HORIZON

University of the Philippines Los Baños

Biological Collections

Preserving Answers to Future Queries

On Biodiversity
Vol. 3, No. 1

The Majesty of **Philippine Hornbills**

Caves and the **Biodiversity** they **Host**

JC Gonzalez Bucerotiphile

The **UPLB Horizon** magazine features news, feature articles, research and extension updates, literary pieces, and information of general interest to UPLB and its publics. Please send your contributions to OPR, e-mail: opr.uplb@up.edu.ph or telefax no. (049) 536-3604.

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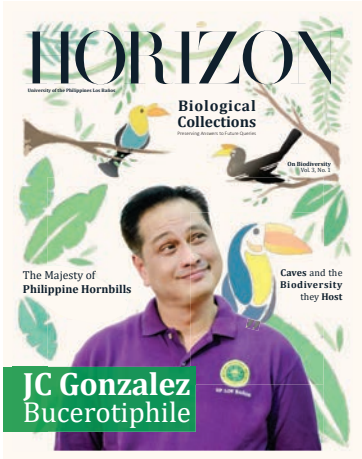


On the cover is **Dr. Juan Carlos Gonzalez**, a professor of zoology, a scientist, a passionate conservationist, and a "self-proclaimed Bucerotiphile" or someone who loves hornbills. Dr. JC is known for the body of knowledge he has contributed to hornbill ecology, conservation, origin, and diversification.

It all started with a simple fascination for the 'Kalaw' or the Great Philippine Hornbill, which he first encountered during a field trip to the UP Quezon Land Grant in one of his classes as an undergraduate student. Progressively, it led to more research, involvement in conservation projects in six biodiversity hotspots in the country, a national conservation workshop, and an international conference. His latest work on hornbills brought him to the molecular level of investigation and discovery. Pursuing his doctorate at the Edward Grey Institute for Field Ornithology , University of Oxford, he conducted a study on the molecular phylogenetics of hornbills, which generated knowledge on their evolutionary origins.

Dr. JC's work on hornbills exemplifies how UPLB instruction is informed by research and public service. Through his research, he has generated new knowledge and enriched academe, while his willingness to educate people cultivated in the public's hearts the need to conserve our natural resources.

Editor's Note

Biodiversity is such a big word. While working on this issue of the Horizon, we were confronted by the vastness of the concept and how we could cover only so much of it in this 32-page magazine.

Biodiversity is not only about the species count, but also about the interrelationship of the different species. This is a wake up call implied by Dr. Juan Carlos Gonzalez, director of the Museum of Natural History (MNH) and an expert on hornbills, when he referred to hornbills as a keystone species.

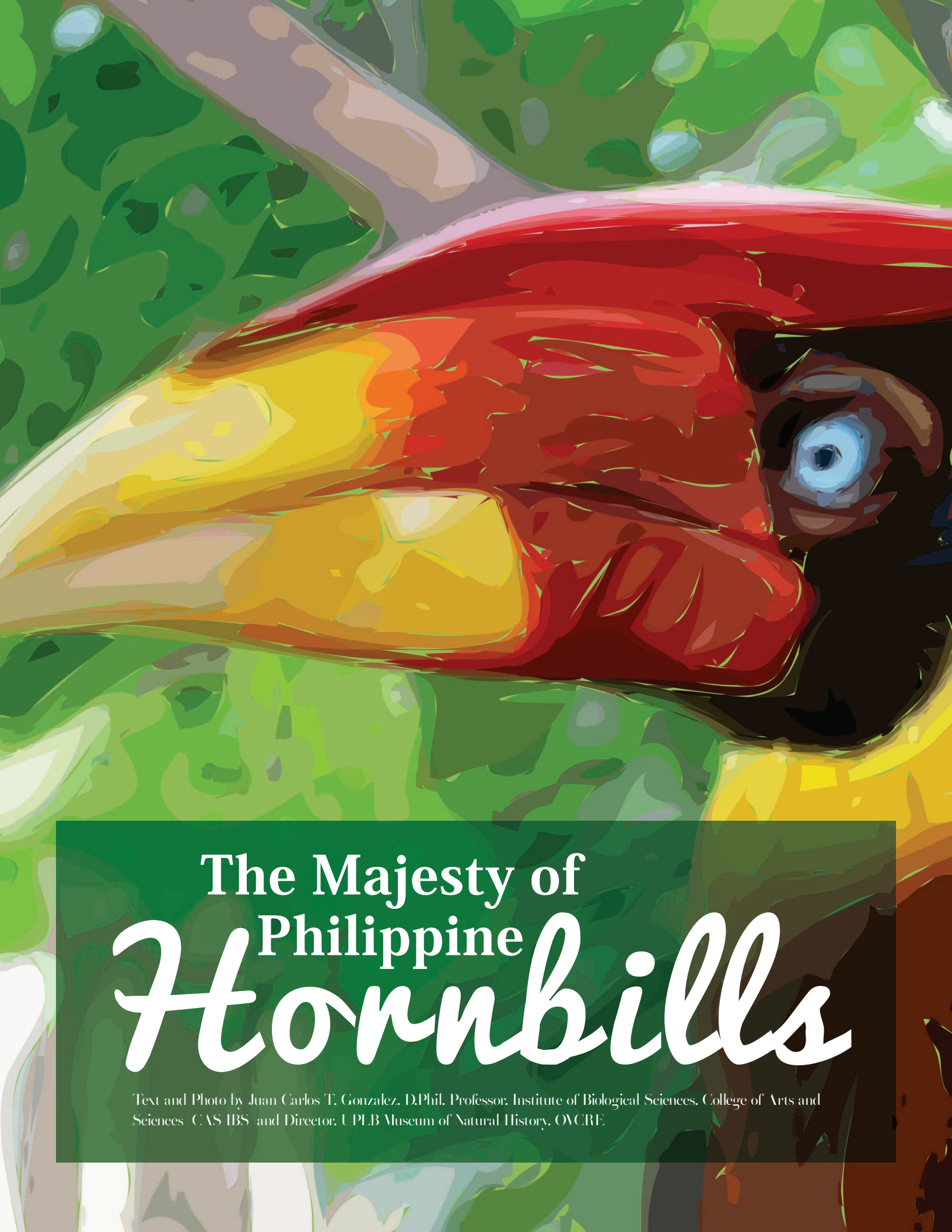
Humans have barely scratched the surface, said Dr. Ireneo Lit, the former MNH director. "It's almost unknown, shrouded in darkness," he said, referring to biodiversity in caves that has been largely unexplored, pushing a group that he led to institutionalize courses on cave ecology.

The "bigness" of biodiversity includes the significance of biological collection facilities and museums in studying it. The importance of biological collection centers and museums, including the living plant/tree museum Makiling Botanic Gardens, and the plant genetic laboratory, cannot be overemphasized as they are useful in our study of biodiversity, application of its principles and in biodiversity conservation.

Dr. Salcedo L. Eduardo, Professor Emeritus of UPLB, made an almost plaintive call for increased investment towards the maintenance of biological collection centers in his "Celebrating UPLB's Great Minds" lecture in 2013. According to him, this can contribute to the discovery, understanding and conservation of Philippine animal and plant biodiversity.

UPLB experts are continuing to discover more about Philippine biodiversity. Is there so much more out there that needs to be known and documented? We hope that we will know how biodiverse - how vast - Philippine flora and fauna is before it's too late.

Josephine M. Bo



The Majesty of Philippine Hornbills

Text and Photo by Juan Carlos T. Gonzalez, D.Phil. Professor, Institute of Biological Sciences, College of Arts and Sciences (CAS IBS) and Director, U.P.L.B. Museum of Natural History, OVCRE

"Oh, so you're the hornbill guy," a statement I now encounter often at conferences and symposia.

Yes, I am a self-proclaimed Bucerotiphile – one who loves hornbills. Well, actually I'm a Bucerotid scientist – one who studies hornbills. But what are these creatures?

Likely, your first introduction to hornbills would be from popular media, such as 'Zazu,' the cantankerous avian adviser to the Lion King Mufasa, and pseudo-nanny to little Simba. Or you may have noticed the majestic-looking birds in Katy Perry's music video 'Roar' or have seen Professor McGonagall change a bird into a goblet in the first Harry Potter movie. That bird was a hornbill.

Hornbills command majesty, with their elaborate "casque" adorning the top of their crown. Apart from hornbills, a few other birds do bear helmet or knob-like casques, such as cassowaries, some cracids and megapodes. They share the fused toes called syndactyl feet with Kingfishers and bee-eaters, thus maintain their links to Order Coraciformes.

Hornbills, however, have many unique features, from the fused neck vertebrae to the enigmatic 'nest sealing.' The latter is a very exclusive hornbill behavior, wherein the female (and even chicks) plasters the opening of her nest cavity with various materials as a means of nest protection, thus leaving only a narrow slit where food can be passed to her by the industrious male. Once 'self-imprisoned,' it is the sole duty of the male to feed his family.

It is from this behavior that Filipinos gave the name 'ibong seloso' to hornbills (jealous bird), thinking that the male actually seals his mate from rivals. Actually, it's the opposite: the female seals itself but the male helps and provides additional materials.

Hornbills belong to the avian family Bucerotidae, and this name was derived from the 'Type genus' Buceros, which translates to "horns of an ox." This describes the shape of the bill of most hornbills as a long decurved structure – reminiscent of an ox's horn. In some literature, the two extant species of ground-hornbills are placed in a different family, Bucorvidae, and both it and Bucerotidae are sometimes placed in their own avian Order Bucerotiformes (Kemp 1995). Apart from their inherent charismatic allure, the taxonomy and ecology of hornbills is just fascinating, and this makes them an ideal model species for various researches in ornithology and evolutionary ecology.

For my chosen career in ornithology, hornbills provided my path of enlightenment in scientific research. Who would not be enthralled by this charismatic and majestic species, particularly the 'Kalaw' or Great Philippine Hornbill? My first encounter with the beautiful Kalaw was during a field trip at the historic U.P. Quezon Land Grant for Mammalogy class with my undergraduate adviser, Prof. Andres Tomas Dans. Prof. Dans encouraged me to pursue birds as the focus of my BS thesis in Zoology, which I conducted in Puerto Galera, Oriental Mindoro (Gonzalez 1993), introducing me to another endemic species – the Mindoro Tarictic Hornbill.

Soon after, we engaged in the project with distinguished conservationist Dr. William Oliver to do work on the poorly known and endangered Polillo Tarictic Hornbill (Penelopides manillae subniger) (Gonzalez and Dans 1996), which in part facilitated the conduct of my MS thesis on the Ecology of Birds of the Polillo Islands (Gonzalez et al. 2010). This collaboration with Dr. Oliver led to the creation of the Polillo Ecology Stewardship Project (PESP), which monitored the status of wildlife in the islands particularly the endemic Tarictic Hornbill. This collaboration eventually facilitated the development of PESP into the locally based NGO, Polillo Islands Biodiversity Conservation Foundation, Inc. (PIBCFI). From this initial project sprung various other collaborative endeavors with Dr. Oliver for other biodiversity hotspots, such as Cebu, South Luzon, Negros, Batanes, and Mindoro.

Fieldwork within these different biodiversity hotspots sparked further interest into hornbill research, and contributing much needed data to the newly established Philippine Hornbill Conservation Programme (PHCP) of DENR. From this program, the first Philippine Hornbill Conservation Workshop was held, gathering all the hornbill researchers in the country. My work on the Polillo and Mindoro Tarictic Hornbills (Penelopides mindorensis) warranted its presentation at the 4th International Hornbill Conference (IHC) in South Africa, through the support of Chester Zoo (Gonzalez 2007).

This growing interest in hornbill studies eventually led me to completing a doctorate on the Origin and Diversification of Hornbills at the prestigious Edward Grey Institute for Field Ornithology, University of Oxford, under the supervision of Dr. Ben Sheldon (Director of EGI), Dr. Joseph Tobias and Dr. Nigel Collar (authors of "Threatened Birds of Asia," BirdLife International, BLI). Completion of my DPhil at Oxford was made possible by a scholarship from Ford Foundation International Fellowship Program that was introduced to me by the late Dean Corazon Lamug. Additional support for my DPhil research was provided by grants from the British Ornithologist's Union, Chester Zoo and St. Anne's College, as well as an approved 4-year study leave with pay from UPLB.

A key output of my dissertation was a molecular phylogeny of hornbills

of the world published in Molecular Phylogenetics and Evolution (Gonzalez et al. 2013), which garnered an International Paper Award from the University of the Philippines Office of the Vice President for Academic Affairs (UP-OVPAA) in 2014. This research allowed me to sample both contemporary and historical samples, including toe-pads, from museum skins collected by Dr. Dioscoro Rabor, our very own Father of Philippine Wildlife; Dr. Ernst Mayr, the Father of Evolutionary Biology; and Sir Alfred Russel Wallace, the Father of Biogeography.

It was indeed a baptism of fire into molecular phylogenetics, but this allowed me to earn invaluable skills in the analysis of historical DNA, which in turn facilitated my application of this invaluable knowledge in the Philippines, through an approved project from DOST. My thesis chapter on the evolutionary origins of hornbills was dubbed "piece de resistance" by eminent hornbill expert Dr. Alan Kemp, who wrote seminal Hornbills of the World (Kemp 1995) and contributed to the chapter on Hornbills in the Handbook of Birds of the World (de Hoyo et al. 2001). He served as my Ph.D. examiner at Oxford together with Dr. Stephen Harris. Dr. Kemp had been influential in my continued research on hornbills, being the recognized global expert on Bucerotiformes.

Equally influential was Dr. Pilai Poonswad, who had been globally dubbed the "the great mother of the hornbills" for her award-winning work on hornbill research in Thailand and was awarded the prestigious Rolex Award for Enterprise in 2006. I had the privilege of meeting her in South Africa at the 4th IHC, where she encouraged me to continue my work on Philippine Hornbills, placing emphasis on its global importance due to the limited information and threatened status. Of the 62 species of hornbills worldwide, 16 are currently recognized as threatened by BirdLife International (www.birdlife.org), wherein seven endemic Philippine hornbills are included.

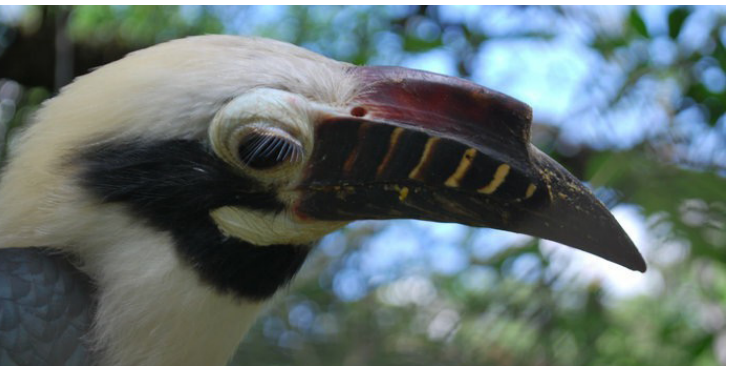
All of the ten species of hornbills found in the Philippines are endemic, and occur nowhere else in the world. Information about this invaluable group of forest frugivores are rather limited, notwithstanding that 70% of the current species are threatened with extinction, and already one unique subspecies from remote Ticao Island (Penelopides Panini ticaensis) is now recognized as functionally extinct (Oliver and Gonzalez, in prep, 2014). Most of the recent studies are centered on both in-situ and ex-situ conservation work in Negros and Panay for the threatened Visayan Hornbill (Penelopides panini) and Rufous-headed Hornbill (Rhabdotorrhinus waldeni) (Kauth et al. 1998; Sammler et al. 2012).

This depauperate knowledge on Philippine hornbills facilitated my conduct of studies on the ecology of sympatric hornbills in Palanan, Isabela, within the legendary Northern Sierra Madre Natural Park. The late Leonard Co, a champion of Philippine botany and plant conservation, had encouraged me to do research in frugivore ecology at the CTFS plot, established by UP Diliman and Conservation International. Results of the population survey on two species of Luzon hornbills (Buceros hydrocorax and Penelopides manillae) at the park were presented at the 2010 Student Conference on Conservation Science and the 2011 International Hole-Nesting Birds Conference, both held at Oxford University, UK.

This comprehensive ecological study of two sympatric hornbills from northeast Luzon (Gonzalez 2012) strengthened our understanding of the importance of hornbills as keystone species of the tropical lowland forests. Being obligate frugivores, hornbills were documented to disperse large-seeded fruits of indigenous and endemic hardwoods such as Nutmegs (Myristicaceae), Canarium (Burseraceae) and Aglaia (Meliaceae), apart from figs and palms. Hornbills also represent ideal biological indicators to forest disturbance due to their sensitivity to human perturbations from excessive habitat loss and direct hunting pressure.

With their added charismatic value, they also represent an ideal flagship species for forest conservation. This has been proven in the adoption of the Polillo Tarictic Hornbill as a municipal emblem of Polillo town, thereby venerated in the annual Polillo Tarictic Festival, in which PIBCFI has been consistently involved.

The importance of studying fruit preferences of hornbills and their value as essential seed-dispersal agents was well encapsulated in the highly acclaimed book by Margaret Kinnarid and Tim O'Brien in 2007, entitled "Farmers of the Forest." Part of my comprehensive study on hornbill diversification being influenced by a



sudden shift to obligate frugivory was presented at the 2011 joint conference of the Association of Tropical Biology and Conservation and Society for Conservation Biology held in Arusha, Tanzania. This monumental evidence from my thesis had aligned the potential co-evolution of hornbills and their hornbill-dispersed fruits, which was commended by two eminent ecologists, John Terborgh and Theodore Fleming. It was indeed an inspirational moment in my career.

While pursuing graduate studies in Oxford, most of my colleagues had aimed to publish their results in top journals, such as Science or Nature. I distinctly remember that the last article on hornbills that was featured in Nature was by Henry David Thoreau in 1947. Not wanting to get my hopes up, I didn't submit to either of them. However, I was fortunate enough to have one of my chapters accepted in the prestigious Proceedings of the Royal Society B or PRSB (Gonzalez et al. 2013b). Inspired by a talk at a convocation held in UPLB, Academician Evelyn Tecson-Mendoza emphasized the value of impact factors in scientific publications, and this made me re-think my choices for journals, and that I should aspire higher in terms of publishing my results.

Indeed, this paper in PRSB, presents an alternative global scenario to the evolution of cooperative breeding in hornbills. It opened my mind to testing models of evolution, thus learning new skills in comparative analysis and use of current bioinformatics programs. Upon my return to UPLB after completing my doctorate, I have begun to include these novel methods in teaching graduate courses in WLDL/ZOO 291 (Special topics in Wildlife Studies and Zoology), FBS 268 (Molecular Phylogenetics) and BIO 241 (Biogeography).

One of these comparative analyses allowed me to trace the Historical Biogeography of Asian Hornbills, which I presented at the 2013 Wallace Conference held in Kuching City, Sarawak, Malaysia. A visit to Sarawak, which is dubbed "Bumi Kenyalang" or "Land of the Hornbills," exposed me to the ethno-cultural importance of Malaysian hornbills. This reignited my interest in ethno-ornithology and led me to pursue another paper that focused on the similarities of the mighty spiritual hornbill, Kenyalang of Borneo, with our own Sarimanok of Mindanao, which was presented during the annual Philippine Bird Festival of the Wild Bird Club of the Philippines (WBCP) held in Zamboanga City in 2014. I had drawn influence from my previous paper describing the ethno-ornithological importance of Philippine hornbills during the 5th IHC held in Singapore in 2009, and eventually published in Raffles Bulletin of Zoology in 2011.

What is ethno-ornithology? It is a multidisciplinary approach to studying the ethno-cultural importance of birds, cutting across ornithology, anthropology and linguistics. In a recently concluded session for Café Scientifique in 2014 organized by the UPLB College of Development Communication (CDC), I featured this novel field in my talk on the Evolution, Ecology and Ethno-ornithology of Philippine Hornbills. This talk reiterated the importance of integrating molecular phylogenetics, field ecology and ethnobiology in addressing conservation issues for threatened group of endemic birds. Hopefully, this introduction to the potential impacts of ethnobiology in conservation outcomes inspired the development of collaborative studies between CDC and CAS-IBS. Apart from putting emphasis on the need for ethno-ornithological studies in the Philippines, my talk also focused on the need for establishing evidence-based species delimitation, given the exceptional diversity of birds in the archipelago.

My thesis chapters tried to address this issue of species limits in Asian hornbills, which dealt on comparing genetic divergence (using mtDNA) with phenotypic difference (based on the 'Tobias' criteria, Tobias et al. 2010). My study compared 52 pairs of Asian hornbills, mostly from Philippines, which led to the sound delimitation of current taxa. Therefore, confirming previous splits suggested and elevating several subspecies to full species, including three Philippine hornbills, namely the Mindanao Rufous Hornbill (Buceros mindanensis), Samar Tarictic Hornbill (Penelopides samarensis) and Basilan Tarictic Hornbill (Penelopides basilanicus). This brings to a total of 12 species of hornbills recognized to occur exclusively in the Philippines. This apparent change in taxonomic status has implications to the current

area of occupancy, and thus merits reassessment of the International Union for Conservation of Nature (IUCN) category, and has been systematically adopted by BLI in their recent update of threatened birds of the world (www.birdlife.org).

Moreover, result of hornbill species delimitation was presented during the 6th IHC hosted by WBCP and the Philippine Biodiversity Conservation Foundation, Inc. (PBCFI). This result was presented in tandem during a plenary talk on the status of Philippine Hornbills by Dr. William Oliver, the director of PBCFI and creator of PHCP. Dr. Oliver not only re-launched PHCP, but also stressed the need to expand conservation initiatives for Philippine Hornbills. Of the 12 species depicted in my talk, nine are now recognized as globally threatened and near-threatened (BLI 2014; IUCN 2014), including two species that are seriously categorized as critically endangered.

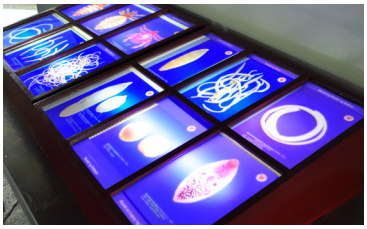
Among the two critically endangered endemic Philippine hornbills, the Rufous-headed Hornbill of Negros and Panay islands has been well studied in captivity by Prof. Lucia Lastimosa at the Mari-it Conservation Park in West Visayas State University (Lambunao campus, in collaboration with PBCFI), and in the wild by Dr. Eberhard Curio of Ruhr University, Germany, Dr. Curio is now a visiting professor at UP Diliman and recently gave a seminar on conservation science at UPLB. Both had conducted monumental work that facilitated the gradual recovery of this critically endangered species, unlike that of the equally threatened Sulu Hornbill (Anthracoceros montani), which remains the least known of the Philippine hornbills.

The original holotype specimen of the Sulu Hornbill is kept in Paris, and most information is based on the few scattered museum skins deposited in the United States and the UK. The only known skin specimen in the Philippines is currently housed at the Aga Khan Museum in Mindanao State University in Marawi City, Lanao del Norte. Recent information from the wild is based mainly on photographs and field notes taken by Desmond Allen and Ivan Sarenas of WBCP. It is an extremely challenging species to study due to its restricted range in the Sulu archipelago, with the last remaining population occurring in Tawi-tawi. The last expedition, which attempted to find the Sulu Hornbill in the wild, was thwarted by the kidnapping of Swiss museum taxidermist and hornbill enthusiast Lorenzo Vinciguerra in 2010. This inherent risk has prevented implementing much needed research and conservation work for this critically endangered Sulu endemic; and a similar scenario appears to befall the Basilan Tarictic Hornbill.

Beyond the more practical and locally recognized aspects of ecological research and conservation science for Philippine hornbills, I had begun to look into more current global approaches in evolutionary biology to study hornbills. In addition to underpinning factors contributing to hornbill diversification and understanding their historical biogeography, I had extended my interest on answering other aspects of hornbill evolution, such as the influence of environmental stability on cooperative breeding behavior within the family (Gonzalez et al. 2013b), and tracing the development of their casque. I had presented evolutionary models contributing to casque elaboration at the prestigious 26th International Ornithological Congress (IOC) in August 2014 held at Rikkyo University, Japan. Travel and accommodation in Tokyo was generously supported by a research dissemination grant from the UP-OVPAA through the UPLB Office of the Vice Chancellor for Academic Affairs.

My participation at the IOC rekindled my strong interest in expanding more collaborative research on Philippine hornbills, and becoming more pro-active with the re-launched PHCP and contributing to the recently launched Ethno-ornithology World Archive (EWA). I distinctly recall the talk given by Dr. Alan Kemp during the 5th IHC in Singapore in 2009, wherein he emphasized the importance of the Philippines and West Africa as key areas for hornbill research. From this, I sincerely hope to implement more projects focused on Philippine hornbill conservation and concurrently inspire students in UPLB to conduct comprehensive research on our endemic hornbills.

While I was completing this article, I learned about the sad news of the sudden passing of eminent hornbill conservationist, Dr. William Oliver - an invaluable champion for Philippine Biodiversity Conservation. For all his significant collaborative projects with UPLB beyond hornbill research and conservation, I dedicate this paper in his memory, and may his extensive contributions serve as an inspiration to us, Filipinos.

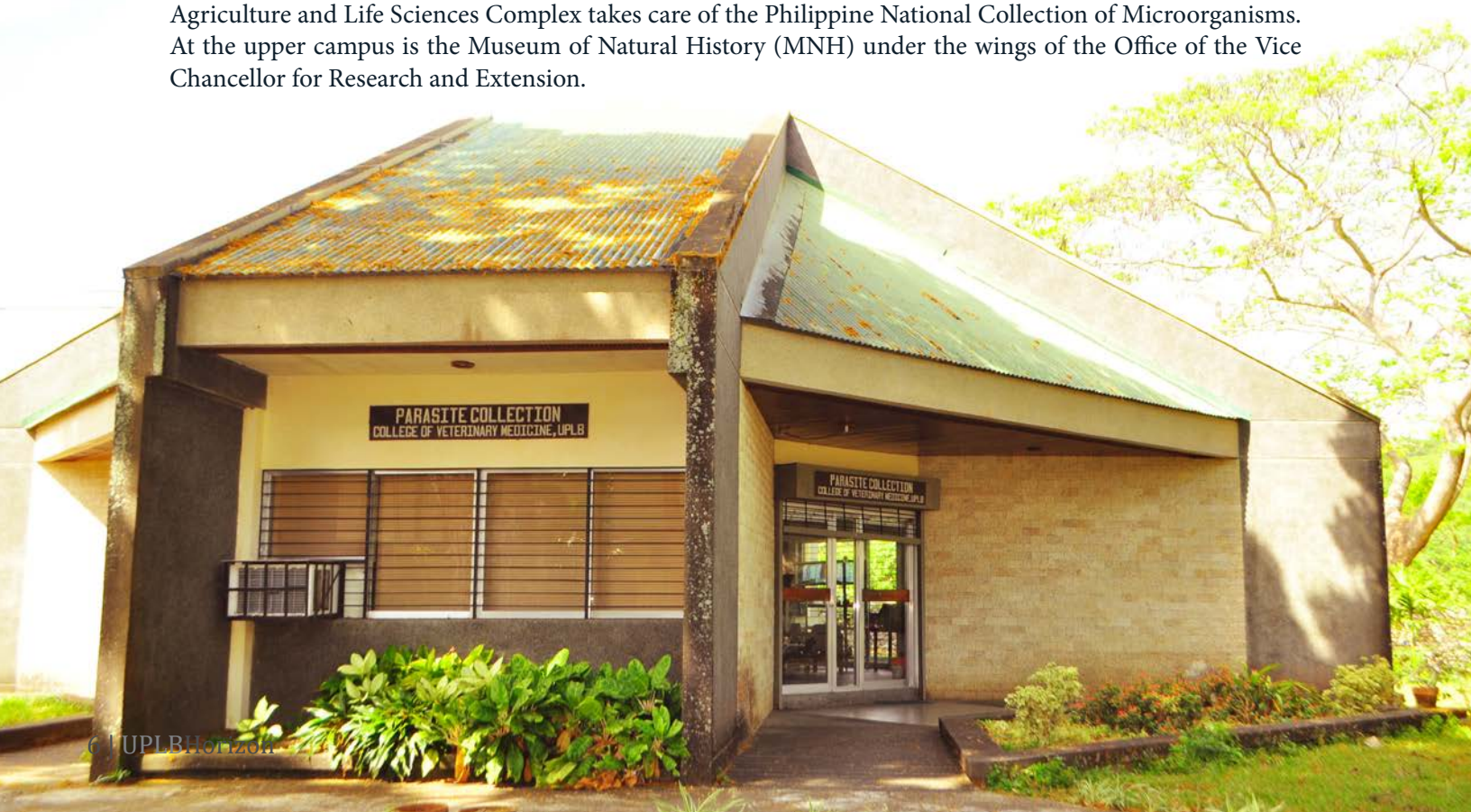



Biological Collections:

Preserving Answers to Future Queries

By Mark Jayson E. Gloria
Photographs by Christopher V. Labe

UPLB hosts a number of biological collection units that preserve animal, plant, and microbiological species. At the Animal Science Complex stands the Parasite Collection Center of the College of Veterinary Medicine (CVM). Meanwhile, the National Institute of Molecular Biology and Biotechnology (BIOTECH) within the Agriculture and Life Sciences Complex takes care of the Philippine National Collection of Microorganisms. At the upper campus is the Museum of Natural History (MNH) under the wings of the Office of the Vice Chancellor for Research and Extension.



Aside from providing practical learning venues, these collection centers serve their indispensable purposes in our society. This fact was highlighted by Dr. Salcedo L. Eduardo, former dean of the CVM, in his lecture entitled "Enhancing the Usefulness and Maximizing the Utilization of Biological Collections in the University of the Philippines." Dr. Eduardo said, "the collection of animal and plant specimens contribute to the discovery, understanding, and conservation of Philippine animal and plant biodiversity, and therefore are resources of national and international biological knowledge." Dr. Eduardo delivered the lecture as a newly appointed professor emeritus of UPLB at the "Celebrating UPLB's Great Minds" Lecture Series in 2013.

Here are the four major benefits that can be derived from intensive and conscientious biological collection practices:

Essential to taxonomy

"Biological collections are essential and pivotal to taxonomy. You cannot do taxonomy without biological collections," said Dr. Aimee Lynn Barrion-Dupo, professor and deputy director of the Institute of Biological Sciences (IBS) in UPLB. The voucher specimens, or the specimens collected from the field work, serve as the basis in naming and describing the species. In that sense, taxonomy opens up the door for further investigation on biodiversity.

Dr. Barrion-Dupo said that the voucher specimens become integral to biological collections and provide information to taxonomists on what have been collected, described, named, and other activities relevant to species identification. Biological collections give them baseline data as they further pursue their taxonomic researches. In his paper, Dr. Eduardo, who is

also the MNH curator for animal helminth parasites, said that biological collections can provide physical evidence of the presence of a particular taxon at a specific place and point in time.

According to Dr. Barrion-Dupo, protecting biodiversity starts with knowing the species' name, classification, and status (e.g., endemic, endangered). This information can be derived from taxonomy, a field that is being updated by the discovery of new species. "The most important part of discovering new species is really showing that the country is still megadiverse. The fact that we are still discovering new species means that there are several niches and several organisms that have been undiscovered. [Our discoveries] emphasize the need to further protect our biodiversity," Dr. Barrion-Dupo stated.

Crucial to research

Biological collections contribute to biological researches, including studies on climate change. "Biological collections are necessary to many types of research in biological sciences. They also serve as important reference

and comparative materials," Dr. Eduardo said in his lecture. He further explained that these collections are vouchers for research because they are able to document the existence of a physical or biological component at a given place and time.

Dr. Barrion-Dupo cited trends in biological researches that make use of biological collections based on the visitors she has encountered at MNH, where she also serves as a curator for entomological collections. These include the movement of species, their adaptation to climate change and resistance of insect pests to pesticides.

"Other scientists visit biological collections to check potential pest species that could enter their country," Dr. Barrion-Dupo said. According to her, some foreign scientists predict that

climate change would cause insects to move from warmer to colder regions, hence, they prepare their country for the entry of species that are new to their inventory.

Dr. Eduardo said that comparing recent collections with the ones collected earlier would show the effect of climate change among species. "Global warming has extended the distribution of mosquitoes farther up north where they did not exist before. The heartworm of dogs, which is transmitted by mosquitoes, was only reported in the southern United States like Florida but cases are already being reported in central and northern US," Dr. Eduardo explained.

Dr. Barrion-Dupo explained that by looking at biological collections of neighboring countries, scientists and researchers could identify the potential insects that might enter their territory and determine if the existence of these species would result to competition and infestations. By knowing these, they can make appropriate preparations against the threat such as enforcing quarantine measures. Dr. Eduardo also noted that the use of biological collections could save time for those undertaking scientific endeavors. "Current workers can easily identify materials when these are compared with those deposited in biological institutions. The time used to establish the identity of their materials, and to determine whether the species they are dealing with already existed before or is a new one, will be shortened," Dr. Eduardo further explained.

Another climate change-related research that relies on biological collections is the study of species' adaptation to climate change. "There are researches that look at biological collections to see the effects of climate change on the (decreasing) size of organisms," Dr. Barrion-Dupo shared. "The only way to prove this is to look at past collections to compare and determine if indeed such is happening."

Contribute to public health studies

Biological collections are sources of information for molecular studies on insect resistance to pesticides. "For instance, we had visitors who wanted to prove if a species of moth has developed resistance to a particular pesticide. They had to look at past collections when pesticides were not yet used and compare this with more recent collections," Dr. Barrion-Dupo said. In order to do this, researchers need to study the gene sequences of species before and after the use of insecticide.

Biological collections contribute to public health investigations. The importance of biological collections to public health studies have been articulated in the journal article cited by Dr. Eduardo, entitled "The Value of Museum Collections for Research and Society" published in the Oxford University's BioScience Journal in 2004. Its authors, Dr. Andrew V. Suarez (University of Illinois at Urbana - Champaign) and Dr. Neil D. Tsutsui (University of California - Irvine) said that biological collections contribute invaluable insights in the study of pathogens, vectors of diseases, and environmental contaminants. "Collections are often used to track the history of infectious diseases and identify their sources of reservoirs," the two explained in their paper.

They are reliable tools in tracking the nature of previous pandemics and comparing them with the current public health phenomena. "By examining museum specimens, researchers can estimate historical levels of contamination and construct a baseline against which current levels can be compared," wrote Drs. Suarez and Tsutsui. Likewise, Dr. Eduardo said that "some biological causes of current epidemics can easily be solved by comparing the causative organism of similar epidemics in the past that are kept in biological depository institutions."

Among the classic examples of this is the comparison of influenza outbreak in 1918 and the recent emergence of avian influenza by Taunbenberger, et.al. (1997) and Fanning, et.al. (2002), as cited by Dr. Eduardo in his paper. Through biological collections, it was found that the cause of the 1918 outbreak was different from the virus that caused avian influenza.

Likewise, Dr. Barrion-Dupo counts on the capacity of a biological collection center to contain knowledge on the presence of parasites and disease vectors. Knowing this would save energy and money, as further investigation and quarantine activities are properly employed. Thus, authorities could focus on how to prevent the spread of the disease.

Cultural heritage

Biological collections belong to our cultural heritage. "Our biological collections are heritage collections," Dr. Barrion-Dupo also said. In particular, she explained that the collections at UPLB tell about the scientists who established the University. She said that the story of the establishment of the museum is part of the story of UPLB. The University's biological collections reflect the dynamics and traditions of UPLB scientists some of whom had painstakingly collected and contributed these to UPLB.

Dr. Barrion-Dupo also cited the use of biological collections in studying culture, such as tracking the occurrence of entomophagy or insect-eating in the Philippines. Since biological collections indicate the locations of species, including edible insects, anthropologists may utilize this information to visit such places and find out if the practice of entomophagy exists in respective localities. As an example, Dr. Barrion-

Dupo said that this can be used to locate which other provinces, aside from those in Central Luzon, have population that consume camaro or cricket. This baseline information could result to a focused study that would contribute to the body of knowledge in cultural studies.

Given the benefits of having biological collections, Dr. Eduardo emphasized the need to ensure that they are preserved, especially because these collections are non-renewable. "UP must ensure the practice of proper collection management and care so that these collections will be accessible, useful and stable," he said.

According to Dr. Eduardo, this could be done by the University through the following: (a) adequate funding; (b) upgrading of facilities and personnel; (c) updating the organization of the collections; (d) directing collection growth as scientific research changes; (d) providing proper care of the collections; and (e) using the best preservation methods, preservation protocol.

Dr. Eduardo also pointed out how biological collections could be useful as a tool establishing international linkages. He believes that UP's biological collections will attract regional and international clients, leading to international cooperation. "Foreign scientists, especially those working on Philippine materials will also be encouraged to deposit specimens in repository units of the University. The biological collections in UP may be significant in her quest to become a world-class university," Dr. Eduardo concluded.

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A Green Investment

By Miguel Victor T. Durian
Photographs by Christopher V. Labe

Why do we save money in the bank? Simple. To have a hedge against the uncertainties of the future.

The same principle has been applied in the establishment of genome resource banks to collect, store, preserve, and study the genetic material of humans, plants and animals. These banks may not be repositories of money but deep within the seed chambers and in the field plots, are resources equal or probably greater in value to money. These resources are the genetic materials of important crops and plants, some of which are already on the edge of extinction.

UPLB hosts one such bank, the National Plant Genetic Resources Laboratory (NPGRL) at the Crop Science Cluster of the College of Agriculture. Established on Nov. 12, 1976 through Presidential Decree 1046, the NPGRL houses the germplasm or the reproductive or vegetative propagating materials of significant and potentially useful agricultural and horticultural crops except rice. This very important facility, which provides an insurance against the erosion of genetic diversity and ultimately, human existence, is housed in a nondescript building at the CSC/Institute of Plant Breeding complex.

Role of the NPGRL

The NPGRL aims to provide the IPB and crop improvement programs with the genetic materials needed to breed superior crop varieties. "The Genebank/Laboratory plays many roles," said Maria Lea Villavicencio, head of the NPGRL. "It is responsible for acquiring, characterizing, evaluating, conserving, and documenting the national germplasm collection."

For more than 30 years, the NPGRL has been conserving about 36,000 collections of germplasm materials. It serves as the world base collection center for the germplasm of winged beans, snake gourd, bitter gourd, wax gourd, and many Southeast Asian indigenous vegetables.

It also conserves duplicate world collections of mungbean, the Asian collection of tomato, and the world's largest collection of wild bananas. Moreover, it also conserves endemic species of crops. The germplasm are stored in field genebanks, which can be found in orchards at the IPB compound, at the Jamboree area, at Forestry, and along Pili Drive.

Germplasm materials are also stored as seeds in cold storage chambers kept at the NPGRL building. Researchers, scientists, plant breeders, farmers, and other research institutions can avail themselves of the use of the collection at the NPGRL.

The NPGRL monitors and coordinates national efforts to conserve plant genetic resources. But the job of NPGRL goes beyond conservation or storage. It also acquires or collects germplasm materials by conducting fieldwork, donations, and exchange of materials with other agencies.

The NPGRL does not only handle commercial crops but is now focusing on native or indigenous crops, especially those that have been declared as endangered. It is also looking at the possible use of weedy and wild plants as potential agricultural crops because these plants are resistant to harsh environments and extreme climatic conditions. Plant breeders assimilate these desirable traits into the commercial crops' gene pool. The NPGRL is also responsible for the reacquisition or collection of lost germplasm materials.

The NPGRL then evaluates and characterizes the germplasm materials based on morphological, biochemical, molecular, cytological, and taxonomic characteristics using descriptors' list from Biodiversity International. When there are no descriptors available, the NPGRL formulates one for its own use. The data is then documented and archived in NPGRL's database system. As of this time, about 40% of the NPGRL collection has already been characterized.

Loss of Biodiversity

Many forces are causing the loss of biodiversity. One of these is climate change. Agriculture in the country is drastically affected by erratic changes in rainfall patterns and temperature. Many crops cannot withstand such changes and are not able to adapt, hence, the possibility of genetic erosion or the number of species getting even smaller.

There is also the human exploitation of our natural resources. "When people harvest from the mountains, they get everything," said Villavicencio. She also added that foreigners often smuggle native orchids. One such orchid is the Lady's Slippers (Paphiopedilum philippinense), which is very popular abroad, and as a consequence, has also been listed as endangered, as have native eggplants and tomatoes. Villavicencio claimed that there used to be many of them in Bukidnon and in Isabela. But now, one has to climb the tallest of mountains in order to find them. Without the intervention of science and technology, there will indeed be great loss, not only to agriculture, but also to biodiversity.

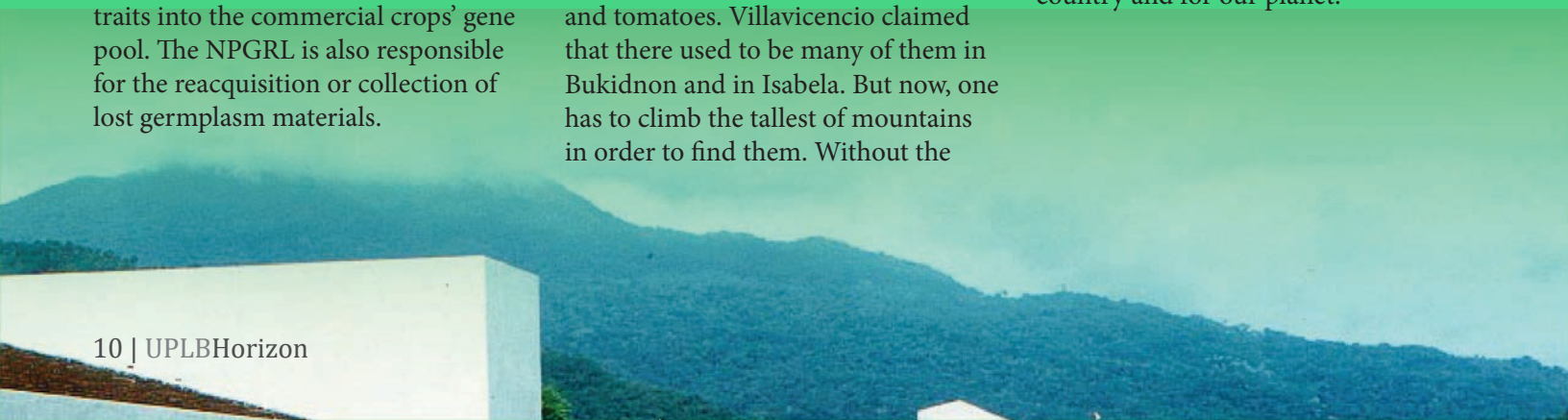
NPGRL is a family

In partnership with the Department of Science and Technology, the NPGRL has just finished conducting a three-year regeneration program. The program was composed of seven projects, representing different crop groups aimed at regenerating the NPGRL germplasm collection in three years and completing the characterization of all the germplasm materials.

The NPGRL has also drafted a bill creating the National Plant Genetics Resources Center, which will cover not only agricultural plant genetic materials, but also forest plant genetic materials.

Also among the NPGRL plans is the construction of a new building at the IPB compound where the germplasm collections may be stored. This is a strategic measure to minimize the risk of total loss.

As a reservoir for a diverse collection of plant genetic resources, the NPGRL is an investor of natural heritage and agricultural productivity. If given the attention and support it deserves, the NPGRL can do so much more for our country and for our planet.



An early history of research on Mt. Makiling's Biodiversity

By Mark Jayson E. Gloria

The flora- and fauna-rich Mt. Makiling has silently witnessed UPLB's storied past and has contributed to it as well.

A renowned taxonomist, the late Prof. Juan Pancho, made reference to this in the first edition of the "Vascular Flora of Makiling and Vicinity" that appeared in Kalikasan Journal in 1983. He said "in regard to Mt. Makiling, the most significant event was the founding of the UP College of Agriculture (UPCA) at the base of the mountain."

Prof. Pancho's research further revealed that Mt. Makiling has been involved in a few studies for Western scholars and explorers even before the American colonial period. In fact, the mountain has appeared in botany literature as early as the 18th century. This was through the Spanish Malaspina Expedition that visited Los Baños in 1792.

Prof. Pancho also inferred that botanical expeditions might have been conducted in the mountains by English plant collector Hugh Cuming in the 1830s and the United States Exploring Expeditions in the 1840s.

UPCA's two American deans, Edwin Bingham Copeland and Charles Fuller Baker, explored the biodiversity of the forest reserve. Copeland, a systematic botanist, was deep into field work in Mt. Makiling. He started a herbarium at the College and encouraged his protégés to do intensive work in

> "Perhaps the greatest opportunity on Mt. Makiling is for forestry research. There is always need in forestry, even more than in the other arts, for long-continued studies of the development and evolution of natural vegetation."
>
> Prof. Forman T. McLean

botany. Baker, on the other hand, was an all-around agricultural scientist known for his insect collection.

Dean Baker had already been overseeing UPCA for three years in 1919, the ninth year since Mt. Makiling was declared a forest reserve and since the Forest School (now the College of Forestry and Natural Resources) was established. During this year, two articles about the potential of Mt. Makiling as a biological and botanical research station appeared in the August-September issue of the UPCA journal, the Philippine Agriculturist.

In the article "Mt. Makiling as a Station for Botanical Research," the authors, Sam F. Trelease and Forman T. McLean, who were also professors at UPCA said that "the vegetation of the Makiling region should strongly appeal to botanists - whether their work lies in the field of taxonomy, morphology, physiology, or ecology." According to them, Mt. Makiling had very rich flora, with around 160 of the estimated 200 families of vascular plants in the Philippines found in it.

They also cited data that highlighted Mt. Makiling's floral biodiversity. One of these was made by one Mr. ADE Elmer of the Bureau of Forestry, which indicated that the number of woody species in Mt. Makiling was almost a third of those found in the whole United States. The land area of the mainland United States (excluding Alaska and Hawaii) is more than 8 million sq km. Mt. Makiling occupied only a little more than 37 sq km when it became a forest reserve in 1910 through Proclamation No. 106 signed by then Governor General William Cameron Forbes.

Frederick A.G. Muir's article entitled "Makiling as a Biological Station" called the forest reserve "a remarkable biological and entomological region." Muir said that Mt. Makiling had 1,814 species of ferns and flowering plants, 800 of which were tree species. Muir also mentioned that 55 of the 68 species of insect family derbids that can be found in Luzon at that time can also be found in Mt. Makiling. These figures were based on the investigations of Dean Copeland, Bureau of Forestry's FW Foxworthy, and Bureau of Science's WH Brown.

Muir, an entomologist from the Hawaiian Sugar Planters' Experiment Station who had travelled to Australia, China and the Southeast Asia, found the tropical Makiling a good site for research, thus he pleaded for biological stations to be set up in the area. "Biologists working on the laws of inheritance often have to wait a year for one generation in the temperate zones; whereas, in the tropics, it would be possible to have ten or a dozen in the same period," he justified.

A year later, on November 30, 1920, then Governor General Francis Burton Harrison signed Proclamation No. 60, which renamed the forest reserve as The Makiling National Botanical Garden.

Prof. McLean, in his article "The Makiling National Botanic Garden" in the Philippine Agriculturist (March-April 1921), was optimistic about the potentials of the Garden. "Perhaps the greatest opportunity on Mt. Makiling is for forestry research. There is always need in forestry, even more than in the other arts, for long-continued studies of the development and evolution of natural vegetation," he said. McLean also said that agricultural studies on crops such as coffee, abaca and fruit trees can be carried out in the area.

The succeeding decades saw changes in the name and stewardship of MMFR. Nevertheless, the indispensability of the forest reserve in advancing knowledge in forest science and natural resources studies has remained.

At the same time, the worthiness of UPLB as a steward continues to be proven, most recently (2013) by the declaration of the MMFR as the 33rd ASEAN Heritage Park.

Using ICT for Precise and Smart Forestry

By Mark Jayson E. Gloria
Photographs by Karl Cadapan

Components of a basic RFID system

Many of our daily activities and transactions can no longer be carried out efficiently without the use of information and communication technology (ICT). Even in academe, learning has become unthinkable without the use of electronic and online resources. ICT has also become a very important tool in forest conservation.

Dr. Nathaniel C. Bantayan, professor at the Institute of Renewable and Natural Resources and director of the Makiling Center for Mountain Ecosystems of the College of Forestry and Natural Resources (CFNR-MCME), is gearing up for a new system of gathering forest tree data using radio-frequency identification (RFID) and geomatics.

This will be part of a system that will enable researchers to monitor trees, determine the impact of climate change on their growth, and identify those that are resilient to climate change. It will also enable Dr. Bantayan's team to establish a clear link between the effects of physical and biological forces and changes in the forest ecosystem.

Inside the Mt. Makiling Forest Reserve, which is administered by the MCME, are four two-hectare long-term ecological plots where this technology will be implemented.

Dr. Bantayan, who has been pushing for precision and conservation forestry, is optimistic about generating funding for this project. According to him, this technology has been successfully implemented in countries like Malaysia through the initiative of Abdul Rahim Omarali of the Forest Resources Institute Malaysia. In fact, the technology is now applied on trees in the Malaysian city of Putra Jaya.

How does the technology work? In his paper published in the Wulfenia Journal in May 2015, Dr. Bantayan defined RFID as "a system that wirelessly transmits the identity of an object or person in the form of a unique alphanumeric code using radio waves," citing Reynolds and Riley, 2002. RFID tags will be tied to each subject tree in the experimental plot to easily identify them using a hand-held reader, which is also used to collect data on tree parameters. This approach to forest tree monitoring and forest conservation also makes use of geomatics, particularly mapping, databasing, and radio waves to locate and identify objects.

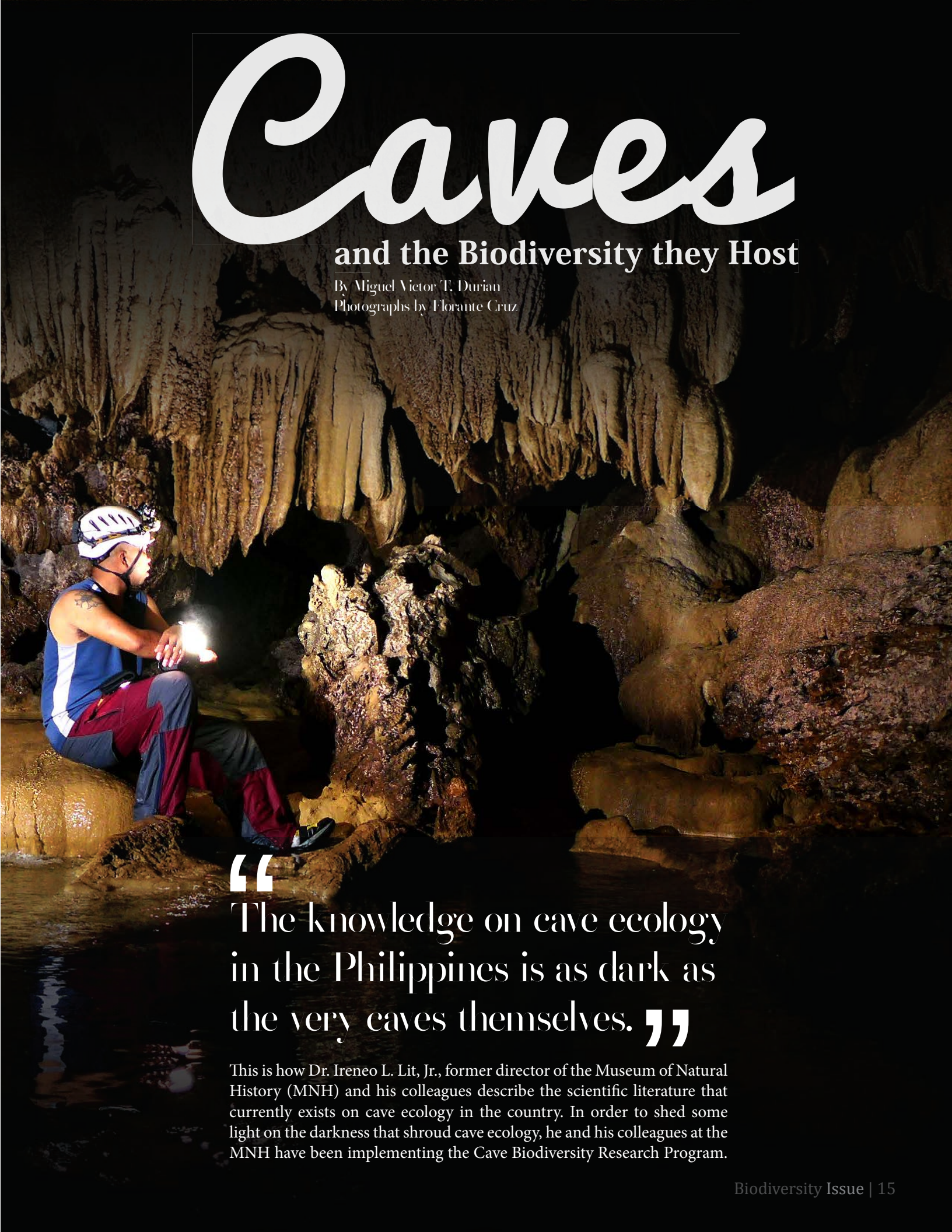
Dr. Bantayan said that the automation system eases field work and speeds up encoding and data transfer. It reduces time, facilitates processing, modeling needed, and visualization, and eliminates human error in gathering forest tree data. Among the tree parameters that could be gathered through the system are diameter, height, and crown size.

Monitoring and assessment of tree parameters would allow forest administrators to identify tree species that are resilient to climate change. Knowing resilient tree species in the forest is important. "If we are able to visualize the effects of climate change in the forest, we can design interventions, like identifying species to plant. That is what we want to find out, because right now we don't have empirical basis on it," said Dr. Bantayan. This technically would usher in "Smart Forestry." "If we already have 'Smart Agriculture,' then this one is 'Smart Forestry.' Well, 'Smarter Forestry,'" Dr. Bantayan concluded.

Caves

and the Biodiversity they Host

By Miguel Victor T. Durian
Photographs by Florante Cruz



> "The knowledge on cave ecology in the Philippines is as dark as the very caves themselves."

This is how Dr. Ireneo L. Lit, Jr., former director of the Museum of Natural History (MNH) and his colleagues describe the scientific literature that currently exists on cave ecology in the country. In order to shed some light on the darkness that shroud cave ecology, he and his colleagues at the MNH have been implementing the Cave Biodiversity Research Program.

This bright idea was hatched in 2006 when Dr. Lit, then newly appointed as director of the MNH, tried to conceptualize a research program that could be attributed to the Museum. He shared the idea with Phillip Alviola, a faculty member at the Institute of Biological Sciences and Museum curator who had also been studying cave vertebrates, particularly cave bats. It was also around this time when the Protected Areas and Wildlife Bureau, now the Biodiversity Management Bureau (BMB) of the Department of Environmental and Natural Resources consulted the MNH regarding the Cave Law (RA 9072: National Caves and Cave Resources Management and Protection Act). "The BMB needed help to assess caves all around the country, and as we have the most number of systematists and other experts, we were the ones that they consulted," Dr. Lit explained.

Dr. Lit's team saw this as an opportunity to propose a research program on cave ecology. After consulting other faculty members, namely: Dr. Leticia E. Afuang, Dr. Anna Pauline O. De Guia, and Prof. Judeline C. Dimalibot, they conceived of the Cave Biodiversity Research Program.

"Caves are very unique ecosystems," said Dr. Lit. "We already know a lot about other ecosystems like forests, marine, and freshwater ecosystems but we know very little about caves." He said that the various conditions inside caves such as the absence of light make them different from other ecosystems and play important roles in their ecological dynamics and biodiversity. "Many species that thrive in caves await discovery," Dr. Lit added.

Research staff

Cave ecology encompasses various areas of study of which the MNH has expertise. Because cave ecology is its major research focus, MNH does research on both living and non-living components inside caves, as well as the dynamics that exist among them.

The cave research program has behind it a powerhouse of young experts: Phillip Alviola on cave vertebrates; Ivy Amor F. Lambio and Annalee S. Hadsall on cave plants or cave flora; and Dr. Marian P. De Leon, a pioneer in cave microbiology, and her team are working on isolating Staphylococci from the oral and anal cavities of bats, microorganisms, particularly E. coli, from standing and dripping cave waters, and in soils and guano.

Dr. Lit leads the cave arthropods research team. Dr. Leonila Raros, Professor Emeritus, studies cave mites while Dr. Aimee Lynn B. Dupo works on cave spiders and moths. Prof. Sheryl A. Yap works on cave hoppers and ground beetles while thesis students have so far done research on cave cockroaches, crickets, millipedes, lice, and wasps. Dr. Daniel Edison M. Husana also used to be on the team as the expert on stygobionts or animals that live only in groundwater such as in caves and crustaceans.

MNH has already conducted expeditions in major caves in the Philippines, including the Cavinti Underground River and Cave Complex, the caves in Polillo Island, in Palawan, and in other areas around the country. Dr. Lit is also developing general cave biodiversity assessment techniques that regional cave committees can easily and quickly use. The MNH has also launched the Museum Publications in Natural History to feature journal articles on studies on cave ecology.

Institutionalizing cave ecology instruction

"We need to develop people who are knowledgeable about caves so that regional cave committees could get the information that they need from them," Dr. Lit said. Dr. Lit and his colleagues first introduced instruction in cave ecology through a special topics course (BIO 191) in the second semester of AY 2009-2010. The course has already produced five batches of students.

The MNH welcomes students, faculty and staff members, as well as representatives of other institutions who want to join the annual cave expeditions that it conducts under the cave research program.

The special topics course on cave ecology became a full-fledged course called BIO 154 or Cave Ecology, the very first formal course on cave ecology in the country to be offered by an academic institution.

By trailblazing in cave education research in the country, UPLB is opening up opportunities to new knowledge on biodiversity to be revealed.

Bird Photography 101 with Dr. Segfredo Serrano

By Joseph Lydio R. Roble III
Photographs by Dr. Segfredo Serano and Isagani Serano

> “Bird photography isn’t just about taking the usual snapshot. The skills required in this type of photography are quite different from the set of skills demanded by portrait photography or street photography.”

All kinds of wildlife, including migratory birds makes UPLB a magnet for bird enthusiasts and photographers. One of the better known photographers is a local who has shared with us some tips or insights that he himself learned through years of expressing his passion for birds and bird watching through photographs.

"Bird photography isn't just about taking the usual snapshot. The skills required in this type of photography are quite different from the set of skills demanded by portrait photography or street photography," says Dr. Segfredo Serrano, Undersecretary of Agriculture. He spearheads the Department of Agriculture's research and development efforts and partnerships with other universities.

An advocate of preserving nature and wildlife, especially birds, he takes to the plains every weekend morning to take photos of the birds in areas surrounding Mount Makiling. "I aim to document these birds – how they live, how they survive, what they look like – so that when they go extinct, we'll have photos to remember them by." Dr. Serrano also talks about his experiences in bird photography and uses the photos as a means to educate the people about the dwindling number of birds and bird species in our country. He also shares with them the following tips on how to become a good bird watcher and photographer:

1. Try watching birds before photographing them.

Bird photography is an expensive hobby because of the tools needed. The best thing to do is try to get a taste of being with the birds first. See how they react to human presence, how close you can get to them and the time of the year when they appear in the different parts of the country. While familiarizing yourself with these birds' behaviours, try reading up on them, as well. This wealth of information will come in handy when you are in the field, trying to photograph them.

2. Respect the wildlife.

This could not be emphasized. Spending time with the birds means being in their territories. Their territory is where they hunt, raise their young, and establish their homes. Leaving traces of your presence in this area may affect how the birds live in the long run. Clean up your garbage, make minimal noise and do not get too close to the animals.

In addition to this, avoid using artificial animal calls. Many bird watchers and photographers use fake animal calls in order to coax a reaction from the birds, unknowingly destroying the balance in the area and sometimes even increasing the chances of getting the birds killed. This is because when birds are hiding, it is because there is a danger or they must rest. By creating a fake bird call which could mean that there is danger or that there is a possible mate, the birds expose themselves to the elements that they were avoiding in the first place. At the very least, such methods induce unnecessary stress to the birds, particualrly the territoral ones.

3. Control your spending.

"Bird photography equipment is expensive" says Dr. Serrano, and indeed, the gear required in this field is expensive, thus his emphasis on the need to control spending. "Spend on cheap equipment and as you gain in skill, work your way up. A standard camera with good zoom power and minimal loss at full zoom will do. By buying equipment this way, you are able to purchase only the equipment that you really need," he added.

Bird photography is as relaxing as it is educational. It allows for a good break – to get away from the noise of the city, take nature in and keep the memories with a quick press of the shutter button. "It helps me a lot," adds Dr. Serrano. "It helps me focus. In my line of work, knowing when to seize the opportunity is crucial. I learn a lot from the birds, especially the raptors who sit there, waiting, keeping an eye on the prey and when the time comes, they swoop and snatch the prey up and out of its feet. One false move and if the prey gets away, the raptors go hungry. Same with me; one wrong move and a lot of us will go hungry," said the key government official whose portfolio include the country's agricultural policy, planning, research and development, and regulations.

Preserving the beauty that is Mt. Makiling

By Jessa Jael S. Arana
Photograph by Karl C. Cadapan

It has been three years since the Mt. Makiling Forest Reserve (MMFR) was declared the 33rd ASEAN Heritage Park in 2013, the fifth natural reserve to be given the title in the Philippines.

The ASEAN Heritage Parks and Reserves is a project initiated by the Southeast Asian group of countries to conserve and protect their respective natural resources. Natural reserves possessing "uniqueness, diversity, and outstanding values" are recognized as such so that their importance as conservation areas can be more widely known.

Makiling's gift of life and beauty

According to recent studies, Mt. Makiling supports more than 2,000 known plant species and various animal species, 62 of which are considered endemic to the Philippines, such as the Philippine eagle owl (*Bubo philippinensis*), the Philippine pygmy fruit bat (*Haploncyteris fischeri*), and the Philippine monkey (*Macaca fascicularis philippensis*). More species continually being discovered in its forests, a further testament to the natural reserve's rich and diverse ecosystem.

Possibly related to its significance in biodiversity conservation is the value of other ecosystem services that Mt. Makiling provides, some of which we do not give a second thought to until they are gone. For instance, have we ever imagined not seeing a verdant Mt. Makiling as we approach Calamba from the South Luzon Expressway? Perhaps, never, but it is definitely a sight that welcomes us from the smog and pollution of Manila. Mt. Makiling also has cultural ecosystem services as a landscape and as a symbol of Laguna. This and other ecosystem services, some experts contend, may be related to biodiversity conservation, and thus forest management and administration that UPLB has been undertaking for the past 25 years.

Full knowledge about and appreciation of Mt. Makiling's ecosystem services may encourage more support and stronger commitment from people to pitch in to help ensure its maintenance and conservation. The Makiling Center for Mountain Ecosystems (MCME), the University's front liner in the management of the MMFR, has continually undertaken steps to increase community awareness of the ecosystem services of the MMFR in order to elicit enhanced support towards its conservation and preservation.

Energy and water source

Mt. Makiling is an inactive volcano that rises 1, 090 meters above sea level and is a source of geothermal energy and fresh water, both of which are utilized by surrounding industries and communities. Mt. Makiling provides water to several irrigation systems, hydroelectric dams, and domestic and industrial watershed systems. Its proximity to Laguna de Bay, one of the largest fresh water lakes in Asia, makes its landscape all the more unique.

As a natural watershed, it cushions the area from adverse climatic changes and provides a sanctuary for wildlife, allowing them to thrive in favorable conditions. Makiling's rich forest is also a source of raw natural products such as water, timber, forage, fuelwood, wildlife, and other forest or plant products.

Naturally rich soil erodes from the mountain, creating fertile plains ideal for farming. Locals are highly encouraged to cultivate diverse crops and fruits trees since buyers from nearby cities and provinces can easily travel to the region, allowing for several market opportunities.

Ecotourism, climate change mitigation and seat of S&T research

The mountain also ranks as one of the Philippines' 32 key ecotourism sites and is famous among tourists and nature lovers for its scenic views, exquisite flora and fauna, and relaxing natural mud and hot springs. For city folks longing to unwind for the

> "Mt. Makiling plays a significant role in managing climate change. Its forests act as a carbon dioxide basin, helping clear the air of excess carbon dioxide and mitigating its adverse effects on the atmosphere and the oceans."

weekend, Mt. Makiling can be an ideal destination since it is just a few hours' ride away from urban centers.

Aside from these, Mt. Makiling plays a significant role in managing climate change. Its forests act as a carbon dioxide basin, helping clear the air of excess carbon dioxide and mitigating its adverse effects on the atmosphere and the oceans, such as global warming and ocean acidification.

Makiling's natural landscape has also made it very accommodating to research institutions, with its forests acting as an outdoor lab for researchers. International and local institutions such as the International Rice Institute (IRRI), the ASEAN Center for Biodiversity (ACB), the Philippine Council for Agriculture and the Aquatic and Natural Resources Research and Development (PCAARRD), and UPLB, have established their bases at the foot of Mt. Makiling and have turned it into a center of discovery and education.

Conservation efforts

As an ASEAN Heritage Park, Mt. Makiling adheres to the maintenance standards and goals set by the ASEAN Expert Group on the Environment (AEGE) and ASEAN Experts in Nature Conservation (ANC).

As the main overseer of the conservation efforts in Mt. Makiling, MCME commits itself to developing and propagating knowledge on conservation and sustainable development in partnership with local mountain communities.

MCME's researches cover conservation science, forest science, tropical forest science, and ecotourism. Close observation of Makiling's trees also helps them gauge the status of the Makiling forest, allowing researchers to discover its role in climate change and determine its resilient species.

Eliciting support for conservation efforts

Preserving a whole mountain simply cannot rest on a few people's shoulder's. MCME recognizes that to effectively protect Mt. Makiling. They must work together with Makiling's stakeholders.

"We want to reach as many people as we can and tell them what we're doing," said Dr. Nathaniel Bantayan, director for MCME.

To make their research known, MCME makes use of printed media, such as technical journals, field guides, guide books, and coffee table books, and also provides download links in their website mountmakiling.org, and in other social media such as Twitter and Facebook.

Dr. Bantayan also discussed the collaborative conservation efforts of MCME with the nearby communities. "We call it 'CNRG' (pronounced as "synergy")", Dr. Bantayan says. CNRG is an acronym for "collaborative natural resource governance", indicating that everyone is a stakeholder.

Through CNRG, MCME engages the community as partners and friends, making them active protectors of the resource as well.

Dr. Bantayan considers the collaborative effort with organizations within and around Mt. Makiling to be essential to the survival and sustainability of the mountain. Citing examples such as landslide and flood prevention, Dr. Bantayan adds, "You benefit from Mt. Makiling. You may not realize it, but you do. So it is your responsibility to protect it."

Post-AHP

Since being declared an ASEAN Heritage Park in 2013, Mt. Makiling has received generous resources from government organizations such as the Department of Environmental Resources (DENR) and the Department of Tourism, with more corporate partners coming in. "[Every big company] wants to be associated with it. And you just realize, its branding. If you have branding, people will fall in line and want to join you," Dr. Bantayan said.

While the AHP title has been a great achievement, MCME still has a broader vision for Mt. Makiling. At the moment, its next target is to be a UNESCO World Heritage Site. According to Dr. Bantayan, it could be Mt. Makiling's ultimate achievement.

As one of the many steps, MCME has, for the past two years, been in talks to be included in the Office of the Chancellor's sub-units. "We are a small unit handling a very big responsibility. There's an imbalance," Dr. Bantayan says. "We want to have that stature that can enable us to deal with more partners, as part of the Office of Chancellor. It's exciting."

In line with this, MCME is also in the works of becoming the Philippine Center for Tropical Forest Science (PhilTROP), one of UPLB's several interdisciplinary centers. Next year, its new building will be completed.

Despite rapid urbanization around Mt. Makiling, Dr. Bantayan said that the MCME is positive that this will not be a hindrance to achieving the UNESCO title. Instead, Dr. Bantayan sees urbanization as an opportunity to look for new conservation advocates. As an example, Dr. Bantayan cited Central Park, a beautiful garden in the middle of highly urbanized New York. "There are a lot of examples around the world, and Mt. Makiling can be at par, or even better than all of these," he said.

"Visit Mt. Makiling!" Dr. Bantayan implores. "It's small, but it's the best place to be."

MBG

A Not So Secret Garden

Written by Mark Jayson E. Gloria

Photographs by Karl C. Cadapan and Christopher V. Labe

Maria Makiling's garden in UPLB, aptly named Makiling Botanic Gardens (MBG), is not a secret to anyone. Unlike Mary Lennox's "secret garden" in the classic novel "The Secret Garden" by Frances Hodgson Burnett, one does not need to find a rusty old key to enter its premises. Its tall brown gates will be opened to anyone who is interested and willing to pay a student-friendly fee that goes to its maintenance.

Unlike the dry and gloomy environment of the Secret Garden that greeted Mary, MBG delights its first-time visitors with blooming flowers, tall trees, crawling insects, and chirping birds. If Mary deemed, at first, that her Secret Garden was dead, this Botanic Gardens' visitors could easily tell that it is alive and marvel at its lively biodiversity.

Flamboyant Petals and Trustworthy Trunks

"MBG is a unique garden because it is the only botanic garden in the Philippines that started as a natural forest," said Dr. Manuel Castillo, former deputy director of the Makiling Center for Mountain Ecosystems (MCME), the CFNR unit that is responsible for overseeing the MBG. "It is an example of an *in-situ* botanic garden," he added. In-situ conservation avoids the manipulation of the original vegetation and physical features of the environment. Only a small portion of MBG has been improved such as putting in of hardscapes like tables, chairs, and structures such as the pavilion and other amenities.

Near the entrance, the Rainforest Biodiversity Diorama houses an exhibit of the rare flora and fauna in the MMFR. Growing in profusion nearby are wild ornamental plants, some of which are already listed as "Critically Endangered Species" and "Endangered Species" by the Department of Environment and Natural Resources (DENR) Administrative Order No. 2007-01. Among these flowering species are the Kapa-kapa (*Medinilla magnifica* Lindl.) and Jade vine (*Strongylodon macrobotrys* A Gray). Another beautiful flowering plant species is the fuchsia-colored Rose of Venezuela (*Brownea grandiceps* Jacq.).

On the right side of the entrance is a picnic site – the Tree World – a theme garden that showcases trees that have industrial uses including Tuai (Bichofia javanica Blume), White lauan (Shorea contorta Vidal), and Bitanghol (Calophyllum blancoi Pl. & Tr.). The Tree World also features tree species with notable flowers, such as the bat flower (*Tacca chantrieri* Andre) that bears guess what, bat-looking black flowers; and the Hong Kong tree (Bauhinia blakeana Dunn.), on which the floral emblem of Hong Kong is based.

On the upper left part of the Tree World is a theme garden that overlooks Molawin Creek, the Philippinensis Plants Row. Among the endemic Philippine trees that grow in this theme garden are Malapinggan (*Trichadenia philippinensis* Merr.), Magabuyo (*Celtis luzonica* Warb.), Katap (*Trigonostemon philippinensis* Stapf.), Philippine Teak (*Tectona philippinensis* Benth. & Hook.f.), and the critically endangered Kamagong (*Diospyros blancoi* A. DC.) and Smooth narra (*Pterocarpus indicus* Willd. forma indicus).

Heart of the Wilderness

Beyond the recreation area and the theme gardens of MBG is a plantation of various tree species. Approaching the ecotrail farther from the Tree World and Philippinensis Plants Row and beyond a natural pool and mini falls, is the Molave Plantation that features the Molave (*Vitex parviflora* A.L. Juss.). One has to cross the shallow waters and huge rocks of the Molawin Creek to be able to reach this natural theme garden, which is the oldest plantation in the MBG, having been established in 1912.

Another theme garden is located towards the end of the Philippinensis Plants Row - the Dipterocarp Arboretum. It harbors about seven genera and seven species of the family Dipterocarpaceae, which is the best known family of the tropics, Dr. Castillo said that MBG has around 22 species of dipterocarps.

Among the species found here are the cliff-hanging Bagtikan (*Parashorea malaanonan* (Blanco) Merr.) and the sunlight-seeking Guijo (*Shorea guiso* (Blanco) Blume). The enormous height and width of these tree species are testament to their age. The arboretum also features young dipterocarp species planted recently with the help of MBG's partner institution, Isuzu, including the Apitong (Dipterocarpus grandiflorus), Almon (*Shorea almon* Foxw) and Manggasinoro (*Shorea assamica* Dyer).

The dipterocarp arboretum is also home to the sub-theme garden of Palmetum, which features different species of palm trees, both endemic and exotic to the country. Native to the Philippines are the species Anahaw (*Livistona roduntifolia* (Lam.) Mart.), Manila palm (*Adonidia merrillii* (becc.) Becc.), and Mono" (*Areca camarinensis* Becc.). It also features introduced palm species such as Balatbat bilog (*Licuala grandis* H. Wendl.) native to Pacific island nation of Vanuatu, and northeastern Australia's fox-tail palm (*Wodyetia bifurcata* A.K. Irvine).

The farthest, and perhaps the wildest theme garden is the "MBG Natural Forest." Among the endemic tree species in the Dipterocarp Arboretum are Bagang-aso (*Anaxagorea luzonensis* A. Gray), Kamagong (*Diospyros blancoi* A. DC.), Kuratan *(Linociera philippinensis* Stapf.), Malakmalak (*Palaquium philippinense* (Perr.) C.B. Rob.), and White lauan (*Shorea contorta* Vidal).

MBG is also home to some of the biggest and smallest flowers in the world. One is the famous Malaboo (*Rafflesia manillana* Teschem.), which belongs to the family of Rafflesiaceae, the same family in which the world's largest flower, *Rafflesia arnoldii*, belongs. On the other hand, the miniature orchid *Thrixspermum robinsonii* named and discovered in the country a century ago still blooms in the forest's wilderness.

Disseminating Knowledge on Forest Science

MBG serves as an indispensable, and perhaps unparalleled, laboratory for students of CFNR.

"Many of the laboratory classes are being conducted inside the botanic

gardens, especially in our core course in Taxonomy of Forest Plants," said Dr. Castillo, who is a faculty member at the Department of Forest Biological Sciences.

According to Dr. Castillo, MBGs researchers study the phenology, seedling survival, and tree pests and diseases to ensure the continuity of endangered species inside the garden.

Exotic species from other tropical countries thrive inside the MBG. "Most of the (exotic) species were brought by the faculty and researchers from abroad, because they wanted to improve our germplasm and enhance the beauty of the garden," recalled Dr. Castillo. This was during the time when it was easier to transport plant species among countries.

Among the exotic tree species that have added color to MBG, are the yellow Thailand shower (*Cassia fistula*); the red orange Saraca(*Saraca declinata* L.) found in India; and the bright pink Amherstia (*Amherstia nobilis* Wall.) from Myanmar. Among the notable introduced trees in MBG are the orange Fire tree (*Delonix regia* Boj. ex Hook. Raf.) ubiquitous in South America and the Caribbean; the pink-flowered Rain tree (*Samanea saman* (Jacq.) Merr.) found in Mexico and Hawaii; the medium-sized tree with flowers of pink shades and tint Kakauate (*Gliricidia sepium* Jacq. Kuntn ex Walp.) that is native to South America; the sturdy big/large leaf mahogany (*Swetenia macrophylla* King) endemic to tropical Latin America; and the pine tree Norfolk Island pine (*Araucaria heterophylla* (Salisb.) Franco) endemic to Australia.

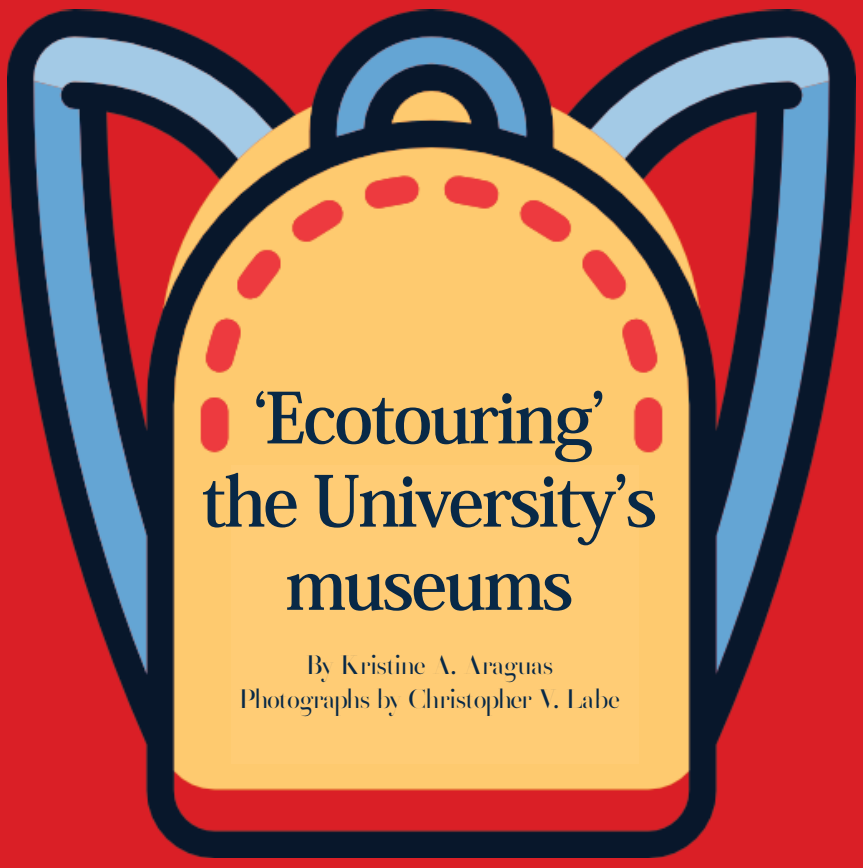
Disclosing Plans for the Future

MBG was created through Republic Act (RA) 3523 signed by the late President Diosdado Macapagal in June 1963. RA 3523 authorized the then College of Forestry (CF), later renamed as the College of Forestry and Natural Resources (CFNR) to establish the MBG "for the purpose of supporting professional instruction and research relating to forestry and plant sciences generally and for serving the needs of tourists as well as the educational and recreational needs of the general public."

CFNR is not alone in the endeavor to maintain and develop the MBG. With the strong support from the DENR, the proactive spirit of international organizations like GIZ and the ASEAN Centre for Biodiversity, and some private companies' willingness to help, MBG is on its way to becoming a more beautiful garden.

Indeed, MBG is not a secret garden. With almost 500,000 visitors for the past seven years, more and more people within and outside UPLB have touched the clean water, and breathed the fresh air of MBG. With this nature's gift, the garden's beauty is not a secret to be kept, nor a jewel to be owned by few. Instead, MBG is a garden to be explored, revisited, remembered, and nurtured.

It's more fun at UPLB



'Ecotouring' the University's museums

By Kristine A. Araguas
Photographs by Christopher V. Labe

Armed with curiosity and childlike wonder, Horizon's Kristine Araguas takes us on a trip to three museums in UPLB where she goes into each nook and cranny of these uncommon but highly educational places that students and conservationists should one day include in their itinerary.

UPLB is a weekend getaway for the harried urbanites looking to a break from their fast paced life in the big city. With the green and lush surroundings, the occasional colors peeking out from flowering trees inside the campus, and the quiet interrupted only by the cacophony of bird calls, the place is absolutely paradise after the pandemonium that is Manila.

It has also long been a destination of choice for researchers and students of science and those on the lookout for technologies and information on agriculture, biotechnology, environment and natural resources management.

On the list of frequently visited places in UPLB are its museums/collection centers where our natural history has been painstakingly documented. These are the Museum of Natural History, Anatomy Museum and the Parasite Collection Center.

Museum of Natural History (MNH)

Located in the Forestry campus, the MNH is the most visited place in UPLB. Established in 1976, it is housed

in an old building in the midst of a grove of trees.Visitors are immediately welcomed at the entrance by an exhibit showing how the museum came to be – from the people who were instrumental in its establishment to the implements that they used over the years.

The MNH is organized into different sections: Botanical Herbarium, Entomological Museum, Forestry Herbarium and Wood Collection, Hortorium, Microbial Culture Collection , Mycological Herbarium Zoological Section, and the Wildlife Museum.

The Botanical and Forestry Herbarium and Wood Collection feature different wood products in the Philippines, the range of sizes/species of bamboo in the country, and products that can be made from them. The Hortorium section shows a replica of the plant kingdom and a forest.

At the Mycological Herbarium Zoological section are various kinds of fungi and mushrooms with interesting facts about them. The section also shows the scientists who contributed to the collection.

The Wildlife Museum features a diorama with almost 15,000 stuffed birds and mammals. These dioramas are taken care of by the museum artists who were also the ones who preserved the animals. They have seen first-hand what the caves look like in the natural setting during their field visit and are thus able to recreate the habitat in the diorama.

Parts of the exhibit show preserved animals that one does not see on a daily basis. Reptiles, specifically cobras, are preserved in a jar, and stuffed rats and amphibians, seemingly alive, are also on display. What makes the diorama seem real are the glossy swiftlets that fly around, having set up residence in the Museum's ceiling.

Other interesting features of the exhibit are the rock collection, minerals and animal fossils, the collection of Philippine insects including cockroaches, praying mantis, walking sticks, and leaf insects. At the entrance are live insects on display. Butterflies have also been preserved, collected and arranged according to their sizes.

Probably the most memorable section of the MNH is the Fetus section. The fetuses represent different stages of development from 1 to 2 months until 7 to 8 months old. Each time I see them, I wonder why they failed to develop fully. The answer would stay with them forever in their bottled up world.

The MNH is open to the public on weekdays from 8am to 5pm with an entrance fee of 10 pesos for students in preschool to Grade 6 and 20 pesos for high school students and adults. Proceeds from the entrance fees are used for the maintenance of the Museum.

Anatomy Museum

A visit to the Anatomy Museum at the College of Veterinary Medicine (CVM) houses body parts and the skeletal system of various animals.

It features animal fetuses collected by students and researchers in Teratology or the scientific study of biological abnormalities and malformations. The Anatomy Museum showcases several cases of these abnormalities such as abdominothoracophagus twins of a cow whose abdomen and thorax were fused, and aborted twin fetus of a monkey, and cyclopia or "one eyed monster" abnormality in a cow. The museum also exhibits other animals with abnormalities, most of them in the fetal stage. The museum's curator, Dr. Joseph Olarve, said that the Anatomy Museum's Teratology collection had been featured in national TV documentaries.

It also has a collection of skeletons of mammals including a cow, goat, tiger, horse, sheep, carabao, and a false killer whale as well as internal parts of animals such as a dog's thorax showing its nerves, blood vessels and heart, Philippine carabao's innermost utero-ovarian blood vessel, a cow's reproductive tract, a horse's heart, and an ox's kidney. In a nearby section of the Anatomy Museum are skulls – a cat's small cranium, a carabao's huge braincase, and a cow's skull that looks like it is grinning with all its teeth intact. The collection is still used by veterinary medicine students.

The Museum also displays different kinds of animal skins that, according to Dr. Olarve, underwent a procedure called "tanning", which is also done in leather-making.

There is a certain consistency between the collection at the MNH and the Anatomy Museum – the details and the packaging seem to have been derived from the same craftsmanship. This is because the MNH artists-cratfsmen also did the preservation process for some of the Anatomy Museum's displays.

Befriending parasites at the Parasite Collection Center

A stone's-throw away from the Anatomy Museum is the Parasite Collection Center (PCC). Still within the CVM complex, the PCC completes the experience of learning about animal life. Putting it at the bottom of the itinerary in visiting the three museums, is logical. After all, parasites are the usual cause of death of animals.

The parasites on display date back as far as 1989. These organisms had been accumulated from CVM's research and collection activities. Students have also contributed much to the Center, with a number of species derived from their projects. CVM alumni also continue their tradition of expanding the parasite collection through occasional donations.

The photographs of animal parasites in the display area are only teasers to what lies ahead at the core of the Center. Passing through these photos are actual organisms, including worms and insects that were painstakingly preserved through the years.

Majority of the parasite samples are stored in a labeled glass although some, for which the Center's curators should be commended, have been showcased lodged in the host animal body parts. Such is the case of the stomach worm that thrives in a pig's abdomen; the heart worm that parasitizes a German shepherd's heart; and the aortic worms that have conquered an aorta of a water buffalo. These exhibits are properly curated and secured in a glass display, hence visitors need not worry about being exposed to any disease.

Replicas of different kinds of parasites are also featured at the PCC. One of the most attractive among the replicas is that of a cobra attacking a squirrel.

The Center is open to the public during weekdays from 9am to 4pm. An entrance fee of 5 pesos for children and 10 pesos for adults is required for the maintenance of the facilities. The Center also welcomes donations for improvement of the collection.

Museums and collection centers such as the three are important especially with more species getting endangered and extinct in the wild. They have become even more important in ensuring that the present species are preserved for the knowledge that they provide.

So do you want to know more about our natural history? An adventure in UPLB is called for.

(K.E. Araguas with reports from MNH and the Parasite Collection Center)

Journey to the Insanely Beautiful Sibaliw

Text and Photo by James DV. Alvarez

"A 5-hour walk, 13 river crossings, countless cobras and vipers" - the description initially formed a picture in my mind of the research facility in the island of Panay.

Back then, it had already challenged my spirit for discovery and passion to learn more about our biodiversity.

So I immediately relented when I was invited by the Panay Eco-Social Conservation Project leader, Dr. Eberhard Curio, professor at the Ruhr University Bochum in Germany, on a trip to far-off Sibaliw.

Dr. Curio had come to UPLB as a visiting professor at the Institute of Biological Sciences, and had led interesting class discussions on conservation, invasion biology and wildlife management. With Phillip Alviola, curator at the Museum of Natural History and faculty member at the IBS, researcher Jeremy Carlo Naredo and two of my classmates, Camila Meneses and Neil Jun Lobite, we took on the challenge to visit Sibaliw.

Very early in the morning, we flew to Caticlan, Aklan. From the Caticlan airport, it took us an hour's drive to reach the headquarters of PanayCon in Pandan, Antique. While we waited for Cam and Neil who were on a later flight, we took in the cool breeze at the Pandan Beach Resort and enjoyed cold drinks and mouthwatering food.

Our second day marked the start of a 4-hour trek, negotiating surging rivers, deep ravines and huge rock boulders.

Just before we arrived at the jump-off point, heavy rains started to pour. But not even the rain was able to stop us from reaching the station. The trek was very challenging, but our local guides were very helpful in making sure that we would not be slowed down. Since the trail was extremely difficult, Prof. Curio and his guides used an alternate but time-consuming route.

It was still raining when we reached an old bunkhouse right in the middle of the vast forest. We were all cold and wet, but hot coffee welcomed us and so did a pair of charming Visayan writhed-bill hornbills - critically endangered birds you will find nowhere else in the world but in the islands of the Negros and Panay. Seeing them up close was already worth the tiring journey. Inside several cages were pairs of Visayan Tarictic, birds found only in Panay Island, and indeed a gem for birders and wildlife biologists.

After taking a brief rest, we conducted activities that focused on different interests. While I helped Neil and Prof. Alviola in mist netting and collecting insect-eating bats, Cam surveyed tree holes in search of an elusive Kaloula species while Jeremy observed the behavior of carpenter bees in reaction to dummy spiders.

Using our mist nets, we documented four bat species, namely: Arcuate horseshoe bat (*Rhinolophus arcuatus*), Philippine pygmy roundleaf bat (*Hipposideros pygmaeus*), Philippine forest roundleaf bat (*Hipposideros obscurus*) and Philippine musky fruit bat (*Ptenochirus jagori*). The latter three species are found only in the Philippines. The island is home to a number of unique mammals that are yet to be studied, some known only by their name.

The forest is also a sanctuary for frogs and reptiles. We encountered many species just outside the bunkhouse, including the beautiful but deadly Philippine pit viper (*Trimeresurus flavomaculatus*). The persistent chorus of frogs, including from those found only in the islands of Panay and Negros - the *Platymantis negrosensis* and *P. panayensis* – rang in our ears wherever we went.

Our search for frogs was filled with excitement that we might just find the undescribed species of Kaloula which has only been heard but has never been seen. The elusive Kaloula makes two sounds, a "pak-pak" and a long and loud "tong," but would stop croaking when they sense movements or light.

Insects and other arthropods, which constitute the most number of species in the biodiversity of life, are also abundant in the area. Wasps were constant visitors inside the bunkhouse and their nests were all over the place — on the walls, ceiling, and even on the clothesline. The diversity of stick insects, cockroaches, grasshoppers and spiders in the place is beyond amazing. But the insect that most fascinated me was the Majangella praying mantis, that is often perfectly camouflaged by the moss that cover the tree trunks. For entomologists, finding the Majangella may be commonplace, but for a wildlife biologist like me, it is such a delight.

Staying inside the forest felt heavenly because it is a sanctuary of rich floral and faunal diversity; a zen for people who want to study biodiversity in the hopes of helping conserve it for the future.

It is a perfect venue to arouse and satisfy scientific curiosity and the search for knowledge. No doubt it is the same reason why this foreign scientist, Dr. Curio, fell deeply in love with the forests of Panay.

A lot of research work remains to be done in Sibaliw, which is just a small fraction of the vast forests of the Philippines. What we saw was just a snippet, a snapshot of a time and place that will never be enough to capture this beautiful and biologically diverse place in words. There will always be a reason to come back.

In Broad Strokes

MMFR

A showcase for biodiversity conservation

Dr. Fernando C. Sanchez, Jr.

> "The MMFR is a very important watershed, providing water for irrigation, as well as for industrial and domestic purposes."

The sight of a verdant and lush Mt Makiling as one drives from Manila's concrete jungles towards the Calamba tollway is not only refreshing – it is reassuring – that this last frontier of biodiversity in this part of the country still stands proud and magnificent against the onslaught of urbanization and population pressure.

Credit UPLB for holding strong against people and even institutions that have cast more than greedy glances at Mt. Makiling. For 56 years now, UPLB has held strong. Some of its men have paid with their lives, and many a times, UPLB personnel have lugged documents containing argument and evidence to the lower house and the Senate to avert the fragmentation of Mt. Makiling.

UPLB's campaign has not failed to earn support from important organizations, the most recent of which is the Association of Southeast Asian Nations (ASEAN) that declared it as one of only 37 heritage parks in the region and of eight in the Philippines. This is a testament to the dedication of all the people and institutions who have worked together to conserve and safeguard it. The most significant outcome of the MMFR's inclusion as an ASEAN Heritage Park is the government's full support to reforestation and protection of the park.

The mountain has always been synonymous with UPLB, even before sole stewardship was formally entrusted to the University. After all, UP established an agriculture and forest school at the foot of Mt Makiling in 1909, and was given the responsibility to manage the mountain in 1960. By virtue of RA 3523 and RA 6967, the University was given the exclusive jurisdiction and administration over Mt. Makiling to serve its primary purpose as a training laboratory for instruction, research and extension.

Renowned for its enchanting beauty and cultural relevance, and widely regarded for its enormous biological diversity and genetic resources, Mt. Makiling has an exceptional collection of woody plant species, totalling more than the entire number of woody species found in the United States of America. In 1977, the late Dr. Dioscoro Rabor, an award-winning zoologist, reported at least 50 species of mammals, 120 bird species, six species of amphibians, 19 types of reptiles and several varieties of fish inhabiting the reserve. It also contains more than 7, 000 insect species.

The MMFR is a very important watershed, providing water for irrigation, as well as for industrial and domestic purposes. It supplies water to five water district authorities, and an indeterminate number of business establishments, government offices and other institutions. It serves as lungs for this part of the country as it purifies the air. A very important contribution of the MMFR is that it stores enormous quantities of carbon that if let loose in the atmosphere, could cause further havoc to our weather and climate systems.

The list of benefits we get from a green Mt. Makiling goes on and on, and for as long as UPLB holds administrative jurisdiction over it, we will exert concerted efforts, along with the stakeholders, to conserve and protect it. UPLB, the steward of Mt. Makiling, will continue to hold a distinction for biodiversity conservation and protection of the only remaining intact forest within a short distance from Manila and one of the few heritage parks in the ASEAN region.

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