) Historical Faunal Survey, Chatthin Wildlife Sanctuary (1999)

**Myanmar Counterparts:** Myint Aung, Khaing Khaing Swe, Thida Oo, Kyaw Kyaw Moe, Aung Than Gyi

**Foreign Counterparts:** Chris Wemmer, Teri Allendorf

In an effort to understand the changes in species abundance and composition during the last 75 years, we conducted an intensive survey of villagers around Chatthin Wildlife Sanctuary (CWS) regarding the occurrence of wild mammals, birds, and large reptiles. The results showed that the current assemblage of large vertebrates in CWS is a fragment of the 20<sup>th</sup> century fauna, which included tigers, bears, leopards, sambar, hog deer, banteng, and gaur, all of which are now locally extinct. The disappearance of these species is correlated with the availability of firearms following WWII, and dependence on a subsistence economy from the 60s to the 80s.

Funding: FONZ

### 12) Remote Sensing analyses of Myanmar's dry dipterocarp forest (1999-2001)

**Myanmar Counterparts:** Myint Aung, Aung Than, Tin Maung Soe and Zaw Min Htun

**Foreign Counterparts:** Kevin Koy, Bill McShea

Koy analyzed Landsat satellite imagery of Myanmar's central dry zone to quantify forest density of dry dipterocarp forests. The study included field surveys performed by Chatthin Wildlife Sanctuary staff to determine the amount of forest cover on the ground. These data were used to create GIS layers that display a percent canopy cover for dry dipterocarp forests in the study area. The material was used for his master's degree at George Mason University in 2002.

Funding: FONZ, CRC Foundation



The original Bird Survey Team (1996): (l to r) Htein Win, Lay Lay Hnin, Thida Swe, Nay Myo Shwe (photo: C. Wemmer)

**U.S. Counterparts:** John Rappole, Dave King, Charles Pickett

**Myanmar Counterparts:** Nay Myo Shwe, Thida Swe, Lay Lay Hnin, Aung Moe, Htein Win, Kyaw Lin, Kyi Aung, Thin Thin, Myo Nyunt, Tin Moe Swe, Myint Myint Soe, Mya Than Da Nyein, Than Zaw Min, Kyaw Kyaw, Kyaw Zin Tun

This netting and banding project represents the most thorough study of Myanmar ornithology to date, with an inventory of 245 species, and detailed information on seasonal movement of resident and migratory species. A preliminary manual was produced and desk-topped published (Shwe, et al. 1999), and a series of papers. The project has significantly added to the ornithological skills of the Wildlife Division.

Funding: FONZ, Abbott Fund (SI)



**14) Chatthin Herpetofaunal Survey & Inventory Project (1997-2001)**

**Myanmar Counterparts:** Htun Win, Thin Thin, Than Zaw Min, Win Zaw Lhon, Kyaw Kyaw, Mya Than Da Nyein, Kyi Aung & Kyaw Zin Tun

**Foreign Counterpart:** G. Zug

The herpetofaunal project inventoried and monitored the frog and reptilian community of the Chatthin W.S. and adjacent areas. Through a series of weekly transects, quadrat plot surveys, monthly drift-fence surveys and general sampling, George Zug and a group of Chatthin Wildlife staff recorded the relative abundance, seasonal activity, habitat selection of herpetofauna. The vouchered Chatthin fauna contains 17 species of frogs, 2 turtles, 12 lizards, and 22 snakes. The major ecological data has not yet been published, although two short notes have been, and a guide to the frogs of central Myanmar was produced by the team and distributed at a major Wildlife Division conference.

**Funding:** NMNH/SI Biodiversity and Survey Inventory Program



*Naja mandalayensis* – a new species of spitting cobra discovered by the late Joe Slowinski of the California Academy of Sciences (CAS)  
(Photo: D. I. in CAS)

**15) Chatthin Vernacular Taxonomy project (1996-1997)**

**Myanmar Counterparts:** Myint Aung, Sein Htun, Aung Moe

**U.S. Counterparts:** C. Wemmer

During a 1.5 year period the hunting activities of a local rat catcher, U Chit Thein, were closely followed to understand subsistence living around Chatthin Wildlife Sanctuary.

**Funding:** FONZ



Insect Survey Team (1999): Lwin Lwin Myint, Myo Khaing, Mya Thanda Nevin, Tin Moe Swe, Aung Moe (Photo: C. Wemmer, SI)

**16) Coleoptera Inventories (1999-present)**

**Myanmar Counterparts:** Aung Moe, Khin Mar Thin, Lwin Lwin Myint

**Foreign Counterparts:** Harald Schillhammer (Natural History Museum, Vienna, Austria)

The goal of the project is to document the diversity of beetles in Myanmar, and to assist in the establishment of a biodiversity museum and the training of para-taxonomists and curators needed for its management. Schillhammer has pursued these activities in concert with Steve Kinyon.

**Funding:** Natural History Museum, Vienna, Austria



A training course during the Butterfly Inventory and Conservation Project (Photo: S. Kinyon)

**17) Woody plant germination on Earthworm mounds in Chatthin Wildlife Sanctuary (1997-1998) (2003-2004).**

**Myanmar Counterparts:** Myint Aung, et alia.; Dr. Win Maung, Khant Khant Chaw (Ph. D. student), Htun Win, Thin Thin and Thin Thin Naing

**U.S. Counterparts:** C. Wemmer

During a 1.5 year period (one annual cycle) the abundance of woody plants germinating on earthworm mounds was compared with control plots matched in area. The data are being analyzed (2003) and a sister project has been initiated by a student of Dr. Win Maung at the University of Yangon.

Funding: Friends of the National Zoo

**18) National Butterfly Inventory and Conservation Project (2000-2003)**

**Myanmar Counterparts:** Dr. Win Maung, Aung Moe,

**Foreign Counterparts:** Steven Kinyon, Mohd. Saharrudin (Wildlife Department, Malaysia; Harish Gaonkar, British Museum)

At the request of U Uga and Khin Maung Zaw, respectively, the Smithsonian initiated a series of training courses in butterfly collection, systematics, collection management, and law enforcement. The project was led by Steven Kinyon. These activities led to the creation of a national collection of Myanmar butterflies, based on the efforts of a small team of dedicated Wildlife Division staff. With Kinyon's encouragement, additional data for the inventory have been provided by the British Museum (Natural History) and the Dept. of Zoology, University of Yangon (Dr. Win Maung). A preliminary field guide is currently being reviewed by the Government of Myanmar, and will be published later this year (2003).

Funding: Disney Conservation Fund, FONZ



## 19) Amphibian and Reptile Diversity in Myanmar Project (1999-present)

**Myanmar Counterparts:** Khin Maung Zaw, Htun Win, Thin Thin, Awan Khwi Shein, Kyi Soe Lwin, Sai Wunna Kyi, Hla Tun

**Foreign Counterparts:** George Zug (SI National Museum of Natural History), Joseph Slowinski (deceased), Alan Leviton, Jens Vindum, Guinevere Wogan (California Academy of Sciences)

This country-wide survey of the herpetofauna of Myanmar is a joint collaboration of the Myanmar Nature and Wildlife Division, the herpetology sections of CAS and NMNH. The goal is to determine the composition of the entire Burmese herpetofauna and provide vouchered distribution/occurrence data for each species of amphibian and reptile. The collaboration has been highly successful and has vouchered more than 200 species, at least 40 of which are new to science. The specimens and tissue samples are made available to research herpetologists throughout the world. The collaborators and affiliates have produced more than 15 articles describing new species or incorporating Myanmar species into broader studies of the relationships among Asian species and generic complexes.

**Funding:** National Science Foundation (Biodiversity Inventory & Survey Program), California Academy of sciences, Smithsonian Institution (NMNH)

## 20) Moyingyi Herpetofaunal Survey & Inventory Project

**Myanmar Counterparts:** Sai Wunna Kyi, That Win, & Zaw Min

**U.S. Counterparts:** G. Zug, Guin Wogan, & H. Dundee

The Moyingyi Wetland Birds Sanctuary is a wild rice marsh and shallow lake created by damming three small rivers and is totally surrounded and its outer borders containing paddy land. The goal is to inventory the herpetofaunal of this agricultural landscape through generalized voucher collecting and to gather seasonal activity and reproductive data on the frog fauna. Inventory and weekly transects began in March 2003.

**Funding:** NMNH/SI Biodiversity and Survey Inventory Program



Ginger flowers as a devotional offering (Photo: W.J. Kress. SI)

## 22) Common Plants of Mt. Popa (1997-present)

**Myanmar Counterparts:** Daw Yin Yin Kyi

**Foreign Counterparts:** W. John Kress, Shirley Maina, Tetsuo Koyama (Makino Botanical Garden, Japan)

The goal of this project is to publish a useful and easily understood guide to the common plants of the Mt. Popa region. Popa Mountain Park is one of the national parks of Myanmar and many of the species of plants found in the forest surrounding this extinct volcano are unique to the region and used by local inhabitants for foods, medicines, and construction materials. Results of the inventories and collections made at the Park will be presented in a book, including text descriptions and photographs, that will serve as a guide to the common native flora found on Mt. Popa for botanists, naturalists, and daily visitors to the park. Important supporting activities of this project include professional capacity building of forest department staff.

**Funding:** Forest Department of Myanmar, Dept. of Botany, Biotic Surveys and Inventories Program, NMNH, Smithsonian, and National Geographic Society.



The gingers are an economically important group of plants of special interest (Photo: W.J. Kress, SI)

### 23) Gingers of Myanmar (1996-present)

**Myanmar Counterparts:** Thet Htun, Dr. Aye Pe

**Foreign Counterparts:** W. John Kress, Michael Bordelon, Kyle Williams, Tanya Rehse

Southeast Asia is a global center of diversity of ginger species (family Zingiberaceae) that are used for medicines, spices, foods, and ornamentals. Myanmar may have more species of gingers than any other country. The goal of this long-term project is to document the wild and domesticated species of gingers of Myanmar through inventories and collections. Important supporting activities include professional capacity building of forest department and university staff as well as US and Myanmar students, and reinforcement and building of existing institutions such as the Kandawgyi National Botanical Garden in Pyin-Oo-Lwin and the herbarium at Yangon University. Periodic scientific papers on newly discovered taxa will be published as well as a final comprehensive treatise summarizing all information on the gingers.

**Funding:** Forest Department of Myanmar, Dept. of Botany, Biotic Surveys and Inventories Program, NMNH, Smithsonian, and National Geographic Society.

### 24) Medicinal Plants of Myanmar (2000-present)

**Myanmar Counterparts:** Daw Yin Yin Kyi

**Foreign Counterparts:** Robert A. DeFilipps, W. John Kress, Tetsuo Koyama (Makino Botanical Garden, Japan)

Many native and exotic plants are utilized by local people for medicines and cures for ailments and diseases. A team of botanists from Myanmar, the Smithsonian, and Japan have initiated a project to comprehensively document the medicinal plants of Myanmar through literature review, plant inventories, and field collections. Important supporting activities include professional capacity building of forest department staff and US and Myanmar graduate students, and reinforcement and building of existing institutions such as the herbarium at the Forest Research Institute and the botanical garden in Pyin-Oo-Lwin.

**Funding:** Forest Department and Forest Research Institute of Myanmar, Dept. of Botany, Biotic Surveys and Inventories Program, NMNH, Smithsonian, Makino Botanical Garden, Japan.



Myanmar participants and Smithsonian instructors collecting plant specimens at the summit of Mt. Popa during the 1997 "Botanical Training Workshop" organized by the Department of Botany at the National Museum of Natural History (Photo: W.J. Kress, SI)

**25) Checklist of the plants of Myanmar (1996-present)**

**Myanmar Counterparts:** Yin Yin Kyi, Aung Zaw Moe, Daw Mu Mu Aung, Dr. Aye Pe

**Foreign Counterparts:** W. John Kress, Robert A. DeFilipps, Ellen Farr

The goal of this major long-term project is to comprehensively document the botanical diversity of Myanmar through inventories and collections. Important supporting activities include professional capacity building of forest department staff and US and Myanmar graduate students, and reinforcement and building of existing institutions such as the herbarium at the Forest Research Institute, the National Kandawgyi Botanical Garden in Pyin-Oo-Lwin, and the Botany Department at the University of Yangon. Over 90 taxonomists worldwide have played a role in reviewing existing and new material of the national flora. In addition to the description of new species and the addition of range extensions, a significant achievement has been the publication in 2003 of "A checklist of the trees, shrubs, herbs, and climbers of Myanmar" (Kress, et al.).

**Funding:** Forest Department and Forest Research Institute of Myanmar, Dept. of Botany, Biotic Surveys and Inventories Program, NMNH, Smithsonian, Atherton Seidell Fund, Smithsonian, and National Geographic Society.

**26) Management of two critical elephant ranges in Myanmar (2001-2003)**

**Myanmar Counterparts:** Khin Maung Zaw (Wildlife Division), Ye Htut (Alaungdaw Kathapa National Park), Myint Aung (Lay) (Htamanthi Wildlife Sanctuary)

**U.S. Counterparts:** Chris Wemmer, Peter Leimgruber

The goal of this program was to strengthen the professional capacity of protected area personnel in these two protected areas. Principle activities included: monitoring wild elephant populations using established methods (dung counts), determining the extent and seasonal changes in herd movements based on radio-telemetry, and determining the socio-economic status and attitudes of villagers living around and in the two areas. The project has a strong landscape component that relies on GIS and remote sensing. Two teams of 15 staff were trained in each park to monitor elephant populations. The dynamics of human communities were explored by the Human Attitudes Survey Team originally trained by Allendorf in Chatthin. A later effort was organized by Karin Eberhardt and Shwe Thein of

CARE Australia. In the final year, management plans for the two parks will be drafted as a result of workshops based on the work and findings of the previous three years.

**Funding:** Asian Elephant Conservation Fund (USFWS), Friends of the National Zoo, Christensen Fund, Jacob Bleibtreu Foundation, MacArthur Foundation



The MTE, NWCD, and SI Elephant Capture Team, December 2002 (Photo: C. Wemmer, SI)

**27) National Status Survey of wild Asian Elephants (2003-2005)**

**Myanmar Counterparts:** Khin Maung Zaw, Myint Aung Gyi (tentative) *et alia*

**Foreign Counterparts:** Peter Leimgruber, Chris Wemmer

This project, about to be launched, will survey elephant populations, habitat status, human populations and threats based on a design of stratified sampling generated by a nation-wide habitat assessment derived from remote sensing images. The survey team will systematically survey the areas, and compile and report data. An action plan will be drafted as a result of an intensive workshop at the close of the project.

**Funding:** Asian Elephant Conservation Fund (USFWS)



**28) Historical and present-day faunal assemblages in the monsoon forests of Southeast Asia.**

**Myanmar Counterparts: Khin Maung Zaw, Myint Aung Gyi, graduate student (tbd) (University of Yangon), Dr. Win Maung, Aung Than Lay, Phoe Yon, Aung Myint Lwin, Nawar Tin, Win Bo, Ohm Shwe, Htun Thein, Waing Maung, Aung Zaw Myint**

**Foreign Counterparts: Melissa Songer (Ph D student, Univ. of Md.), Peter Leimgruber**

This project encompasses the widespread dry dipterocarp or monsoon forest that occurs throughout SE Asia. The project will test hypotheses about the relationship between the past and current distribution and abundance of mega-mammal populations and the demography of human populations and land-use patterns. The project will be based on historical indigenous and colonial literature of mega-mammal distribution, climate, and habitat conditions. Remote sensing analysis of time-series satellite imagery will be used to assess patterns and rates of habitat conversion and combined with GIS analysis of range collapse and extinction of large mammals. We will also conduct case studies on remaining dry tropical forest areas within the SE Asian region, which will include the indaing of Myanmar where SI studies have been concentrated during the past decade.

Funding: To be determined

**29) Correlations between elephant home range estimates based on GPS and VHS methodologies**

**Myanmar Counterparts: Khin Maung Zaw, Ye Htut, counterpart graduate student (tbd) (University of Yangon)**

**Foreign Counterparts: Dan Kelly (M. Sc. student, George Mason University), Peter Leimgruber**

This project will be based on quantitative data obtained from the Asian Elephant Project currently underway in Alaungdaw Kathapa National Park. The project will determine confidence limits of home range size over time, and will compare instantaneous estimates of home range size based on several models of GPS data analysis.

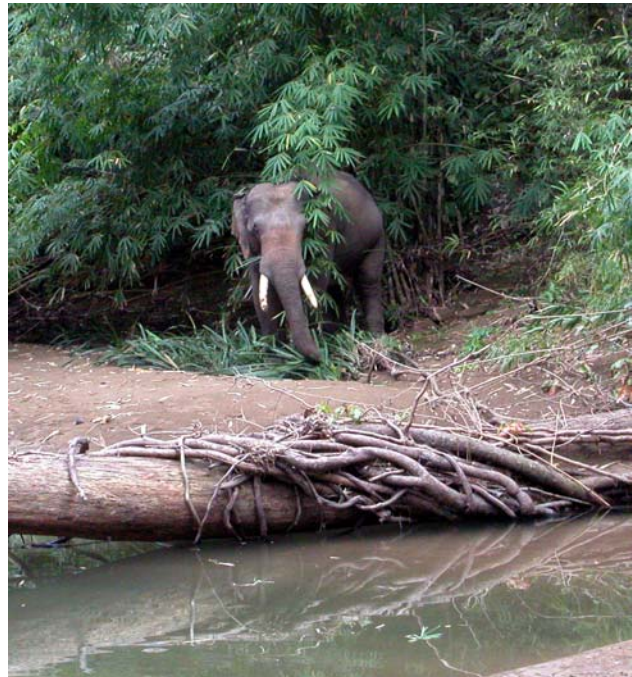
**30) Meta-population analysis of wild Myanmar elephants**

**Myanmar Counterparts (tentative): Khin Maung Zaw, Ye Htut, Myint Aung Gyi, graduate students (University of Yangon)**

**Foreign Counterparts: Thomas, Mueller, Peter Leimgruber, et alia**

The goal of this project is to examine the demographic and genetic viability of wild elephant populations based on computer modeling. Data from remote sensing imagery and field surveys of wild elephants will be used to generate models under various scenarios, and the results will be used to make management recommendations. The information will be used for Mueller's Ph. D. dissertation.

Funding: to be determined



Elephants are the most recent focus of our large-mammal conservation projects in Myanmar (Photo: C. Wemmer, SI)



**31) The Forgotten Side of Wildlife Conservation: Integrating Communities with Htamanthi Wildlife Sanctuary (prepared, not submitted)**

**Myanmar Counterparts (tentative):** Khin Maung Zaw, Myint Aung, CARE-Australia, FREDa, graduate students (University of Yangon)

**Foreign Counterparts:** Chris Wemmer, Peter Leimgruber, Karin Eberhardt, et alia

The time is right to plan and implement activities that will integrate rural communities with sustainable management of protected areas and wildlife. Our goal is to create a model system of protected area management guided by an ecological perspective, bolstered by adaptive management, and encompassing both people and wildlife. Skills training, environmental education, income enhancement, and eco-tourism will be key activities. We have identified Htamanthi Wildlife Sanctuary as the targeted protected area. It is remote, yet accessible, culturally and biologically diverse, and encompasses habitat critical to survival of charismatic endangered species (see text box). The program's specific objectives are to: (a) Improve protected area management by creating dialogue between park managers and local communities, and contributing to community development. (B) Foster ecological literacy and sustainable land use practices of rural communities. (C) Provide villages with alternative resources through the development of small business cooperatives based on local handicrafts and eco-tourism. (D) Develop independent institutions to monitor success, respond to change, and promote similar activities in other areas. We have designed a step-wise process for this program that will take four years to complete. The overall goal will be reached by carrying out 5 inter-related objectives that address the human dimension of wildlife conservation. This is a sister program to the ongoing elephant ecology program currently being conducted in Alaungdaw Kathapa and Htamanthi Wildlife Sanctuary.

**Funding:** to be determined. (Acorn Ventures, Rockefeller Bros. Foundation?)

**32) Promoting graduate education in conservation biology through US-Myanmar counterpart projects in Myanmar (2002-ongoing)**

**Myanmar Counterparts:** Dr. Tin Nwe, Dr Win Maung, graduate students (University of Yangon) and US Universities

**Foreign Counterparts:** Chris Wemmer, Peter Leimgruber, Jake Brunner (CI), Douglas Long (CAS), George Zug (NMNH), Steve Kinyon (NMNH), Harald Schillhammer (Vienna Naturhistorisches Museum) et alia

In 2002, The California Academy of Sciences (CAS), National Zoological Park, and Yangon University signed a memorandum of understanding to promote graduate education in conservation biology through joint mentoring of field projects conducted by graduate students in Myanmar. Participating faculty will give lectures, organize annual symposia, and co-advise students. A key component of the program in the future is a counterpart fellowship program whereby US (foreign) and Myanmar graduate students will pursue inter-related projects. Cross-cultural learning and interdependence are envisioned as key elements in this proposed experimental educational endeavor.



The outdoor lecture hall at Chatthin Wildlife Sanctuary has been the venue of most training courses in Myanmar (Photo: C. Wemmer, SI)

**33) The Tennasserim (Tanintharyi) Trans-boundary Conservation Project (2003-future)**

**Myanmar Counterparts:** Khin Maung Zaw (Wildlife Division), National Committee on Environmental Affairs (NCEA) and Forest Department, Myanmar, FRED, Win Maung, graduate students (University of Yangon),

**Foreign Counterparts:** Ministry of Natural Resources and Environment (Thailand), Department of National Parks, Wildlife and Plant Conservation (Thailand), The Center for Forestry Training (Thailand), WWF-Thailand, Seub Nakhasatien Foundation, WildAid, WCS, SI, University of Minnesota, *et alia*

The purpose of this initiative is to conserve a large relatively pristine ecosystem in southern Myanmar and Thailand. The success of the project will depend upon cooperation at many levels including government agencies and NGOs. This project's "open model" concept is intended as a means of embracing all potential stakeholders to build upon existing efforts to conserve this region and its wildlife. The participants will examine ways and means of broadening the base of support for the effort through a series of workshops that began in June 2003. The major challenge of this project is to heighten awareness of decision-makers and communities of Thailand and Myanmar of the unique biological heritage of the eco-region. This new initiative is an experiment in cooperative project planning for a trans-boundary landscape scale program.

Funding: National Fish & Wildlife Foundation

**34) The ecology of the Myanmar Hare (*Lepus peguensis*) (2003-2004)**

**Myanmar graduate student:** Khin Maung Oo

**Advisors:** Dr. Win Maung (Univ. of Yangon), Chris Wemmer (co-advisor, SI-CAS)

This project is designed to investigate the ecology of an abundant small mammal that is an important source of protein for villagers in the dry zone and indaing regions of Myanmar. This PhD project will examine the hare's social organization, use of space, and seasonal changes in home range using radio-telemetry. Population size will be estimated using pellet group surveys along line transects, and ecological densities will be determined for different habitats. Feeding ecology will be studied by identifying plant cuticles in feces. The study will provide important information for managing the species as a natural resource.

Funding: FONZ

**35) Age, sex distribution, and reproductive characteristics of hunted Myanmar Hares (*Lepus peguensis*), and the impact of subsistence hunting on a population in Upper Myanmar (2003-2004)**

**Myanmar graduate student:** to be determined

**Advisors:** Dr. Win Maung (Univ. of Yangon), Chris Wemmer (co-advisor, SI-CAS)

The goal of this project is to determine the annual reproductive cycle, productivity and harvest of a population of wild Myanmar hares based on a sample of animals killed by local hunters. The specimens will be weighed and measured. Age will be determined by eye lens weight, skull ossification, and tooth eruption and wear. Reproductive tracts will be removed and preserved to determine spermatogenic condition, and to count and measure development of embryos. The project is a sister activity of the Myanmar hare ecology project, and will generate important information for managing the population of this popular source of bush meat.

Funding: FONZ

**36) Species ecology and distribution of earthworms in a second growth indaing forest (2003-2004).**

**Myanmar graduate student:** Khant Khant Kyaw

**Advisors:** Dr. Win Maung (Univ. of Yangon), Chris Wemmer (co-advisor, SI-CAS)

Earthworms are powerful agents of nutrient cycling and soil dynamics, and are particularly prominent features of the woodland ecology in the indaing of Myanmar. This project is designed to identify the species comprising the earthworm community in second growth indaing, to characterize and measure their earth castings on a seasonal basis, and to identify their ecological niches with respect to soil moisture, pH, and plant associations. A reference collection of earthworm taxa will be developed for future investigators.

Funding: FONZ

### 37) Species diversity of ants in Chatthin Wildlife Sanctuary (2003-2004)

**Myanmar graduate student:** Khin Ma Ma

**Advisors:** Dr. Win Maung (Univ. of Yangon),  
Chris Wemmer (co-advisor, SI-CAS)

The goal of this master's degree project is to increase understanding of the diversity of this dominant group of insects in Chatthin Wildlife Sanctuary. The study will supplement taxonomic information previously collected by visiting foreign entomologists and park staff on orthoptera, arachnids, and Odonata. The methodology will generate a species list for the area, and will clarify the relationship between ant species and habitats, and symbioses with other species.

Funding: FONZ



Satellite imagery and GIS revealed major landscape effects of damming the Mu River on Chatthin Wildlife Sanctuary (Photo: P. Leimgruber, SI)

### 38) Physical geology of Chatthin Wildlife Sanctuary

**Myanmar Counterpart:** University of Yangon  
(To be determined)

**Foreign Counterpart:** William Melson  
(NMNH)

A brief survey of the physical geology and soils of CWS is desired to provide background information for biological studies and surveys that have taken place in this important site for ecological and biodiversity research in Myanmar. The information from this survey will help to explain the distribution of plants and animals in the region.

Funding: to be determined

### 39) Ornithological Exploration of Northern Myanmar (2002-future)

**U.S. Counterpart:** John Rappole

**Foreign Counterpart:** Swen Renner  
(Germany)

**Myanmar Counterparts:** Khin Maung Zaw,  
Thein Aung, Myint Aung, Nay Myo Shwe,  
Kyaw Lin, Kyi Aung

The Himalayan habitats of northernmost Myanmar are unique, ranging from alpine tundra, above-treeline grasslands, and rhododendron forests in the highlands to deciduous broadleaf forests (temperate rainforest) in the valleys. Very little ornithological work has been done in the region. The research was designed to provide basic information on avian biodiversity across the range of habitats to be found in the Hkakabo Razi National Park and environs of northern Myanmar, and specifically to determine: 1) What species of birds use the various habitat types of the park? 2) What are the principal systematic relationships of the species and populations in the region? 3) What unique avian populations exist in the region, and what threats, if any, threaten these populations. In addition, the funds support continued ornithological work and training for biologists in the Nature & Wildlife Conservation Division (NWCD) of the Forestry Department at Chatthin Wildlife Sanctuary.



#### 40) Mammal surveys of Myanmar (future)

**Foreign Counterparts:** California Academy of Sciences, Harrison Zoological Institute, NMNH, Smithsonian Institution

**Myanmar Counterparts:** Nature and Wildlife Conservation Division, University of Yangon

The mammalian fauna of Myanmar, and the Chiroptera (bats) in particular, is currently being investigated by Dr. Paul Bates and colleagues of the University of Yangon. Dr. Neal Woodman (NMNH) is interested in surveying Myanmar's small mammals, and shrews in particular. The scientists of the organizations above would like to explore the development of a coordinated national mammal survey, based on the model developed by the CAS and NMNH for reptiles and amphibians. They will identify participants, roles, and graduate student involvement in 2003-04.



Kye-in lake is an excellent example of the "abuse of the commons" (Photos: C. Wemmer and S. Tan, SI)

#### 41) Fish surveys of Myanmar (2003-ongoing)

**Foreign Counterparts:** California Academy of Sciences, NMNH, Smithsonian Institution

**Myanmar Counterparts:** Ministry of Livestock and Fisheries, Nature and Wildlife Conservation Division, University of Yangon)

The Smithsonian and CAS have maintained a collaborative relationship with the Ministry of Livestock and Fisheries to survey Myanmar's freshwater fish diversity. Tyson Roberts, Alan Bornbush, Carl Ferraris and Chris Wemmer made opportunistic and independent collections of freshwater fishes during the 1980s and 1990s. More recently, in 2000, David Catania made fish collections in the Putao District of Kachin State, and Roberts collected 170 spp. during three and a half months of which 70 (41%) appear to be new to science. Ralf Britz and Carl Ferraris are now undertaking surveys as part of a worldwide systematic revision of the catfishes.

Funding: National Science Foundation

#### 42) Fish, Fishing Communities, and Contaminants in Kye-In, Chatthin Wildlife Sanctuary

**Foreign Counterparts:** Shirlee Tan (NZEPA), Chris Wemmer

**Myanmar Counterparts:** Thazin Lwin (Chemistry Dept., Yangon University), Si Si Hla Bu (Zoology Dept., Yangon University), Graduate students to be selected, Department of Fisheries, Nature and Wildlife Conservation Division

The manmade lake, Kye-In, located on the eastern boundary of Chatthin Wildlife Sanctuary is experiencing a major decline in its freshwater fishery. Two Ph.D. projects will examine a) the fish fauna and ethno-zoology of the community fisherman, and b) the degree of environmental toxins found in fish tissue. Pesticides have been used to poison fish in these communities, and the sustainability of the fishery is questionable under present practices. Both aspects will be investigated. The ultimate goal of this project is to recommend better practices in the use of pesticides and the management of the fishery.

#### 43) *In situ* investigations and geo-chemical analyses of jade in Upper Myanmar (2000)

**Foreign Counterparts:** Sorena Sorenson (NMNH, SI), George Harlow (AMNH), Virginia Sisson (Rice University), Hans Azelallemant (Rice University), Robert Kane (independent gemologist)

**Myanmar Counterparts:** Han Htun (Chief Gemologist, Myanmar Gems Enterprise)

During a three-week trip to Nan Si Bon jade mines (Kachin State), the first western scientific group visited the area to sample jade for investigations. Cathode luminescence was used at the SI to examine textural distribution of trace elements, and ion micro-probe analysis of trace element distributions were subsequently conducted at the Carnegie Institution of Washington. These analyses demonstrated that jade was formed as a dreg of re-cycled seawater that was incorporated into the basaltic crust of the ocean and was subsequently subducted in Myanmar 100 million years ago. Dr. Sorenson is interested in conducting future geological investigations in Myanmar, but has no plans in the immediate future.



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- Aung, M., A. Moe, & C. Wemmer. In prep. The Morning Market in Myanmar, degraded landscapes and their commodities.
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## **Myanmar Training Courses and Workshops**

- 1. Bird Survey Course (November 1994) - 3 instructors; 22 participants**
- 2. Domestic Elephant Data Collection Workshop (November 1994) –  
1 instructor; 10 participants**
- 3. Radio Telemetry Training Workshop (June 1995) – 1 instructor;  
8 participants**
- 4. Plant Phenology Workshop (March 1995) – 1 instructor; 8 participants**
- 5. Mammal Inventory Course (May/June 1996) - 2 instructors; 20 participants**
- 6. Herpetology Inventory Course (August 1997) – 3 instructors; 20 participants**
- 7. Environmental Education Course (January 1997) – 4 instructors;  
24 participants**
- 8. Entomology Training Course (October 1998) – 9 instructors; 26 participants**
- 8. Community Relations Training Course (April 1999) – 4 instructors;  
21 participants**
- 10. Butterfly Survey Course (April 2000) – 1 instructor; 30 participants**
- 12. Law Enforcement Seminar (September 2001) – 2 instructors; 10 participants**
- 13. Butterfly Survey Course (September 2001) – 1 instructor; 13 participants**
- 14. Law Enforcement Seminar (May 2002) – 1 instructor; 2 participants**
- 15. Law Enforcement Seminar (June 2003) – 1 instructor; 5 participants**