I. The Establishment of the Center

In May 2000, under the direction of President Yuan T. Lee and Dr. Peter Raven, a member of the U.S. National Academy of Sciences, Academia Sinica hosted an “International Symposium on the Future of Biodiversity in Taiwan.” The purpose of the meeting was to discuss ways to comply with the objectives of the international “Convention on Biological Diversity,” i.e., to stem the tide of species extinction, gene disappearance, resource reduction, and ecosystem degradation, and to sustain Taiwan’s resources and its socio-economical development. It was suggested at the meeting that the government should create a Biodiversity Committee to devise feasible plans and put them into action and that Academia Sinica should establish a Biodiversity and Ecology Institute. This institute would emphasize basic academic studies on systematics, ecology, evolution, and conservation. It would also cooperate with industries, government agencies, and academic institutions to promote work in biodiversity-related research, conservation, and education.

As early as May 1998, Dr. Shang-Fa Yang, ex-vice president of Academia Sinica, began to push for the reorganization of the six life sciences institutes. A new institute with personnel from the institutes of Zoology and Botany who specialized in ecological studies was proposed. However, the proposal was not implemented since the colleagues at the time could not come to a mutual understanding. In 2001, the Legislative Yuan approved revisions to the Constitution of Academia Sinica, legalizing the founding of new multi-disciplinary research centers. With the understanding that the structures of the original institutes would not be affected, it was finally agreed that a new Research Center for Biodiversity should be established. President Lee in the same year requested Dr. Kwang-Tsao Shao, then the Director of the Institute of Zoology, to begin planning for the Center. After two years of effort, with the support and guidance of President Lee, Dr. Sunney I. Chan (ex-Vice President), and Dr. Michael M. C. Lai (the current Vice President), a formal Plan was presented to Academia Sinica in September 2003. The Plan passed the Affairs Meeting on October 1 and the Council Meeting on November 1, and was sent to the Legislative Yuan and the Office of the President for approval on November 10. On January 1, 2004, the Center was officially founded with Dr. Shao as its acting director. A new Director is currently being recruited.

At the beginning, it was thought that the Center would be a completely new organization, all its research personnel would be new recruits, and the 17 biodiversity-related researchers from the institutes of Zoology and Botany would be jointly hired. Nevertheless, to facilitate Academia Sinica’s continuous effort in reorganizing the life sciences institutes, the 17 PI’s agreed at the end of 2003 to formally move to the Center in January 2005. Furthermore, to enable the Center to function as soon as possible, Academia Sinica in 2003 started to provide funds for pioneering and integrated research projects, including the exhibition on the biodiversity of Lanyang at the Institute of Zoology’s Marine Research Station at Jiao-Shi. It also provided money, beginning in 2004, to officially sponsor the Center’s inter-institution
and mission-oriented research projects and the Center’s many international conferences. To make sure that the Center’s future development will head in the right direction, an Advisory Board was formed at the end of 2003. The Board is co-chaired by Dr. Wen-Hsiung Li, an Academician, and Dr. Peter Raven. Its nine overseas and two domestic members are all top experts and leaders in the field of biodiversity research. The first Advisory Board Meeting was held in March 2004. The Center’s infrastructure and future research focuses were examined at the meeting and 28 suggestions and expectations were submitted after the meeting.

II. The Mission of the Center

Since Taiwan is not a member of the United Nations, it cannot pledge to the “Convention on Biological Diversity.” As a result, Taiwan cannot join 188 other countries to become a member of the world’s largest convention organization. Nonetheless, as indicated below, biodiversity research not only has become a global trend in the past twenty years, it has also become the most urgent issue regarding Taiwan’s sustainable development:

A. International Trends

In the 21st century, biodiversity research and gene technology are the two most important fields in the domain of life sciences. Biotechnology applies the methods of molecular biology and biochemistry to study life at the gene and species levels so that more food can be produced and medical techniques can be further improved. Biodiversity research elucidates the origin of life, evolution, and sustaining mechanism at the gene, species, population, community, and ecosystem levels. Most importantly, it tries to understand and catalog all the life on earth, determine the main reasons for the rapid extinction of species and to find ways to amend this situation so that the earth’s ecosystem and environment can be restored to a healthy state and the resources can be utilized evermore. Therefore, biotechnology and biodiversity research complement one another; neither is dispensable.

B. Domestic Necessity and Urgency

Even though Taiwan is a small island, occupying 0.03% of the earth’s land area, it is located in the region with the world’s greatest biodiversity. Taiwan’s latitudinal extent covers both tropical and subtropical zones; its range of altitude covers both high mountain and deep sea environments. With such a diversity of environment, climate and habitats, it is no wonder that Taiwan’s organisms are much diversified. There are more than 50,000 recorded species and between 100,000 and 150,000 organisms waiting to be discovered and named in Taiwan. Of these, a great proportion is endemic, i.e., species that are only found in Taiwan and nowhere else in the world. Hence not only is this natural heritage Taiwan’s pride, but the care of it is also Taiwan’s responsibility. The extinction of any of these organisms resulting from a lack of protection will be Taiwan’s shame. Additionally, Taiwan will lose a heredity resource that has great potential for development. Out of 4,000 vascular plants, one quarter are endemic; out of 300 resident birds, one sixth are endemic; out of 70 amphibians and 90 freshwater fishes, one third are endemic; and out of 30,000 insects, 60 percent are endemic. As for marine organisms, Taiwan has 2,600 marine fishes, or one tenth of the world’s total, and approximately 400 times of the world’s average number of organisms.
Unfortunately, in the past 50 years, Taiwan has focused on economic development at the expense of the environment. Natural habitats and biological resources have been overused. By adding the damage done by invasive species and pollution of environment, Taiwan is experiencing a rapid disappearance of its organisms and a depletion of natural resources. Even the stability of the ecosystem is endangered. Research, education, and legislation are urgently needed to begin conservation and restoration efforts. To formulate proper regulations and laws and to compile appropriate educational material requires thorough scientific investigations. Objective data need to be collected to be used as the foundation for judgment. Since the nature and human environment and biota of each country are different, we should not blindly apply the knowledge and research methods developed in other countries. To succeed, it is prudent that we develop our own research foundation and applications. A fundamental difference between research in biodiversity and biotechnology is that the former concentrates on domestic material and solves domestic problems. Certainly, the academic values and contributions from biodiversity research extend from the domestic level to international levels.

Academia Sinica is the top academic research organization in Taiwan; its mission is to guide, coordinate, and encourage national academic research. Consequently, in the issue of “biodiversity conservation,” it needs to accept the challenges and demonstrate its leadership. At this critical time it needs to lead the nation in taking foresighted actions. The stated mission of the Center, as a result, is “to promote, coordinate, and sponsor basic biodiversity research in Taiwan, to advance domestic and international research collaboration, to integrate biological, biotechnological, ecological, and socio-economical disciplines in pursuit of academic excellence and innovation, and to provide the scientific foundation for the conservation, education, and sustainable use of biodiversity.”

III. The Objectives of the Center

1. In collaboration with domestic and foreign scholars and experts in biodiversity (including multidisciplinary studies), the Center will engage in the basic study of systematics, evolution, ecology and conservation. These studies will concentrate on native species, but organisms in eastern Asia and the western Pacific region will also included. These tasks will enable Academia Sinica to become pivotal in the Asia-Pacific region in the field of biodiversity research.

2. The government, in its “Biodiversity Promotion Plan,” requests Academia Sinica’s assistance in its basic and applied science research. This request includes integration of information, promotion of research in taxonomy, population heredity and evolution, biotic surveys, creation of ecological monitoring systems, long-term marine and wetland monitoring systems, germplasm conservation and utilization, sustainable use of resources, prevention and management of invasive species, eco-engineering, eco-tourism, and participation in international academic activities.

3. Assist the new ministries of Agriculture, Environmental Resources, National Development and Science & Technology, and the new Maritime Affairs Council in promoting biodiversity-related work. The work involves scientific research, conservation, education, and management, especially biodiversity surveys, monitoring, conservation,
and the founding of an information center. The work also involves studies in the sustainable use of agriculture, forestry, and fishery resources and studying and implementing policy.

IV. Major Research Accomplishments and Academic Service Work in the Past Two Years

The Center was officially founded in January 2004. The 17 researchers from the institutes of Zoology and Botany will not transfer to the Center until January 2005. In the past two years, however, those 17 researchers have made important contributions and achievements in basic research, the promotion of applications and academic service work, such as promoting public awareness and helping the government with policy discussions. Their works, along the line of the objectives of the Center, are listed below:

A. Basic Academic Research

1. In the field of molecular phylogeny, colleagues in the Institute of Botany analyzed 18S rRNA sequences sampled from unicellular, sheathless, nitrogen fixing cyanobacteria. No strong correlation between aerobic versus anaerobic nitrogen-fixing activity and phylogenetic relationship was observed. The results support the hypothesis of multiple gains and/or losses of nitrogen-fixation abilities. Additionally, based on the concatenated 61 protein-coding genes common to twelve chloroplast genomes of land plants, it was proposed that monocots branched off from dicots 140-150 Myr ago, at least 50 Myr younger than previous estimates. Colleagues in the Institute of Zoology explored the phylogenetic utility of Acropora corals and found an extremely slow divergence of the SSU rRNA gene in Acroporidae; whereas the evolutionary rate of Acropora LSU rRNA may have accelerated after divergence from the common ancestor of scleractinian corals. These results support the “two-clade hypothesis” of scleractinian phylogeny.

2. In the field of systematic taxonomy, colleagues in the Institute of Botany continued their research on the taxonomy and biosystematics of Begonia of eastern Asian; wrote the taxonomic treatment of the family Begoniaceae for the Flora of China; engaged in the studies of the cytology, molecular systematics and phylogeography of Begonia; and reported the invasion by the notorious Mimosa pigra, a native of tropical Africa and America, in southern Taiwan. The 2nd edition of the “Flora of Taiwan”, which colleagues in the Institute of Botany helped to complete, received the Engler Medal in Silver from the International Association for Plant Taxonomy in 2004. Colleagues in the Institute of Zoology described four new marine species of fish, published the “Identification Guide of Fish Eggs in Taiwan Waters”, and proved that the classification of fish eggs down to the species level cannot rely on morphological characteristics, but have to use DNA sequencing methods. Two papers were published on the molecular phylogeny of Gobiidae and Pomacentridae. Moreover, the artificial incubation and the morphology of larval stages of Xenograpsus testudinatus, endemic to the shallow water hydrothermal vents of Kueishan Island, were described. It was also suggested that these crabs could be elevated to the level of a new family.
3. In the fields of ecology and behavior, colleagues at the Institute of Botany analyzed $^{13}$C NMR and C/N ratio in soil organic substances in the subalpine and alpine regions. They found that the accumulation of recalcitrant material in fine particles favored alkyl C versus O-alkyl C in larger particles. Both soil fungal and bacterial activities decreased significantly with the shift of vegetation from forest to grassland. The mangrove soil lost N at a rapid rate; the N loss could be lowered by adding nitrification inhibitor. Yet, nitrification occurred mainly on the soil surface and thus the effect of the inhibitor in the root area of mangroves would not be as obvious, even though mangroves can transport oxygen from ground level to the roots. Copper (Cu) induces rice roots to produce proline. Since proline supplements added to Cu-treated rice seedlings was found to reduce the Cu absorption in the roots and also Cu exclusion, proline acted as a copper barrier. However, excess Cu led to inadequate proline in rice roots and resulted in the malfunction of the copper transport barrier. Free fatty acid was revealed to be the culprit in producing the toxic effect of *Botryococcus braunii*, a freshwater green alga, on plankton. The toxic effects resulted from the acid’s inhibition of the electron transfer in the photosystems and ATPase activities on cell membranes. A generic index (GI) of diatom assemblages was developed as a bioindicator for river water pollution. With respect to ecosystem studies, it was discovered that the fallen logs in the Yuanyang Lake Preserve provided important substrate for nutrient cycling and habitat for the regeneration of fellow cypress, *Chamaecyparis obtuse*, in the forest. A model of trophic layers was built for Chi-Ku Lagoon and Tamsui estuary ecosystems. This included using multiple stable isotopic tracers (carbon, nitrogen, and sulfur) to analyze the flow of detrital food webs. The detrital flows in the wetland ecosystem exhibited a river sea spatial gradient and were influenced by eutrophication. These studies elevated Taiwan’s ecology research to the level of ecosystem. In fish behavior studies, it was proven that both food abundance and intruder pressure could influence the size of the territory of a fish. As for the research in bird evolution, it was found that island isolation affected bird communication, their mating systems that permitted sustainable small populations, and the genetic structure of inland populations.

4. In the field of conservation, colleagues in the Institute of Zoology published, in the periodical “*Biodiversity & Conservation,*” their success story in assisting The Kinmen County government in establishing a Horseshoe Crab Conservation Area. Additionally, they continued to work in the areas of academic research and social service.

**B. Biodiversity Promotion Plan**

In the Executive Yuan’s “Biodiversity Promotion Plan,” Academia Sinica was designated to render assistance in the areas listed below and its work will be evaluated every quarter. The list also describes the work that colleagues have accomplished so far:

1. Establish and Integrate Taiwan’s Biodiversity Databases and Information Network; and Periodically Update Their Information

Under the sponsorship of the National Science Council (NSC) and with the help of Academia Sinica’s Computing Center, Academia Sinica has finished setting up a national entrance node for TaiBIF (http://www.taibif.org.tw) and Taiwan’s biodiversity website TaiBNET (http://taibnet.sinica.edu.tw). To date, more than 500 of Taiwan’s taxonomy and ecology experts have been recorded, a database of 45,000 species records has been constructed, and
digital information on specimens in Taiwan’s museums and institutes have been integrated. Taiwan, within the Global Biodiversity Information Facility (GBIF), is one of the first to have completed internationally connected databases. “The Fish Database of Taiwan,” “Database of Native Plants in Taiwan,” and “The Taiwan Malacofauna Database”, were all established by colleagues and have garnered great interest because of their rich content. The fish database is drawing more than 30,000 viewers to its website each month.

2. Investigate, Classify, and Study Biodiversity

The colleagues in the institutes of Zoology and Botany, aside from their work on the classification of organisms, are in charge of compiling treatments for some classes and orders for the Vertebrate Taiwanese – fish and birds; Algae Taiwanese, and Crustacea Taiwanese. They are participating in an international cooperative project to establish the setup for a Digital Flora of Taiwan. With respect to the study of deep sea fishes that 10 new species and close to 200 new records for Taiwan have been discovered in the past two years.

3. Strengthen Research in the Monitoring of Biological Resources

Colleagues at the institutes of Zoology and Botany, through their effort in conducting seminars and executing ecosystem research projects on Chi-Ku Lagoon, Ta-Peng Bay, the estuary of the Tamsui River, Kenting Coral Reef, and Orchid Island, have elevated Taiwan’s monitoring and analytical methods from applying the Index of Abundance and Diversity that were often used in the past to the level of modeling for community and ecosystem. They are further trying the Grid technology of instant imaging and remote monitoring instead of the traditional way of working on-site to monitor and investigate. For example, they are coordinating with Taiwan Power Corporation and NSC’s National Center for High-performance Computing to remotely monitor the Kenting Coral Reef. Using this technique, they are also coordinating with the University of Wisconsin and the University of California in the U.S.A. to monitor the metabolic mechanism of Yuanyang Lake, a high mountain lake.

4. Encourage and Reinforce Agriculture and Fishery Biodiversity Research and Utilization

Several colleagues are entrusted with executing the Council of Agriculture (COA) and NSC projects. These include the investigation of plant resources, the study of the benthic fishery resource, and the study of deep sea biodiversity. It is hoped that fishery management methods can be improved by approaching them from the perspective of the ecosystem.

5. Strengthen the System of Protected Areas and Restore Endangered Environmental and Fishery Resources. Academia Sinica has already assisted the government in completing the axis in the western wetlands. At the present time, apart from assisting the COA in defining marine protected areas in the Green Island and Penghu’s Chinwan (inner Bay), it is planning to establish artificial reefs, design and promote eco-tourism, and study nutrient circulation mechanisms in the barren soils of coastal woodlands.

6. Reinforce the Investigation and Management of Invasive Species

Since the problems caused by invasive species are getting worse, the Center, under the direction of President Lee, held a “Forum on the Priority Tasks for Preventing Invasive Species in Taiwan” on September 1, 2004. The conclusions of the meeting were presented by President Lee to the Premier of the Executive Yuan.
7. Participate in the activities of international organizations, and encourage and assist nongovernmental organizations to participate in biodiversity work

Academia Sinica, representing the government, has joined many biodiversity and database related international academic organizations such as IUBS, DIVERSITAS, and CODATA (Dr. Kwang-Tsao Shao is the current Executive Secretary of the Taiwan committees of these three organizations). Over the years, colleagues have participated in the activities of many important international organizations such as GBIF, GTI (Global Taxonomy Initiative), ASEANET (the South eastern Asian Loop of BioNET-International), Species 2000 (a plan to record all the world’s organisms), PBIF (The Pacific Biodiversity Information Forum), and PIMS (Pacific Institute for the Marine Sciences). The international community has also recognized the Center’s long cooperation with FishBase (an international database of fish). The Center was invited this year to join the FishBase Consortium. Since Taiwan is not a member of the United Nations, however, the UN’s Food and Agriculture Organization (FAO) has yet to agree to it.

C. Academic Conference Sponsorship

In 2004, the Center held many international conferences such as the “Workshop on Bioinformatics and Genomics” (February), the “2004 Conference on Integrative Study of Biodiversity” (March 29-31), the “International Symposium on Impacts of Soil Biodiversity on Biogeochemical Processes in Ecosystems” & “International Workshop on Molecular Methods in Soil Biological and Biochemical Diversity in Terrestrial Ecosystems” (April 19-24), the “Forum on the Priority Tasks for Preventing Invasive Species in Taiwan” (September 1), the “Symposium on Corporate Planning of Artificial Reef Projects for the Surrounding Waters of Taiwan” (September 17), the “2004 International Symposium on the Plant Biodiversity” (September 26-27), and the “Workshop of Zoological Terminology Across Strait” (October 12-18). These meetings are important in bringing in new techniques and knowledge, in advancing the domestic and international academic collaboration and exchanges, and in assisting the government with its policies.

In 2005, the Center plans to hold several international conferences, including the “2005 Cross-Strait Symposium on Coral Reef Organisms” (February, 21-25), the 1st “Cross-Strait Ichthyological Conference” (May 14-15), “The 7th Indo-Pacific Fish Conference” (May 16-21), which is expected to have more than 500 participants, and the “2005 International Symposium on the Integration of Biodiversity Informatics” (September).

D. Policy Studying and Planning And Education and Promotion

Many colleagues have been invited to become committee members, consultants or academic team leaders for various departments of the government, including the Sustainable Development Council, National Science Council, the Environmental Protection Administration, Council of Agriculture, the Ministry of the Interior, the Ministry of Education, and the Coastal Patrol Administration, so that they can participate in the drafting, reviewing, and discussion of biodiversity-related policies. They have also been repeatedly invited by the government, academic institutions, and nongovernmental groups to give speeches on the topics of biodiversity conservation and sustainable use of resources. Additionally, in the past two years, the Center has helped to publish more than ten popular books, journals, charts and illustrations, inserts, and CDs in biodiversity education and
guidance. Drs. Lucia Liu Severinghaus, Ming-Shiou Jeng, and Kwang-Tsao Shao are, respectively, the current chairpersons of Taiwan’s National Parks Society, Coral Reef Society, and Ichthyological Society. These NGOs (Nongovernmental Organization) are promoting the related academic and guidance work.

E. The Center’s Animal and Plant Specimen Archives

The Research Museum, Institute of Zoology, Academia Sinica (ASIZ) in the past two years has added many type specimens of fish and more than one thousand new specimens and is the largest fish archive in Taiwan. Its web-accessible database of specimens has completed the integration of digital data of specimens in seven museums in Taiwan. The Herbarium, Institute of Botany, Academia Sinica, Taipei (HAST), as of October 2004, has identified and numbered more then one hundred thousand specimens and has around seventy thousand duplicate specimens that can be exchanged. It is adding specimens at an average rate of five to seven thousand per year and exchanges duplicate specimens with 30 academic institutions worldwide.

V. Future Development of the Center

A. Plans

5. The Center plans to recruit 12 researchers and a number of research technicians to form the strongest biodiversity research team in Taiwan. It will fulfill its role of coordinating, promoting, encouraging, and integrating domestic research.

6. The Center plans to construct a biodiversity research building with the hope of seeing its inauguration in three to five years. Besides providing space, public facilities, instruments, dry and wet experimental facilities, greenhouse, and outdoor garden areas for the Center’s 30 – 40 research personnel, the building will house a biological museum, a biodiversity information center, and a preservation center of the cryobanking of genetic material so that the Center can properly conduct its research and business into the future.

7. The Center will strengthen its cooperation with international organizations and actively participate in international cooperative programs related to biodiversity. It has recently joined the “Barcode of Life” project that is led by the U.S. Smithsonian Institution.

B. Bottlenecks

The Center at present is facing two bottlenecks:

1. Its director has not been appointed, resulting in the possibility of further adjustment of its future research directions. Additionally, the plans for hiring new personnel have been temporarily frozen, resulting in the lack of new recruits. It is a pity that the Center cannot enlist the services of outstanding young scholars until its new director takes office. Fortunately, President Lee took the initiative, with the agreement of the two co-chairs of the Advisory Committee, to direct the Center to start hiring some researchers. Since it is
urgent that young systematics scholars be cultivated, President Lee has allowed the hiring of three researchers in the domain of taxonomy.

2. Its space is seriously insufficient. It may take four to five years to design, construct, and complete a new building for the Center. If the Center cannot borrow enough space inside Academia Sinica during this period, it will not have leeway to expand. It will not have the space for the new director, new personnel, and new equipment and instruments; nor will it be able to start new research projects. The institutes of Zoology and Botany will not take into account the Center’s need when they reconfigure their space. Presently, this is the gravest problem facing the Center.

C. Research Focuses

With respect to the Center’s future research focuses, there are seven as specified in the 2005-2008 mid-range plans submitted to Academia Sinica:

1. Genetic Diversity and Evolutionary Genomics

The formation and expansion of Taiwan’s fauna and flora and species phylogeography studies are two of the hottest research topics these days. The results of these studies can be applied to species conservation, protected area establishment, and natural resource management. Employing molecular genetic markers to elucidate genetic differentiation, population genetics, speciation, mating behavior, species recognition, and gender-specific characteristic can lead to a deeper understanding of the secret of evolution. The Center will also be in charge of the project on “Cryobanking of Genetic Material” for Taiwan’s wild animals (known as the Frozen Ark) and the creation of a soil microorganism gene library and the integration of databases.

2. Phylogeography Studies of the West Pacific

Fishes, scelaractinian corals, polychaetes, horseshoe crabs, and coconut crabs will be examined using the method of molecular genetics, with emphasis on the Genetic Connectivity between the populations in the South China Sea and those of Taiwan. This study is to further comprehend the origin of the biodiversity of Taiwan Island’s marine organisms, to prove the “Stepping Stone” hypothesis, and to provide biodiversity conservation strategies (such as the establishment of marine protected areas) with strong academic proofs.

3. Systematic Studies on Taiwan Biota

Apart from making use of the expertise of current researchers and future recruits to continue advancing taxonomic work on animals, plants, insects, fishes, shellfishes, polychaetes, and lower invertebrates, the Center will help to promote work on the classification of animals, plants, and microorganisms. For example, it will survey Taiwan’s biological resources and establish a database of information on species names and the spatial and temporal distribution of specimens. These works are fundamental to all disciplines of applied sciences.
4. Establishment and Integration of Taiwan Species Databases

The conservation effort and sustainable use of organisms is founded on the construction of a good database that includes taxonomy, ecology, specimen information, distribution, references, and Biology-related pictures and illustrations of species. Biodiversity Informatics, centered on species information, includes Ecoinformatics and Phyloinformatics in addition to a species bank. It is another important field promoted by the international community as opposed to Bioinformatics, which centers on gene sequences. The Center will shoulder the responsibility of unifying and developing Taiwan’s biodiversity databases and building and updating their national websites so that the Center becomes the place of exchange of Taiwan’s biodiversity information. It is also hoped that the Center, through connections with international facilities, will become the information exchange center between the Asia-Pacific and other regions.

5. Studies on Taiwan’s Terrestrial Ecosystems

Taiwan’s researchers in ecology have long focused on the study of individual terrestrial organisms. There are few studies (still in the developing stage) focused on ecosystems, especially on the composition of an ecosystem’s plant, animal and soil microorganisms and their interrelationships, and on the energy and material cycles of ecosystems. The Center will pay special attention to the ecosystems of Yuanyang Lake and Lanyang River. There are three research aspects regarding the latter: a) Biodiversity and function in the forest and agricultural ecosystems in the Lanyang River watershed, b) Biodiversity inventory and databasing of organisms in Lanyang River’s catchments and wetland, and c) Estuary-river mouth linkages of food web dynamics in the Lanyang River.

6. Studies on Taiwan’s Marine Ecosystems

Taiwan is surrounded by water and has extensive coastal areas. These waters provide bountiful resources; however, they have suffered from the severe impact of leisure activities, the development of cities and coastlines, fishery activities, and wastewater pollution. Colleagues at the Center will team up with domestic marine scholars to monitor the various ecosystems of Taiwan’s coastal waters and islands, estuaries, lagoons, rock reefs, and the coral reefs of Pratas (Dong-sha) Island on a long term basis. The results of these studies can be applied to resource conservations and sustainable uses, including habitat restoration, the establishment of marine protected areas, and the promotion of ecotourism.

7. Conservation and Sustainable Use of Biodiversity

Since Taiwan’s environment has been damaged, it is utterly urgent that conservation efforts are adopted and the principles of sustainable use are followed. The Center will promote programs in determining “habitat requirement of organisms,” “habitat diversity recognition – representation, uniqueness, rarity, and diversity, and its application in land management,” “relationships and monitoring of habitat loading and carrying capacity,” “assessment of ecological function and practical conservation of habitats,” “monitoring, controlling, and prevention of invasive species,” “principles in defining protected areas and the promotion of applicable plans,” “localization of biodiversity conservation: establishing mechanisms for community involvement,” and “sustainable use of biodiversity: management strategies.” The habitat studied will include the deep seas surrounding Taiwan, coastal zones, estuaries, inland rivers, streams, plains, and montane forests; their various ecosystems will cover marine waters, coastal wetlands, river watersheds, and montane forests.
With respect to the first and second research plans mentioned above, which focus on evolution, the Center can cooperate with Academia Sinica’s other life science institutes and the Research Center for Genomics and Proteomics and the National Taiwan University, the National Taiwan Normal University, and the Tunghai University to investigate the origin, expansion and sustainability of Taiwan’s biota from the standpoint of molecular evolution and phylogeography. As for the third and fourth research plans, which focus on taxonomy, the Center can cooperate with taxonomists at National Taiwan University, the National Taiwan Ocean University, the National Chung Hsing University, the National Sun Yat-sen University, the National Museum of Marine Biology and Aquarium, the National Museum of Marine Science & Technology, and the National Museum of Natural Science to complete in a timely fashion the writing and compiling of Biota Taiwanica and the integration of digital specimen information. With the assistance of Academia Sinica’s Computing Center, the Center will build the database for Taiwan’s native species and the national information network. Additionally, the Center will cooperate with COA’s research institutes of Agriculture, Forestry, Fisheries, and Animal Industry, the National Plant Genetic Resources Center, and the Endemic Species Research Institute to integrate databases on Taiwan’s biological resources, invasive species, and eco-engineering.

With respect to the fifth and sixth research plans, which focus on ecology, the Center can form a team with colleagues at Academia Sinica’s Institute of Earth Sciences and the Research Center for Environmental Changes and the terrestrial and marine ecology scholars at various universities. The team will work on the confirmation of Taiwan’s hotspots and sensitive areas and their long term study, and on the creation of a monitoring system. Additionally, the team will compile distribution maps of plant populations and coral reefs. It will also try to determine the reasons for damage to ecosystems. The seventh research plan focuses on socio-economics and management. The Center must cooperate with scholars and experts in the fields of the humanities, society, the economy, law, management, environment, and engineering. Moreover, it must team up with nongovernmental groups, local people, fishermen, and aboriginal people, using community building to realize the conservation and sustainable use of resources. The work is academic-service oriented; so it really is not appropriate to evaluate its contribution in terms of how many SCI (Science Citation Index) papers are published or what the Impact Factor is. The work of the seventh plan is also the target of the research of DIVERSITAS, which the international community will pursue; its purpose is to combine biodiversity research with humanities and socio-economic disciplines so that humans can continue to progress. The first Open Science Conference of DIVERSITAS, which several colleagues at the Center will attend, is scheduled to be held in Oaxaca, Mexico, in November 2005.

VI. Conclusion

Even though the Center’s establishment fell slightly behind the establishment of several universities in Taiwan, the fact that the 17 colleagues who will transfer to the Center soon are distinguished scholars in biodiversity research and the fact that Academia Sinica has better research equipment and resources has made many people consider the Center to be the pivotal place to promote biodiversity research. As a result, colleagues must redouble their efforts and raise their own expectations. They must also strengthen exchange and cooperative endeavors with domestic and foreign universities and research facilities to jointly work on restoring Taiwan’s ecological environment and to pursue the sustainable use of resources.
In the field of life sciences, Academia Sinica currently has six institutes – the Institute of Zoology, the Institute of Botany, the Institute of Biological Chemistry, the Institute of Molecular Biology, the Institute of Biomedical Sciences, and the Institute of BioAgricultural Sciences (Preparatory Office) – and a Genomics Research Center that was planned and established two years ago. Most of the more than 200 researchers in these institutes and center use molecular and genetic tools in their study of life. There are fewer than 20 researchers, concentrated in the institutes of Zoology and Botany, who are engaged in the disciplines of taxonomy, ecology, evolution, and conservation. In the past, the equipment and research budgets of these researchers were often not as adequate as those of other researchers. This is because biotechnology in the past 30 years has become the darling of biological sciences and is thought to be the one area with intellectual content and on the cutting edge; whereas biodiversity research was mistakenly considered to be traditional, outdated, investigative work. After the initiation of SCI’s Impact Factor as the benchmark for evaluating research results, the value of the research community in the life sciences was further twisted and a balanced and normal development of different disciplines was compromised. Fortunately, the importance of biodiversity research and conservation has gathered international attention recently and hence the establishment of the Research Center for Biodiversity in Academia Sinica. The Center’s future development must take into account Taiwan’s practical needs in addition to its pursuit of academic excellence. It is hoped that the Center, bestowed with a fine tradition, will move forward, contribute greatly to society and the country, and make Academia Sinica proud.
Fig. 1. Infrastructure of the Research Center for Biodiversity, Academia Sinica.
Fig. 2. Field trips: (A) Sampling and observing birds on Orchid Island. (B) Collection of benthic organisms in Hsinchu’s intertidal zone.
Fig. 3. Aside from promoting long-term studies on marine ecology, the Center assists the government in establishing the Marine Protected Areas (SPOT satellite images “View Taiwan from Space,” September 30, 1994, “The Earth Geographic” magazine).

Fig. 4. With the support of the National Science Council and the National Digital Archives Program, databases for Taiwan’s native fishes, plants, and shellfishes were completed.
Fig. 5 Chart of the Center’s research focuses and collaborating organizations.
Fig. 6. Recent publications of scientific and popular books by the Center's researchers.