



Nature matters

the AQD Museum and Biodiversity Garden, and the Environment Action Group

Museums, gardens, zoos, and wildlife breeding centers in the Philippines

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Non-formal environment education through nature recreation is an effective means toward the 'greening' of the hearts, the minds, and the spirit of the citizens so that they act in favor of biodiversity conservation. This article describes the status of various biodiversity exhibits and conservation centers in the country and urges both the government and the private sector to invest in more of these, especially in programs to reach and involve the people. Good biodiversity exhibits and conservation centers require funds, space, skilled and dedicated technicians, scientists, and artists, and the commitment and support of the government, the local communities, educational institutions, and the private sector.

Museums

The National Museum of the Philippines was established in 1901 as the primary repository and custodian of cultural treasures and biological collections from all over the archipelago. It is mandated to be a research institution and a showcase for the entertainment and education of the public (Fr. Gabriel Casal, Director, National Museum, personal communication). Aside from the permanent exhibits, film shows, slide presentations, and lectures are provided for children, students, and the general public. Most of the art, anthropological, cultural, and historical collections have their own exhibit rooms, but the natural science collections are just in the corridors, looking old and shabby. The pre-war biological collections of the National Museum were all destroyed, but the post-war materials now include 527

species of birds, 2433 mollusks, 93 corals, 86 crustaceans, 469 fishes, 2945 insects, and many others. The National Herbarium contains about 130,000 mounted plant specimens.

The National Museum has both the cultural and natural treasures to be proud of, but does not have enough political support and funds to carry out scientific research, nor space and technical expertise to properly display its collections. Filipinos who have visited the national museums in other Asian countries and in America and Europe can only feel frustrated, even ashamed, about the dismal state of the National Museum of the Philippines. Recently, a beautifully illustrated book *Treasures of the Philippine National Museum* has been published to build greater public support. Plans have also been announced for a National Gallery of Arts and Culture that will be finished in time for the 100th anniversary of Philippine independence in 1998.

Most museums in the Philippines today are exhibits of the arts, culture, anthropology, and history of the Philippines or its many regions, such as the Metropolitan Museum of Manila, Philippine Museum of Ethnology, Ayala Museum, Museo Iloilo, Museo Dabao, Museo Pambata, and various art galleries in large cities. Banawe Museum houses some of the collections and the personal artifacts including the ornate wooden house of the anthropologist H. Otley Beyer, who married into and lived among the Ifugaos and first brought the Banawe rice terraces to international attention. Several universities operate cultural museums open to the public, for example, the Museum of Anthropology and the Vargas Museum at the University of the

Philippines (UP) in Diliman and the Museo de Oro at Xavier University. Museums about indigenous peoples and cultures are in fact biodiversity displays.

Museums of the natural history type are not numerous and these are mostly run by universities for instruction and research. The Museum of Arts and Sciences at the University of Santo Tomas started in 1682 with the collection and classification of Philippine flora and fauna, and now it is crammed with stuffed mammals, birds, and reptiles. The UP-Los Baños Museum of Natural History is a repository and exhibit of the flora and fauna of Mt. Makiling, including 285 families of insects, 709 genera of fungi, 1200 species of forest plants including rare ferns, and Dioscoro Rabor's collection of land vertebrates. The Marine Science Institute of UP-Diliman maintains the Velasquez Phycological Herbarium. The natural science museums of the UP-Visayas, University of San Carlos, Silliman University, and Visayas State College of Agriculture have sizeable collections of marine animals, vertebrates, and insects, but the displays need to be improved to be appreciated by the public. The Aga Khan Museum of the Mindanao State University has collections of the flora and fauna of Lanao Lake and the surrounding watershed, but does little to promote public understanding of the ecosystem.

The International Rice Research Institute in Los Baños, Laguna opened in 1994 the IRRI Riceworld, a visitors' learning center about rice production and research and the importance of rice to global food production. IRRI Riceworld has exhibits that explain the importance of friendly insects in controlling rice pests, the value of

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The AQD Museum and Biodiversity Garden attract and entertain visitors, mostly students. Museum collection includes deep sea fishes from the Philippine Trench; mangrove fishes from Quezon; coral reef fishes from Pangasinan; and molluscs from Ifugao, Sorsogon and other places.

conserving rice seeds to maintain genetic diversity, and why scientists are looking at the role of methane emissions from ricefields in global warming. Riceworld was designed with children in mind and was made possible with a US\$80,000 grant from the German Technical Cooperation Agency.

The SEAFDEC Aquaculture Department inaugurated in 1993 the AQD Museum, a collection and exhibit of fishes, crustaceans, mollusks, corals, other marine invertebrates, and seaweeds. The AQD Museum holds reference specimens of shrimps, fish larvae and juveniles, and mangrove fishes from completed studies. A botanical garden has been annexed to show off plant biodiversity. The AQD Museum and Biodiversity Garden aims to be an educational exhibit for the public, particularly school children, and a laboratory for undergraduate and graduate students in natural history. But there is not enough room for the displays and hardly any students interested in natural history and systematics. Currently, SEAFDEC AQD is making plans for a larger museum

and aquarium to be called Fishworld.

There are also privately owned natural history museums open to the public. In Cebu, the Julian Jumalon family operates the Butterfly Museum, with butterflies and paintings made of butterfly wings on display, amid a sanctuary-garden of butterflies and food plants. The Carfel Seashell Museum in Manila published the book *Shells of the Philippines*.

An important aid to biodiversity research and conservation efforts is a good computerized database. For example, the International Center for Living Aquatic Resources Management (ICLARM) in Manila has put together FishBase and ReefBase on CD-ROM now available to researchers.

Botanical gardens, arboretums, and plant nurseries

Botanical gardens are museums without walls whose mission is the cultivation and study of the diversity of plants. The Philippines now does not have a national bo-

tanical garden. UP-Los Baños maintains the Makiling Botanic Garden and Hortorium that preserve the waterways and natural forest growths, and the Microbiological Culture Collection. Many other universities and agricultural colleges in the Philippines have small botanical gardens, plant nurseries, and arboretums, mostly for instruction and research but also for public viewing and enjoyment. The University of Santo Tomas has started a project to turn the campus into a botanical garden that will serve as repository of endemic and endangered flora, a sanctuary for birds and insects, a resource for teaching, research, and recreation for the university, and as 'green lungs' for part of Metro Manila.

The International Rice Research Institute is committed to the conservation of rice genetic resources and maintains a gene bank with 70,000 seed accessions (as of 1991) for both IRRI research staff and outside users worldwide.

The Department of Environment and Natural Resources (DENR) maintains a



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111-ha mangrove reserve in Pagbilao Bay, southern Luzon, where research and experimental plantings are carried out by schools and by local and international private foundations. The Pagbilao secondary-growth forest contains a high diversity of mangroves and associated plants, including the 'nilad' *Scyphiphora hydrophyllacea*, which used to grow luxuriantly in Manila and gave the place its name ('May nilad' or where there is 'nilad'). Mangroves are now a rare sight around Manila Bay and other urban coastal areas. Many mangrove reforestation projects have been carried out all over the country, but only a few were successful, for example, those in Danacon Island in Bohol and in Busuang, Aklan. Mangrove plantations have become more common as community-based projects.

The International Institute for Rural Reconstruction (IIRR) in Silang, Cavite espouses regenerative agriculture and maintains a campus that is a biodiversity exhibit in its own right. Various fruit trees, hardwoods, ornamentals, and farm crops including grasses for fodder make the landscape. IIRR has bio-intensive gardens where many kinds of vegetables are raised without chemical inputs. IIRR also produces a variety of information materials for teachers, trainers, students, policymakers, and sectoral leaders involved in environment education.

Home gardens also promote biodiversity awareness, in addition to providing income, ornamentation, fruits and vegetables, spices and medicine, fish and meat, firewood, and fodder. The government launched several home garden programs but these always lacked funds, well-trained garden teachers, textbooks and other instructional materials, garden tools, and improved seeds and planting materials. At present, the Department of Education, Culture, and Sports encourages school gardens to teach children about the variety and importance of vegetable, fruit, and medicinal plants.

Commercial plant nurseries propagating many varieties of orchids, bromeliads, anthuriums, heliconias, roses, ferns, palms and other ornamentals are veritable biodiversity exhibits. Nurseries for fruit and hardwood trees are also becoming more numerous. Plant nurseries and the cutflower business are growing strong in several places in the Philippines, including Los Baños, Bacolod, Iloilo, and Davao. Garden fairs are held frequently and are very well patronized.

Zoos, aquariums, and wildlife breeding centers

Zoos and aquariums are effective vehicles for the environment education and entertainment of children and adults alike. The Philippines does not have a national zoo and aquarium. The old Manila Zoo is a perennial crowd-drawer and a low-priced alternative to shopping malls. But the animal enclosures, the visitor facilities, and the interpretive trails and signs need improvement. Happily, there are now plans to make the Manila Zoo world-class. Indeed, zoos, aquariums, and animal showplaces are major tourist attractions and income earners in Hongkong, Singapore, and other Asian countries.

Several conservation programs have been launched by the government to protect endemic wildlife and some endangered species. The Tamaraw Conservation Program was launched in 1969 to protect the habitats of the endemic 'tamaraw' *Bubalus (Anoa) mindorensis*, including the ancestral lands of the Mangyans, from the cattle ranchers. Mt. Iglit and Mt. Baco, both tamaraw haunts in Mindoro, were declared a game reserve and bird sanctuary in 1969 and a national park in 1970. In October 1990, the first 'tamaraw' born in captivity was recorded in the Canturoy Gene Pool.

The 3,760-ha Calait Game Preserve and Wildlife Sanctuary in northern Palawan was established in 1976 and now maintains several species of herbivorous African mammals and populations of the endemic Calamian deer, mouse deer, Philippine

crocodile, Palawan pheasant, Palawan bear cat, porcupine, as well as marine turtles, giant clams, and dugong. The government now spends about P4 million on Calait, whose management has been contracted to a non-government organization.

The conservation of the Philippine eagle *Pithecophaga jeffreyi* was given impetus by Charles Lindbergh himself in 1970. The Philippine Eagle Research and Nature Center, managed by the Philippine Eagle Foundation Inc., lies at the foothills of Mt. Apo in Davao City. PEFI has produced information materials on wildlife conservation and biodiversity, and the Center has a good collection of raptors, small mammals, trees, and ornamental plants. But only the Philippine eagles have large cages, and the other birds look so forlorn in their small cages. The Center's reception room is small and has little instructional function.

The Wildlife Rescue Center at the Ninoy Aquino Park in Quezon City houses animals confiscated from illegal traders and owners. It now has 26 species of birds, 6 reptiles, and 14 mammals and operates with a staff of 18 on a budget of P3.8 million (P26=US\$1). Problems include lack of funds for food and medical care of animals, lack of quarantine facilities, overcrowding due to lack of cages, and bureaucratic red tape in deciding matters concerning the welfare of the animals. The Center for Philippine Raptors on Mt. Makiling rehabilitates captured birds of prey and serves as a back-up facility for the Philippine eagle conservation program. It conducts captive breeding research, laboratory and field studies, and education and information campaigns, with a staff of 10 people and funds of less than P1 million from the government and private organizations. Clearly, these wildlife centers could not go very far with such limited budgets.

The Crocodile Farming Institute was established in Irawan, Puerto Princesa in 1987 to focus on the propagation, protection, and conservation of *Crocodylus mindorensis* and *C. porosus*, with support from the Japan International Cooperation



Agency. Under the Marine Turtle Conservation Program, turtle sanctuaries have been declared in the Turtle Islands, in El Nido and Calauit in Palawan, and in Caluya Island. The Dugong Conservation Program is being conducted in Palawan with the cooperation of the Toba Aquarium of Japan. The Philippine Tarsier Conservation Program is being implemented in Bohol, Samar, Leyte, and Mindanao through the Debt-for-Nature Swap. The DENR's Protected Areas and Wildlife Bureau (PAWB) oversees all wildlife conservation and breeding programs in the country. PAWB also organizes bird banders to conduct mid-winter bird counts for the Asian Waterfowl Census.

Universities are also involved in wildlife breeding and conservation. Silliman University in Dumaguete City established in 1993 the Alfredo Y. Reyes Botanical and Zoological Garden, where wildlife are shown in a dipterocarp forest setting and some endangered species (bats, crocodile, deer) are bred in captivity. The West Visayas State University also established the Mariit Wildlife Conservation Park in Iloilo in 1993 in collaboration with the Mulhouse Zoo of France and England. Plans include ecotourism and captive breeding of Philippine spotted deer, warty pig, muskrat, hornbill, and other wildlife indigenous to Panay Island. The Marine Science Institute of the UP-Diliman has an ongoing breeding and conservation project for the endangered giant clams. Several species of *Tridacna* and *Hippopus* are spawned and grown at the UP Bolinao Marine Station and then transferred to selected reef areas that enjoy some form of protection and management by the local fisherfolk. But even in these 'protected' areas, the giant clams are not always safe from exploitation.

Note

Full citations are given in the original paper entitled *Nature parks, museums, gardens, and zoos for biodiversity conservation and environment education in the Philippines* that has been accepted for publication in *Ambio*.

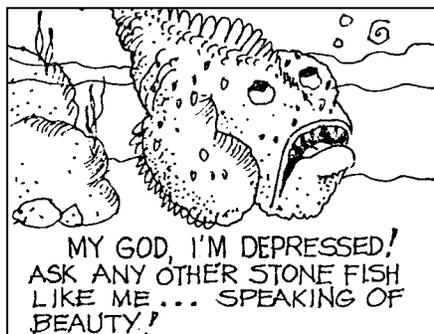
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incisor-shaped or a mixture of somewhat incisor-shaped and canine-like; (b) the setal types replacing other types previously borne on the same site; and (c) the degree of occurrence of the denticulated setae on the 45 mm TL juvenile and adult stages. The implications of these mouthpart transformations on the feeding ability of the early juveniles, late juveniles, and adults are discussed, with mention of the potential ability of the redclaw for suspension feeding. Types of food appropriate for each stage were inferred.



Golez NV, Kyuma K. 1997. Influence of pyrite oxidation and soil acidification on some essential nutrient elements. *Aquacultural Engineering* 16 (1-2): 107-124 --

Influence of soil acidification on some essential nutrient elements was observed experimentally during periodic leaching at 10-day intervals of pyritic soil materials. Pyritic soil in glass columns saturated with distilled water was treated under waterlogged or submerged and drained conditions. Waterlogged was inundated and had overlying water of 2-cm depth above soil surface. Extremely acidic soil conditions, caused mainly by oxidation of pyrite (FeS₂), led to other serious problems. Results showed that strong acidification of soils influenced the solubility and availability of some nutrients. The loss of calcium (Ca), magnesium (Mg), zinc (Zn), and copper (Cu) was enhanced by acidification. Intense acid conditions also dissolved manganese (Mn), high amounts of which would lead to toxicity problems in plants and animals. As oxidation progressed, soil acidification increased and depressed availability of phosphorous (P), thereby leading to the deficiency of this nutrient. Sodium (Na) and Chlorine (Cl)



were leached out rapidly in both treatments regardless of soil acidification. The common problems associated with acid soil formation from oxidation of pyrite are fish mortalities and very poor response of the soil to phosphorous fertilization. For idle land or areas abundant in pyritic materials, soil acidification can be avoided by inundation with water to a depth of 2-3 cm, rather than draining and exposure, which lead to the formation of acid sulfate soil. Periodic leaching was found effective in reducing soil acidity although some essential nutrients were also removed. Therefore, fertilization during amendments is found to be of necessity.



Tan-Fermin JD, Pagador RR, Chavez RC. 1997. LHRHa and pimozide-induced spawning of Asian catfish *Clarias macrocephalus* (Gunther) at different times during an annual reproductive cycle. *Aquaculture* 148 (4): 323-331 --

Captive *Clarias macrocephalus* were induced to spawn during the off-season (February), before (May), during (August) and end (November) of the natural breeding period to test their seasonal responsiveness to hormone treatment, and assess the resulting egg and larval quality. Intramuscular injections were given to five fish in each treatment consisting of 0.05 mu g LHRHa + 1 mu g PIM g(-1) body weight (BW). 0.05 mu g LHRHa. 1 mu g PIM, or LHRHa vehicle (0.9% NaCl) and PIM vehicle (1 dimethylsulfoxide: 9 propylene glycol, v/v). At any phase of the annual cycle, only fish injected with a combination of LHRHa and PIM spawned, although initial egg size was similar among fish within a season. However, initial egg size was largest in fish induced to spawn in May (1.59 mm), followed by fish induced in August and November (1.54 mm), and smallest in fish induced in February (1.49 mm). All fish ovulated when induced to spawn in May and August, but ovulation rates decreased to 80% and 60% when fish were injected in November and February, respectively. Catfish induced to spawn in May, August and November had higher egg production, fertilization and larval survival rates than the fish induced in February. Hatching rates were higher in fish induced in May and August than in February, while hatching rate of fish induced in November was similar to those spawned at other times of the year. These results provide useful information regarding the broodstock management and hatchery production of *C. macrocephalus*.