

Report on the
Establishment of a
Regional Information
Node for
Asia/Oceania



PSA The Pacific Science Association



NIES National Institute for Environmental Studies (Japan)



NBII The National Biological Information Infrastructure (U.S.A.)

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Executive Summary

A workshop was convened in Tsukuba, Japan, on 4 and 5 October 2003, under the auspices of the Pacific Science Association's Task Force on Biodiversity and Conservation. It was the culmination of efforts that began a year earlier with an informal group of scientists and interested individuals who convened to discuss issues and opportunities to cooperate on a biodiversity information system for the southwestern Pacific. The group determined that it would promote the concept of a Pacific Biodiversity Information Forum (PBIF) as a mechanism to support collaboration on common biodiversity interests in the region. A small steering committee of volunteers was established to plan a workshop to further the concept.

Over 40 individuals (Appendix I), representing various organizations from throughout Asia/Oceania, attended the one and one-half day workshop. The workshop goals were three-fold:

- 1) Refine the PBIF concept as a vehicle for collaboration and innovation.
- 2) Explore ways to make biodiversity data more fully available to Pacific Basin and Rim nations.
- 3) Identify potential pilot projects that would further biodiversity efforts in the Pacific.

The workshop began with a summary of relevant activities currently underway, as a prelude to a discussion of the issues and benefits that a cooperative effort would bring to the region.

During the discussions, three issues were identified as potential barriers to the establishment of the Forum.

- **Intellectual property rights.** There was concern that providing free and expanded access to biodiversity information would create problems due to differences in intellectual property laws and policies in countries of the region, and the willingness of intellectual property owners to provide access to their data. It was noted that there were ever-expanding efforts by museums and other organizations to provide access to data for educational and scientific purposes and that this may no longer be a critical barrier. PBIF would take a significant first step in the development of a biodiversity informatics service to the region by providing organized access to the data and other resources that owners are willing to share.
- **Taxonomic capacity.** There are few taxonomists from the region. Those who are active are in the latter

parts of their careers, and there are few new recruits. BioNET-INTERNATIONAL has begun to address taxonomic capacity building by facilitating the establishment of partnerships, including PACINET, ASEANET, and EASIANET as regional organizations for building taxonomic capacity. PBIF could support these efforts through improved access to taxonomic information and automated tools to support species identification and training of para-taxonomists.

- **Information technology capacity.** Information technology is unevenly distributed throughout the region. Many have the Internet and the latest technologies while other countries are lacking access. To help address this disparity, PBIF would seek to support efforts to improve information capacity in the region, while also providing products that would employ both the World Wide Web and other, more traditional media to accommodate the wide-ranging needs of the region.

With these concerns identified and addressed, the group agreed that important progress could be made to establish the Forum. Therefore, work continued to proceed toward defining a common goal and a workable implementation strategy for the Forum.

The statement, "PBIF seeks to develop a complete, scientifically sound, and electronically accessible Pacific biological knowledge base and make it widely available to local, national, regional, and global users for decision-making," was embraced as the goal for the Forum. Using the goal statement as a guide, a six-step approach for node development was articulated and would include:

- Developing links to existing data and information;
- Publishing bibliographies;
- Compiling species checklists;
- Providing information services;
- Establishing outreach and networking activities; and
- Reviewing progress after year one.


This was followed by the identification of projects that could begin quickly and provide considerable progress toward the establishment of an operational node. Four projects will be initiated to assess regional biodiversity, develop in-country databases, and support development of regional taxonomic capacity. Finally, a leadership team was established to facilitate the formation and initiate operations of the node under the auspices of the Pacific Science Association.



Introduction

Biodiversity is being threatened virtually everywhere in the world. The threats come from a variety of sources such as a changing global climate, pollution, land use and development, intrusion by non-native species, and natural disasters. Recognizing the need to better understand global biodiversity and enable better stewardship of this resource, the Organization for Economic Development defined the need for a mega-science project on informatics for biodiversity (OECD, 1999). The Global Biodiversity Information Facility (GBIF) was formed as the implementing agent. GBIF is developing as an international scientific co-operative project based on a multilateral agreement (Memorandum of Understanding or MOU) between participating countries, economies, and international organizations. Its purpose is to "...make the world's primary data on biodiversity freely and universally available via the Internet" (GBIF, 2003). It is evolving toward an interoperable, distributed network of databases containing scientific biodiversity information and information tools to analyze and apply the information. The initial focus is on species and specimen level data, but it will eventually expand to include molecular, genetic, and ecosystems level data. GBIF has been under development for three years and has a membership that includes 24 voting participants. It also cooperates with a variety of biodiversity information organizations such as: Convention on Biological Diversity, Clearing-House Mechanism, and the Global Taxonomy Initiative (GTI); BioNET-INTERNATIONAL, the Integrated Taxonomic Information System (ITIS), and Species 2000; and a number of regional initiatives including ASEANET, EASIANET, ENBI, and the IABIN.

Current representation of the Asia/Oceania region within GBIF is provided by participating countries and economies including: Australia, India, Japan, Korea, New Zealand, Pakistan, Province of Taiwan, and the United States. Associate Participants with interests in the region include: ASEANET, BioNET-INTERNATIONAL, EASIANET, Species 2000, and IUCN. Other countries, economies, and organizations from the region are not represented and there is no representative for the region as a whole. This suggests the need to encourage broader participation by key representatives from the region.

A world map with a grid of latitude and longitude lines. The map uses a color gradient from light blue for oceans to green and yellow for landmasses. A white rectangular text box is centered over the Americas, containing text and a numbered list. The text box is semi-transparent, allowing the map's grid and colors to be seen through it.

A second related and important initiative is the GTI, which was established through the Convention on Biological Diversity (GTI, 2002). Member nations of the Convention acknowledged that lack of taxonomic information and expertise is an impediment impacting the conservation and sustainable use of biodiversity. The GTI was established to address this impediment as it relates to major work areas of the Convention. To accomplish this charge, the GTI Programme of Work was adopted as COP decision (UNEP/CBD/COPVI/8) and within the Programme of Work five operational objectives are stated:

- 1) Assess taxonomic needs and capacities at national, regional, and global levels for the implementation of the Convention.
- 2) Provide focus to help build and maintain the human resources, systems, and infrastructure needed to obtain, collate, and curate the biological specimens that are the basis for taxonomic knowledge.
- 3) Facilitate an improved and effective infrastructure/system for access to taxonomic information, with priority on ensuring that countries of origin gain access to information concerning elements of their biodiversity.
- 4) Within the major thematic work programmes of the Convention include key taxonomic objectives to generate information needed for decision-making in conservation and sustainable use of biological diversity and its components.
- 5) Within the work on cross-cutting issues of the Convention, include key taxonomic objectives to generate information needed for decision-making in conservation and sustainable use of biological diversity and its components.

These are laudable objectives. The lack of access to taxonomic information and expertise in the Asia/Oceania region is also considered an impediment to biodiversity conservation and the promotion of sustainable development in the region. Therefore, it would be valuable to develop a regional biodiversity information node that can also collaborate with this initiative.

Brief History of PBIF

The idea for a regional node for the Pacific Basin was first discussed at a side meeting convened during GBIF3 in Paris in 2001. Delegates representing the various member countries in and bordering the Pacific Ocean discussed the possibility of a regional node for the Pacific Basin. At that time it was determined that a small planning meeting should be convened to further develop and evaluate the concept.

That initial planning meeting took place in June 2002 on Maui, Hawaii. The meeting was an informal gathering of individuals from in and around the region of the Pacific broadly defined as Asia/Oceania. The meeting objectives were to develop a common understanding of and general framework for a Pacific regional biodiversity information network, and to develop an action plan for a broader regional workshop to further refine the concept. Attendees were asked to provide information related to national, regional, and global biodiversity information initiatives relevant to the region.

Maui meeting attendees concluded that the concept of a Pacific Biodiversity Information Forum (PBIF) should be pursued to support the common biodiversity interests of people, nations, and economies in the Pacific Basin and Rim. The Forum would provide a mechanism for exploring regional cooperation. It should contribute to and not duplicate other regional information efforts. Further, it should add clarity to the roles and relationships of the existing groups in the region and help to identify the gaps in coverage that exist. It was also determined that the PBIF should coordinate with global initiatives to help meet worldwide objectives.

A vision: “informed environmental decision-making in the Pacific supported by the improved generation and usefulness of biodiversity information resources about the Pacific Region” was unanimously embraced. A small steering committee was established to plan a workshop to be held in 2003, based on the vision.

A second informal meeting was convened in Copenhagen on 3 April 2003 as a side meeting to GB6. Attendees included interested country and organizational representatives from GBIF. The results and recommendations from the Maui planning workshop were reviewed. The steering committee also presented their plans for a workshop to be convened as a side meeting to the Joint Forum on Biodiversity Information: Building Capacity in Asia and Oceania, to be held in Tsukuba, Japan, on 4 - 5 October. The venue was recommended because of the relevance of the global initiatives to any future biological diversity information efforts in the region and to leverage the association of this important regional workshop co-sponsored by GBIF and the GTI of Japan. Further, the workshop would be convened by the Pacific Science Association, Task Force on Biodiversity and Conservation. The delegates agreed with the proposal and asked that the planning team assume leadership for planning and conducting the Tsukuba Workshop. This document reports on the results of that workshop.

The concept of a Pacific Biodiversity Information Forum (PBIF) should be pursued to support the common biodiversity interests of people, nations, and economies in the Pacific Basin and Rim.



Workshop Process

Over 40 attendees were present, representing governmental, intergovernmental, and non-governmental organizations throughout Asia/Oceania (Appendix I). The workshop addressed the following three objectives during the one and one half day venue.

- Refine and develop the PBIF concept into a vehicle for collaboration and innovation.
- Explore ways to make biodiversity data more fully available and useful to Pacific Basin and Rim countries.
- Identify potential PBIF pilot projects to further biodiversity information efforts in the Pacific.

The workshop began with the introduction of attendees. This was followed by a panel session that briefly summarized relevant regional initiatives as a background for later discussions (see Appendix II: Workshop Agenda).

Considerations Toward a PBIF Regional Node

Biodiversity is particularly important to many in the region who are dependant upon the sustainability of the scarce natural resources typical of island nations. Conservation activities stem from concern over the potential loss of culturally or economically important species and/or whole ecosystems. The most immediate threats are impacts of invasive species, climate change, and land use. To mitigate or combat these impacts requires wide-ranging efforts including quarantine and biosecurity controls as well as programs for sustainable development.

These concerns highlight the need to provide access to good scientific information that is accurate, easy to find, and targeted to specific needs of people in the region. This can be accomplished most efficiently and effectively by linking to or developing appropriate region-based informatics activities (data and analytical capabilities and computer capacity and Internet access, and so forth). Such a system would: 1) support government needs by linking biodiversity information to the policy formulation and legislative processes; 2) promote scientific advancement in the region by providing an information resource for scientists, and aid in building scientific capacity; and 3) improve local conservation efforts by providing a venue for communities to access scientific information and expertise.

There are several barriers to implementing a regional information system including institutional and political inertia. Organizations must cooperate to overcome the inertia and support system development. A first step is for partners to begin by championing existing efforts, seeking to eliminate conflict, and promoting partnerships. The critical components for PBIF consideration include several elements that must be examined for any regional biodiversity system. These elements and related issues are discussed on the following pages.



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Natural History Collections

The related fields of taxonomy and systematics inform us on the natural history of organisms, their evolutionary relationships, and their potential role in the environment. The assignment of a label or a unique "name" for each species provides a link to what is known about a particular species. Thus, taxonomic information is a basic element required for managing biodiversity.

The world's natural history museums house an estimated 200 million Pacific Island specimens, but most of the museums holding these specimens are situated outside the Pacific. Some specimens may have associated temporal, spatial, environmental, or quantitative data.

These ancillary data vary with each specimen and, depending on how the data were collected and recorded, they may be used to determine (or at least infer) distribution, abundance, health, or other characteristics of the organism on either a local or global scale. Some biodiversity issues that could at least be partly addressed by information contained in collections include: organisms that cause disease; invasive species that threaten the existence of native species or whole ecosystems; status of threatened or endangered species; and the assessment of local, regional, or worldwide biodiversity. These data may provide both current and historical records of what is (or was) present in a particular region and could serve as the beginning point for national or regional inventories. The results of these inventory efforts would serve as a baseline for biodiversity conservation and sustainable use. Therefore, it is important that natural history information and related taxonomic expertise be made widely available to people and countries in the region of origin.

As noted, taxonomy provides a unique name for each organism. It is at this juncture where informatics and taxonomy combine to link the advancement of science to the information products that it generates. The species name serves both as a tool for scientific inquiry and information discovery. From an information perspective, the name is a key attribute to link many disparate data sets or other information. This capability depends on the creation of standardized authority files for species names (including both scientific and common names). Without the application of a properly vetted species name as a "standard label" it would be difficult if not impossible for search engines to locate relevant species-specific data. The authority files also provide information that can help elucidate taxonomic questions and address issues of synonymy (the correct appellation of a scientific name), a common goal for scientists throughout the region. Also, by linking scientific names and local names, the stronger linkage is made between scientific efforts and local cultures and projects.

There was concern that a large number of specimens have been removed from the region and a desire by some to repatriate many of the specimens, particularly the "type specimens." This issue is not easily resolved because of competing interests and laws of the respective countries involved; despite the difficulties, there have been some recent successes. As an example, emerging digital technologies allow the museum holding the specimen to obtain and store high quality image data, linked to the digitized supporting data associated with that specimen. The result is that the country of origin can then gain access to full information about the specimen, as well as



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detailed images sufficient for most taxonomic study. In fact, digital data can easily be copied and provided directly to the country of origin for inclusion in national data sets. The likelihood for the success of this approach is supported by the increasing amount of information that is being made available in the public domain. This is particularly true within the museum community, which has increasingly made data, particularly digital data, available for teaching and conservation purposes. As an example, India has created a database of nearly 100,000 specimens that were collected within the country but are located in museums in Europe and the Americas.

Emerging digital technologies allow Pacific countries virtual access to specimen data from their countries, which are held in remote museum collections around the world.

The field of informatics is providing new opportunities to address important issues and enabling creative ways to advance our knowledge. The fundamental challenge is to induce users to contribute to and apply this valuable natural history collection data to biodiversity conservation and sustainable development.

Databases

With emerging technologies enabling the sharing of natural history data, mechanisms must be identified to improve the integration/interface of taxonomic initiatives with biodiversity conservation initiatives. This would likely require some fundamental changes in the way both taxonomists and conservationists currently think and work. As an example, there is a need to develop database systems that include observations or reports of taxa, in addition to museum or specimen collection data. This would be helpful for many taxa where there are few specimens but many observations (e.g., sightings of whales or sounds/calls of birds) that are often the only practical means of inventorying the organisms. Data schema and information transfer protocols are currently emerging to facilitate access to and integration of collections data over the Internet. The same must be done for other biodiversity-related data including observation data and measurements of abundance or environmental conditions.

A number of biodiversity and ecosystems informatics activities are already underway in the region. These projects employ emerging informatics technology to develop biodiversity databases. One example of such a database is Australia's "virtual herbarium," which will provide online access to distribution information for an estimated 5,000,000 specimens. Other initiatives seek to record traditional knowledge and to provide online descriptions and illustrations as well.

There is a need to develop database systems that include observations or reports of taxa, in addition to museum or specimen collection data.

The emerging informatics technologies also offer the opportunity for greater collaboration on the creation and maintenance of data sets. Where resources or capacity are limiting, individual entities may choose to contribute to and access primary data sources maintained by another entity within the information system. This is an important function that should improve both data capture and accessibility; this same function may also help address the problem of data rescue. In order to capitalize on these opportunities, additional training of individuals to create and maintain long-term data sets may be needed.

Despite the degree of sophistication in many areas of taxonomic informatics, many organizations in the region are limited in accessing and applying these resources. To address one aspect of this problem, there are programs designed to train policy makers and local communities in the application of spatial data.

Intellectual Property

There is an ever-increasing amount of biodiversity information being made available and few technical obstacles remain. Information technology has advanced to the stage where data can be easily shared over the Internet or through electronic products such as compact discs. Thus the current situation seems to be shifting from concerns related to technology (although there is still a question of capacity for some Pacific islands and developing countries) to concerns related to cultural and economic impacts. One prominent issue seems to be that of intellectual property rights. This issue is the result of several disparate but related concerns. In summary, the region of Asia/Oceania encompasses a significant number of countries and cultures with varying approaches to intellectual property rights. Intellectual property laws and regulations vary from country to country, from some having little or no national policy to those with very well developed laws and regulations. Steps must be taken to create a framework for data sharing that recognizes the need and requirements of participants within this complex legal framework.

Intellectual property is not a critical issue for most types of biodiversity surveys. One exception is when the biota under investigation is important for traditional practices (e.g., knowledge of medicinal plants, fishing grounds, bait used to catch target species, and so forth). In such instances there is considerable concern that biodiversity data and traditional knowledge made available to the public may be exploited by other nations for commercial gains. Each country or institution must find its own comfort level regarding what information they are willing to share and what information they wish to retain for their own use. The PBIF node itself can do little to resolve this issue, other than comply with the laws of participant countries and the wishes of the owner of the intellectual property.

A second and related issue is the willingness of scientists to share data. In the past, many scientists have exhibited a reluctance to openly share data. The reluctance seems to relate to either concern over misuse or misapplication of data or failure to properly credit the scientist who contributed the data. This can be at least partially addressed by assuring that information provided by the PBIF node is adequately described; i.e., that the metadata created accurately represents the data set, including methodology, data quality, and acknowledgment of the contributing scientist or organization. A related matter is the time frame in which the data are released to the public. Scientists often spend considerable effort and resources developing experimental protocols and/or collecting the data. They are hesitant to share their data until they have adequately mined the data for their own use. This timeliness of access to data must be balanced with the need to share data to avoid or mitigate negative impacts on the biodiversity. Node activities must recognize this desire and be willing at times to delay data access for a reasonable period of time to allow for publication of research results.

These issues notwithstanding, there is a considerable amount of data in the public domain that is not easily available for electronic query or application. A practical approach would be to begin developing PBIF by incorporating only data that are already in the public domain.

This would quickly provide access to a vast amount of data for research and management purposes. In addition, many of the available data are from museums. If these data were electronically available, a considerable amount of data could be repatriated, as suggested previously. With this approach in mind, considerable

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progress could be made while other appropriate means outside of the node address the intellectual property issues noted.

Capacity

The region as a whole lacks sufficient capacity to fully address biodiversity management. Access to scientific expertise, particularly taxonomic expertise and information, is a barrier to identifying and addressing key biodiversity issues. This becomes an important conservation concern because key steps in conservation planning require access to data and knowledge about the region's biota, its interdependence on environmental attributes, and the actions of local communities. Integral to the process is the ability to effectively communicate the data and related information to important constituencies to gain support for corrective measures and help shape future conservation plans and actions.

There is a dearth of taxonomists within the region. Those present are an aging population, and there are few young recruits. This is a serious problem as there is a need to maintain a critical threshold of taxonomic expertise to provide the necessary scientific foundation. No immediate relief from the situation is apparent; however, recent opportunities have opened up to Pacific island people. A few scholarships are available to study within the islands and abroad. This is an important first step as undergraduates and post-graduates from Pacific universities can be a driving force in capacity building and can help ensure long-term sustainability of the field. More could be done to address this issue.

To supplement professional taxonomists, local individuals can be trained to conduct surveys in many smaller Pacific islands where there are low levels of biodiversity and very limited terrestrial endemism. These "para-taxonomists" could provide badly needed on-the-ground expertise to supplement the work of the already overextended taxonomists. The information is critical, especially in some "less diverse" areas where biodiversity is often far more endangered and in need of management attention, and for whom biodiversity is a foundation for the protection of economic livelihoods and the alleviation of poverty. The University of the South Pacific and the Pacific-Asia Biodiversity Transect Network (PABITRA) are playing key roles in helping to train these individuals. Short courses can be useful for developing para-taxonomists, as well as for training taxonomy professionals for specialized study or work in specific locations, such as performing reef surveys. Computer-based taxonomic keys are another helpful component for making biodiversity data available for specialists working in remote locations. For education, curriculum materials must be developed that include appropriate examples of important taxa, and that are tailored to appropriate levels within the school system. These and similar approaches need to be more widely available within the region. For any long-term solution to work, it is essential that educational materials encourage the interest of future generations of taxonomists and para-taxonomists.

Information technology capacity within the region is mixed. Some countries have excellent high speed access to the Internet and all of its resources. Others have poor or no high speed Internet access. The situation with computer hardware is much the same. At this point it is unclear what can be done by a regional biodiversity network to improve Internet access for partners. However, this is a concern that should be addressed as opportunities arise.



Resources can be shared across existing networks. Needed capacity could be acquired by linking existing systems, or by aggregating existing data into the regional system as part of an interim solution.

In the short term, resources can be shared across existing networks. Needed capacity could be acquired by linking existing systems, or by aggregating existing data into the regional system as part of an interim solution. This approach would potentially increase the information capacity for those who lack adequate capacity while such capacity is developed at local levels. A second element of this solution is to develop alternative products on media other than the Internet, such as hard copy or compact discs.

As an integrating entity, PBIF would complement and not duplicate existing activities.

The need to develop capacity to support the development and management of biodiversity databases in the region is paramount. This includes developing appropriate protocols and standards for data sharing and integration. Standards for the sharing and management of biodiversity data are being developed by international efforts. The region must be represented in these deliberations. This will ensure that regional concerns are included in the final standards and that as the standards are implemented they can be readily adopted into the region by the respective partners.

Collaborators

There are a considerable number of initiatives underway in the region that relate to PBIF. These activities address a specific issue, audience, or thematic area and range from digital libraries of scanned documents to full GIS capacity including numerous digital map layers. As an integrating entity, PBIF would complement and not duplicate existing activities; rather, it would form a nucleus for coordination and sharing between the various initiatives. An example of this is embodied in the relationship between BioNET LOOPS and PBIF. LOOPS are regional organizations of collaborating governments organized under BioNET-INTERNATIONAL. The role of building taxonomic capacity in the region is a main element of the BioNET-INTERNATIONAL charter, a goal that LOOPS and a Pacific biodiversity information system would support. Furthermore, the LOOP activities within BioNET emphasize bringing together governments and people, while PBIF is concerned with science, biodiversity management, and data. The two approaches are complementary and would become willing partners as opportunities arise for collaboration. In other words, PBIF and BioNET LOOPS in the region would seek to leverage the strengths of each program to the benefit of their respective missions. Building taxonomic capacity is likely only one potential area for collaboration.

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Beyond efforts of individual nations, the South Pacific Regional Environment Program and the Secretariat for the South Pacific are important contributors to biodiversity management in the region. Their support is critical to the success of PBIF.

Outcomes

Shared Goal

The shared goal, "PBIF seeks to develop a complete, scientifically sound, and electronically accessible Pacific biological knowledge base and make it widely available to local, national, regional, and global users for decision-making," was developed to provide a common framework for the PBIF node. The goal complements the vision articulated during the initial planning effort noted above in the "Brief History" section. To accomplish this goal it is important that PBIF serve the needs of member countries and the region as a whole and that each member's goals be recognized and included

early in node development. PBIF will operate in such a way so as to complement existing efforts including the development of other complimentary nodes by serving as an integrator of a decentralized regional node, as noted earlier.

Implementation Strategy

A leadership team was established (Appendix IV) and a strategy defined for the early development of PBIF. The node as envisioned would serve a variety of constituencies including government and policy-formulating organizations; scientific, educational and conservation organizations; and community-based initiatives (see Appendix III). Serving such a broad constituency with varied expertise and interests will be a challenge. The strategy summarized in Figure 1 first addresses data and information that are critical to setting the scientific foundation for the node and development of applications that incorporate these data into a wide range of products to serve the various user groups. As an example, one early focus will be species (taxonomy, distribution, and so forth). The hope is to include as wide a range of taxa as is possible, with emphasis given to species at risk (particularly those of either economic or cultural importance) and alien species. This foundation will be used to provide a basic information resource to the region and will allow for the development of customer-specific information products and services.

The strategy is somewhat similar to that of the Hawaii Biological Survey, which was instrumental in completing a comprehensive species inventory of the Hawaiian Islands in the middle 1990's (Allison, 2003). This approach is appropriate for PBIF because it provides a comprehensive process for acquiring and organizing a large amount of biodiversity data in a fairly short time frame. In practice, these activities take place concurrently and continuously, with the result that the information resource is constantly growing and improving.

The first four elements of the strategy are activities required to establish a credible information foundation for the region, as noted previously.

- Step one would link to information that is already available on the Internet. By completing this step, PBIF would add considerable value through organizing access to this information from one virtual location. A second component of this step is the identification of data and other information resources that are valuable but not yet available via the Internet. For these information sources PBIF would attempt to facilitate a process to enable data access.
- Steps two and three build upon step one and would lead to the first products for the node. These steps begin to address a key element of the approach: the creation of a collective resource containing data on species that currently inhabit the region and where they occur. Step two would have the added benefit of providing references to additional information on each species. The references could be from a variety of information resource types including: authority files, specimen data, images, descriptive data, genetic data, local vernacular names, and ethnobiological data.
- The fourth step would enable World Wide Web based access to the distributed services that are linked through, or developed by, PBIF partners. It is the complementary technological element to building the content of the node, the focus of the first three steps. This activity includes

PBIF Strategy

1. Link existing data and information in any format.
2. Develop bibliographies.
3. Develop a species checklist.
4. Implement Internet services.
5. Implement outreach and network activities.
6. Review progress after one year.

Figure 1.

implementing Internet standards-based protocols for information exchange, application of content standards to ensure information and database compatibility for the integration and delivery of taxonomic and spatial data related Internet services, and creation of an architecture to connect distributed data resources across the Internet.

- Step five is critical to the ultimate success of PBIF. A strategy must be developed and implemented to foster its growth and use. This strategy should include gaining financial support from potential donor organizations, political support from prospective member organisations, membership (participation) from various scientific enterprises that could contribute content or become active users, and awareness from various community organizations within the region that would be the ultimate beneficiaries of the node.
- Step six reviews progress after one year and implements adjustments that are necessary. Year one will begin with the publication date on this report.

The process articulated above provides a generalized roadmap for development of the regional gateway for PBIF. It provides a basis for the early steps of development and will help set the stage for long-term operation of the resource. Questions will arise as development of PBIF commences, which will help shape our understanding of data needs of the region and will help identify future focus areas related to both content of the resource and capacity. However, there is also a need to provide early direction for PBIF development. Four projects were identified to provide this direction (Figure 2).

The projects reflect the early decision to concentrate on species. Projects 1 through 3 would identify the occurrence of species in the region at ever smaller scales, beginning with largest scale (region-wide) to a within region survey (sub-regional inventory) to the smallest scale (in-country). The final project would aid in improving the scientific capacity of the region by providing training for the next generation of taxonomists. Appendix VI summarizes the project selection process and provides a comprehensive list of all projects considered. Appendix IV lists the volunteers who agreed to provide leadership for each of the projects selected. Specific project plans are currently under development by each of the project teams and will be shared as appropriate when they are fully developed.

Leadership and the Role of the Pacific Science Association

With many of the issues identified and solutions posed as appropriate, the attendees concluded that a regional information forum for Asia/Oceania should be developed. Furthermore, the forum and its developing projects and products should be incubated through the Pacific Science Association in cooperation with the various participants of this workshop and others who wish to participate.

Leadership would be provided by a group of volunteers selected from the members of the workshop (Appendix IV). The initial role of the Leadership Team would be to guide the early formation of PBIF as a regional entity and to serve as the coordinating body for all activities during its first year of development. The team would be supported by an operating agent. The agent would serve as the central operational organization for development and coordination of technical details for the PBIF. The

Initial PBIF Projects

1. Pacific Biological Survey
2. Sub-regional Biodiversity Inventory
3. In-Country Databases
4. Training Taxonomists

Figure 2.

Pacific Basin Information Node, located in Hawaii, would serve as operating agent during formulation of PBIF and start-up activities. Following the one-year review, further consideration will be given as to the membership of the leadership team and the location for forum operations.

During this first year the leadership team will develop a charter for the team and an operating plan for the agent. PBIF would seek to become an associate member of GBIF by the GB9 meeting currently scheduled for October 2004. Listed below are a variety of functions that have been identified as needed in the region. These functions will be given further consideration as to whether they can and should be addressed by the leadership team, a project team, or the operating agent:

- Serve as a clearinghouse/portal for taxonomic information of value to Pacific Basin user groups.
- Monitor the types of information that are in greatest demand from users and get feedback from users.
- Facilitate capacity building in the area of systematics and biodiversity collection, processing, and curation.
- Develop relevant databases and database capability.
- Set minimum requirements of data to be input into databases to facilitate search of queries or searches to databases.
- Address IPC/IPR issues and facilitate collection and exchange of specimens and data.
- Develop taxon/species record pages/cards for all-important taxa (e.g., similar to Fish Base, where a person can search on the name yellow fin tuna and find information about that species regarding scientific and vernacular names, taxonomy, biogeography, abundance, life history, photographs, important references, and so forth).
- Facilitate digital photographic documentation for important taxa and help develop standard procedures for what constitutes a good digital photo record of different species groups, how it should be coded, documented, stored, disseminated, and so forth to allow comparative taxonomic and biogeographic studies of given species or taxonomic groups.

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Appendix I – List of Attendees

<u>Name</u>	<u>Affiliation</u>
Peter Adler	Keystone Center, USA
Allen Allison	Bishop Museum, USA
Tsetseg Baljinova	Institute for Biology, Mongolia
Bonnie Carroll	Information International Associates Inc., USA
Vishwas Chavan	National Chemical Laboratory, India
Mark Cleaver	Landcare Research Investments, New Zealand
Gladys Cotter	USGS NBII, USA
Ian Cresswell	Environment Australia, Australia
Daphne Gail Fautin	University of Kansas, USA
Mark Fornwall	Pacific Science Association
Luigi Guarino	Secretariat of the Pacific Community (SPC)
John M. Hill	National Biological Information Infrastructure, USA
Tran Thi Hoa	Institute of Agricultural Genetics, Vietnam
Tarita Holm	National Biodiversity Coordinator, Palau
Kevin Hyde	University of Hong Kong, Hong Kong
Kanehiro Kitayama	Kyoto University, Japan
Thomas F. Lahr	USGS NBII, USA
Daw Phyu Phyu Lwin	Myanmar Agriculture Service, Myanmar
Domingo A. Madulid	Philippines National Museum, Philippines
Gerald McCormack	Natural Heritage Project, Cook Islands
Imelda C. Panga	ASEAN Regional Centre for Biodiversity Conservation, Philippines
Gustav Paulay	Florida Museum of Natural History USA
Ching-I Peng	Academia Sinica, Province of Taiwan
David Penman	Landcare Research, New Zealand
Pheng Phengsintham	University of Laos, Laos
Rachun Pooma	The Forest Herbarium, Thailand
James Sabi	Department of Environment and Conservation, Papua New Guinea
Kwang-Tsao Shao	Academia Sinica, Province of Taiwan
Soetikno S. Sastroutomo	ASEANET, Malaysia
Junko Shimura	NIES, Japan
Richard Smith	BioNET INTERNATIONAL, UK
Larry Spears	GBIF
Randy Thaman	University of the South Pacific, Fiji
Siuli Tuaillemafua	PACINET, Samoa
Nat Tuivavalagi	Global Consultancy Ltd., Samoa
Karen L. Wilson	Royal Botanic Gardens, Sydney, Australia
Jeng-Tze Yang	National Chung-Hsing University, Province of Taiwan

Appendix II – Workshop Agenda Pacific Basin Information Forum, 4-5 October 2003

Objectives & Outputs

- Further refine and help evolve the Pacific Basin Information Forum (PBIF) concept as a vehicle for collaboration and innovation.
- Explore ways to make biodiversity data more available and useful to Pacific Basin and Rim countries.
- Identify potential PBIF pilot projects that will further biodiversity information efforts in the Pacific.

Products

1. Principles for PBIF organization and a Statement of Resolve.
2. Proposed mechanisms for repatriating biodiversity data to the Pacific.
3. A short list of possible projects.

Agenda – Saturday, 4 October 2003

- 9:00a **Welcome and Start-Up.**
Welcome; Recap of Previous Meetings; Vision from the Maui Meeting (Junko Shimura and Mark Fornwall). Agenda Review and Introductions (Peter Adler)
- 9:30 **Panel and Discussion on The Status of Pacific and Asian Biodiversity Information Efforts.**
Brief comments by Siuli Tuilemafaaas, Ian Cresswell, Junko Shimura, and Mark Fornwall followed by group discussion moderated by Peter Adler
- 10:30 **Break**
- 10:45 **Grappling With Tough Issues: Ownership, Dissemination, and Repatriation of Data.**
Brief discussion-framing comments by Allen Allison followed by brainstorming on:
- What Are the Specific Needs?
 - What Are the Barriers and Challenges and How Might We Overcome Them?
 - What Principles Should Underlie Data Repatriation?
 - What How Might Data Repatriation Efforts Be Undertaken?
- 12:00p **Adjourn**

Agenda – Sunday, 5 October 2003

- 9:00a **Potential PBIF Projects (First Pass).**
Moderated discussion on how a well-functioning PBIF can accomplish great things. Brainstorming session on:
- Mechanisms for Strengthening Cooperation Between Institutions and Countries
 - Potential Projects that Could Benefit Basin and Rim Countries.
 - Criteria for Comparing Competing Good Ideas.
- 10:30 **Break**
- 10:45 **How Can We Build PBIF Into An Effective Forum That Effectively Serves Basin and Rim?**
Discussion on building the right kind of coalition or organization that complements and does not duplicate other existing efforts. Among the topics to be discussed:
- Key Assumptions Underlying PBIF
 - Potential Strategies for Carefully Developing It
 - Structure, Function, and Organizing Tasks
 - Key Principles to Embed in a Statement of Resolve from the Meeting
- 12:00p **Lunch Break**
- 1:00 **Potential PBIF Projects and Activities (Second Pass).**
Building on the morning discussions, we will try to sharpen a list of projects and directions. Discussions will include:
- Examine Specific Action Steps To Help Build PBIF.
 - Review and Revise List of Potential Projects and Associated Criteria for Comparing Competing Good Ideas
 - Narrowing the List and Identifying Leadership
 - Planning for Implementation
- 3:00 **Break**
- 3:15 **Finalizing A Statement, Set of PBIF Organizing Principles, and A Statement of Resolve**
- 5:00 **Adjourn**

Appendix III – Potential User Groups

Types of Data/Information and User Groups That Biodiversity Database Initiatives and PBIF Could Target

- Agricultural and forestry departments
- Plant breeders/plant selection agencies
- Plant protection/quarantine agencies
- Invasive species managers
- Health/medicinal practitioners/disease control agencies
- Conservationists (endangerment status, distribution, biodiversity hotspots)
- Biological scientists
- Museum/Herbarium/reference collection community (e.g., species lists)
- Educationists/curriculum developers
- Fisheries scientists
- Local linguists/dictionary committees/cultural heritage agencies
- Policy makers/economic planners
- Local communities
- Environmental impact assessment agencies
- Tourism/ecotourism community

Appendix IV – Team Membership

All teams were selected by volunteering and were affirmed by the workshop members. Teams have the responsibility to collaborate on respective projects. The results will be shared with the PBIF node partners.

Leadership Team

Allen Allison
Ian Cresswell
Mark Fornwall (Facilitator)
Luigi Guarino
Tran Thi Hoa
James Sabi
Soetikno Slamet Sastroutomo
Junko Shimura
Randy Thaman
Siuli Tuilemafuaas
Karen Wilson
Jeng-Tze Yang

Sub-regional Biodiversity Inventory

Allen Allison
Kevin Hyde

Gustav Pauley (Facilitator)

Training Taxonomists

Kevin Hyde (Facilitator)
Randy Thaman
Nat Tuivavalagi
Karen Wilson

Pacific Biological Survey

Allen Allison (Facilitator)
James Sabi
Randy Thaman

In-country Databases

Gerald McCormick (Facilitator)
Tarita Holm
Imelda Paanga
Randy Thaman

Appendix V – Current Regional Initiatives

Participant	Relevant Activities/Contributions
Pacific Information Network (PACINET)	<ul style="list-style-type: none"> • A BioNET-INTERNATIONAL Loop - under development, interim coordinating committee established and includes: SPREP, SPC, USP and 17 Pacific Island Nations • Primary area of concentration is building taxonomic capacity in the region • Could facilitate development of organization of PBIF - facilitate development of formal agreements between participants of PBIF
University of the South Pacific (USP)	<ul style="list-style-type: none"> • Maintains collections including herbarium of 11,000 specimens, 4,000 marine algae, and museum collections of 6,000 finfish and many invertebrates • Access to the Marine Resources Information System (PIMRIS) • Expertise in the identification of island biota • Analysis and databasing of ethnobiological information from 12 member countries
Cook Islands	<ul style="list-style-type: none"> • Has a government-bases natural heritage project • Original goal was to preserve traditional knowledge of biodiversity expanded by law to address all biodiversity issues • Database of 4,000 species profiles and 2,000 images, vernacular names, and ethnobiological/traditional knowledge on the Web and compact disc
University of South Florida	<ul style="list-style-type: none"> • Large collections including 25,000 photographs (digital and conventional) • 80,000 invertebrates from Pacific islands
Pacific Asia Biodiversity Transect Network (PABITRA)	<ul style="list-style-type: none"> • A system of biodiversity study along an east west transect from Malaysia through Melanesia, Micronesia, Polynesia and Hawaii • Training programs for undergraduate and graduate students • Methodologies for marine, freshwater, and terrestrial ecosystem surveys
Bernice Pauahi Bishop Museum	<ul style="list-style-type: none"> • Collections of approximately 22,000,000 specimens for Hawaii and the Pacific • Bibliographic databases on species on all Pacific Islands • Spatial data (shape files) for reptiles, birds, and mammals in 2004
Papua New Guinea	<ul style="list-style-type: none"> • Several initiatives to facilitate data sharing • Bilateral agreement of cooperation with Australia • Gaining formal consent to share from local communities for collection of biodiversity material • Trying to bring together all in-depth information on biodiversity collected in the past 20 - 30 years • Accessing NGO data as well • Goal species risk assessments using IUCN criteria (pilot with 12 bird species) • Have begun species mapping
United States Pacific Basin Information Node (PBIN)	<ul style="list-style-type: none"> • Information node under development for Hawaii and US interests in the Pacific • Offers World Wide Web-based taxonomic and spatial data capabilities • Extensive information on invasive species and birds
Ocean Biogeographic Information System (OBIS)	<ul style="list-style-type: none"> • Databasing marine biodiversity data (uses DiGIR protocol and requires "Darwin Core" of minimum data elements)
Palau	<ul style="list-style-type: none"> • Lacks data to support decision-making • Returning graduates are being used to collect biodiversity data

Guam	<ul style="list-style-type: none"> • Many from outside have collected from the island • More recently seeking information from local communities • Much of the data has a backup photographic record
DIVERSITAS in the Western Pacific and Asia	<ul style="list-style-type: none"> • Part of IBOY (International Biodiversity Observation Year) • Concentrated efforts on standard methodologies and manuals for the collection of biodiversity and ecosystem data in the region
ASEAN	<ul style="list-style-type: none"> • 10 Member Countries in S.E. Asia • Voluntary Network • Offers training workshops for countries to participate • Databases: <ul style="list-style-type: none"> Species Lists Treaty Memberships Protected Areas Endangered Species
Pacific Agricultural Resources Network (PAGREN)	<ul style="list-style-type: none"> • Base at the Secretariat of the Pacific Community • Uses e-mail and Web to Communicate
EASIANET	<ul style="list-style-type: none"> • Loop of BioNET-INTERNATIONAL • Offers training in mycology
Global Taxonomy Initiative Asia/Oceania, Japan	<ul style="list-style-type: none"> • Voluntary Network for GTI pilot project • Capacity building in taxonomy on coastal/island biodiversity in Indonesia and Thailand • GBIF provider • Tools to handle taxonomic information • Databases: <ul style="list-style-type: none"> Type specimens in Japan Freshwater fish specimens in Japan Flora of Japan

Appendix VI – Project Selection

Meeting attendees were asked to provide a list of potential projects that would help build the node and fill an important need for the region. Attendees provided a preliminary list of projects during a brief brainstorming session. Prior to developing the list, criteria were developed for comparing projects and identifying the highest priority projects. The following criteria were identified and used by the group to select the most appropriate projects:

Criteria for Comparing Suggested Projects

- Needs to be thematic (e.g., invasives)
- Needs to have a spatial/geospatial focus (e.g., country, region, locality)
- Infrastructural (builds the capacity of the network and member organizations/countries, and so forth)
- Advances technical objectives
- Advances networking
- Advances transnational issues
- Addresses a real problem
- Relevance to decision-making
- Takes advantage of an opportunity
- Is it do-able

- Has to be user-focused and friendly
- Timely provision of the data
- Involves partnerships

Potential Beneficial Projects to Pacific Basin and Rim Countries

- Supporting PABITRA as a means of generating, compiling, and sharing taxonomic and biodiversity data on sites along a West-East transect into the Pacific Islands. It was stressed that one of the main objectives of this project was to prepare a manual for biodiversity surveys and run training workshops and field courses for promising Pacific Island students.
- Training more Pacific Island taxonomists.
- Providing taxonomic support to regional Invasive Species Information Systems and regional plant protections systems.
- Supporting an international or regional gazetteer on authorized place names (including all languages) for georeferencing species information.
- In-country databases, using outside help and information, because of the needs for such information.
- Regional atlas of the wild relatives of crops.

- Systematic studies of genetic diversity; e.g., cultivars of economic and culturally important cultivated and wild plants (including checklists, biogeographic data, and abundance/endangerment status).
- A list and network of taxonomic specialists and institutions elsewhere that could be brought to the region or are willing to assist remotely related issues.
- Using regional taxonomic expertise to validate and verify checklists in the region. This worked particularly well in the Hawaii Biological Inventory.
- Requiring/encouraging taxonomic surveys (critically important) to record local vernacular names/taxonomic data and, where possible, include ethnobiological expertise in survey teams.
- Cataloging of Pacific Island biodiversity collections held outside the regions.
- Going beyond the preparation of checklists and to link these to the real life world of decision-makers, ecotourism operators, managers and developers of protected areas, educators, and other relevant user groups.
- Producing guidebooks for ecotourists and students.
- Supporting the input and digitization of existing data.
- Survey or inventory of biodiversity hot spots.
- Providing taxonomic support/including traditional taxonomy for surveys and certification of products for traditional/native agroecosystems, agroforestry systems, wildland harvest systems, rather than just in natural systems.

Priority Projects Identified by Workshop Participants

Projects are listed in order of priority based upon number of individuals supporting each project from the above list of possibilities.

- Sub-regional Biodiversity Inventory
- Training Taxonomists
- Pacific Biological Survey
- In-country Databases

Appendix VII – List of Acronyms/Abbreviations

ASEANET	South East Asian Loop of BioNET-International
BioNET-INTERNATIONAL	Global Network for Taxonomy
CBD	Convention on Biological Diversity
COP	Conference of the Parties, to the Convention on Biological Diversity
EASIANET	East Asian Loop of BioNET-INTERNATIONAL
ENBI	European Network for Biodiversity Information
GB#	Governing Board Meeting Number
GBIF	Global Biodiversity Information Facility
GTI	Global Taxonomy Initiative
IABIN	Inter-American Biodiversity Information Network
ITIS	Integrated Taxonomic Information System
IUCN	The World Conservation Union
MOU	Memorandum of Understanding
NBII	National Biological Information Infrastructure
NIES	National Institute for Environmental Studies
OECD	Organisation for Economic Co-operation and Development
PABITRA	The Pacific-Asia Biodiversity Transect Network
PBIF	Pacific Biodiversity Information Forum
PIMRIS	Pacific Islands Marine Resources Information Systems
SPC	The Secretariat of the Pacific Community
SPREP	South Pacific Regional Environmental Programme
UNEP	United Nations Environment Programme
USP	The University of the South Pacific