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Scientific Capacity Building & Enhancement for Sustainable Development in Developing Countries

Capacity Building and Meeting Research Needs on the Ecology of Global Change in Island Landscapes of the Republic of Palau

**Final Report for APN CAPaBLE Project:
CBA2006-01NSY-Manner**



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Final Report submitted to APN

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Overview of project work and outcomes

Non-technical summary

The Pacific-Asia-Biodiversity Transect Network is a program of the Ecosystem Division in the Pacific Science Association (PSA) Task Force on Biodiversity. Its aim is to collaborate with Pacific Islanders on biodiversity research and ecosystem conservation. Its research strategy is two-fold: to encourage comparative studies across Oceania in ecosystems that belong to the same biomes (the horizontal strategy) and to study selected island landscapes from the mountains to the ocean (the vertical strategy).

Objectives

The present project aimed to:

- Train Palauan students/scientists in the methods of ecological analysis so that they can conduct the studies and data collection that the country will need for policy development.
- Increase the participation and capability of Palau's scientists and residents in the analysis and conservation of their island ecosystems.
- Link Palau within the PABITRA network of sites for long-term ecological research through better communication and involvement of scientists in the region.
- Develop greater understanding of island ecosystem dynamics and their effects in island landscapes.

Amount received and number years supported

The Grant awarded to this project was:

- US\$ 42,000 for Year1, 2006-2007.

Work undertaken

In collaboration with the Palau Natural Resources Council (PNRC), PABITRA held two meetings in Koror, Palau: an Initial Planning and Scoping Workshop on August 7- 11, 2006; and a Joint Analysis and Synthesis Workshop on March 25-April 2, 2007.

Results

For the Initial meeting, three PABITRA core members (Drs. H. Manner, D. Mueller-Dombois, and C. Daehler) made presentations on PABITRA's history, goals and accomplishments in the Pacific Islands; the need for biodiversity science in managing ecosystems and the threats of global change; the task of biodiversity assessment and monitoring as a fundamental learning activity; the PABITRA biodiversity transect concept; the PABITRA Manual; methods of analyzing vegetation and ecosystem threats (in the field and classroom); the graphical presentation of ecosystem features, climate and profile diagrams; the selection of the Ngerikiil and Diongradid watersheds as PABITRA transect and study sites for the Joint Analysis and Synthesis Workshop on March 25 - April 2, 2007; and the equipment and training needs for that meeting.

At the 2007 Joint Analysis & Synthesis Workshop Drs. K. Bridges, J. Juvik and A. Whistler joined members listed above. Dr. S. Juvik participated in Palau on her own funding. She brought additional expertise to the meeting. The workshop began with a reconnaissance trip of Babeldaob Island, which is experiencing rapid ecological change associated with the near completion of an all weather road. Presentations were made by the Palauan participants on the soils of Palau, a forest inventory assessment,

graphical displays of the Ngerikiil and Diongradid watersheds, and a topographic profile diagram. Presentations by the overseas participants included: a session on hydrometeorology by Dr. J. Juvik; basic statistics and their applications by Dr. C. Daehler; mapping with PowerPoint by Dr. Kim Bridges; review and updating of the Palauan plant data base by Dr. Daehler; methods of ecosystem analysis by Dr. Mueller-Dombois; herbarium collecting and mounting techniques by Dr. Whistler, to name a few. A full list of the presentations can be found in the attached agenda.

Training exercises in the field included transect reconnaissance, assessment of vegetation and land use pattern, and site selection for climatic and hydrological instrumentation. Dr. Mueller-Dombois led a group exercise in the relevé method and ecological tree inventory methods, including a hands-on exercise on cover-abundance estimation, the count-plot method and plotless sampling techniques. Dr. Manner conducted a training exercise on mapping using compass and meter tape. Dr. Juvik led the PABITRA group in constructing and installing an automated data logging station for seven climatic and hydrological sensors in the Ngerikiil forest watershed (Transect 1). Near that station, an automated stream-measuring device was installed. It was shown how this device senses stream depth (by pressure) and how to calibrate it for velocity. Stream cross-sectional area was measured and discharge rating curves explained. A tipping bucket rain gauge was installed at the summit of the second watershed (Transect 2) Mt. Ngerchulchuus in Ngardmau State, Babeldaob Island. A lizard pitfall trap was also established in the Ngardmau State Waterfall Forest.

Relevance to the APN CAPaBLE Programme and its Objectives

This project is clearly relevant to APN's CAPaBLE Programme and objectives. Using planning and scoping workshops in combination with hands-on field training by leading conservation scientists and experts from the Pacific Region provides for mutual capacity building with indigenous Palauan scientists. This effort will be catalytic in generating the scientific information needed for land management with ecosystem conservation and for installing an appropriate policy for sustainable development. The PABITRA effort will continue through networking.

The instalment of meteorological/hydrological stations with modern high-tech data loggers will also continue to be of value for providing new data, if properly managed. It can also be considered an asset for learning. It will encourage the needed interpretation of climatic data to understand Palau's watershed systems and the water-balance on the main volcanic island Babeldaob.

Self evaluation

Written evaluations by the Palauan participants at the end of the workshop showed that they greatly appreciated PABITRA's efforts. The methods of biotic analyses, PABITRA's emphasis on capacity building, and the establishment of modern data logging stations were considered to be of lasting impact. At least one Palauan scientist will participate at the next Pacific Science Congress. The personal interaction with the Palauan scientists and field managers in pursuit of a common goal can certainly be viewed as a complete success. We are confident that the classroom and field training activities have greatly enhanced Palauan capability in standardized research methods.

Potential for further work

PABITRA received tremendous in-kind support and collaboration from the Government of Palau and the Palau Natural Resources Council. Despite this interest, some of the Palauan participants do not have the necessary preparation to fully comprehend the

complexities of ecosystem dynamics to take full advantage of the PABITRA training. This suggests that effective capacity building must begin earlier, perhaps with a greater emphasis in science education in the intermediate school years, in order for Palau (and other countries of the Pacific) to develop the skills needed to better understand and protect their ecosystems.

The need for capacity building is also evident in other countries of the Pacific. Thus, PABITRA will be resubmitting a proposal for continuing PABITRA capacity building activities in Eastern Polynesia during the next proposal cycle. The focus will continue to be the capacity building of young indigenous scientists for researching and managing their own biological resources for sustainability. This will become the foundation for global change research as defined by APN.

In addition to the training in methods of biodiversity assessment in the context of island ecosystems, PABITRA's efforts in building inexpensive meteorological stations with nearby stream gauging stations will provide for enhanced understanding of watershed functioning. On May 12, 2007 Ms Ann Kitalong, a Palauan participant at the PABITRA workshops reported that the first data set had been successfully from the stations PABITRA established in late March of this year.

Publications

Kitalong, A., and Costion, C. 2007. A forest survey of Babeldaob, Palau: Floristic diversity, plant communities, and conservation recommendations. Paper accepted for presentation at the 21st Pacific Science Congress, June 12-18, 2007, Okinawa.

Manner, H. 2006. Interim Report for CAPaBLE Project (CBA2006-01NSY-Manner. Report submitted to APN, April 2007. See also PABITRA in Palau (August 2006) at http://www.botany.hawaii.edu/pabitra/documents/Palau_Report.pdf.

Manner, H. 2007. Second Interim Report for CAPaBLE Project (CBA2006-01NSY-Manner. Report submitted to APN, April 2007.

Mueller-Dombois, D. and Daehler, C., eds. 2005. The PABITRA project: Island landscapes under global change. A special PABITRA issue with 13 contributions published in *Pacific Science* 59 no. 2

Mueller-Dombois, D., Bridges, K. W., and Daehler, C., eds. 2007 *Biodiversity Assessment of Tropical Island Ecosystems: PABITRA Manual for Interactive Ecology and Management*. Bishop Museum Press, Honolulu, HI. In press.

Acknowledgements

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Technical Report

Preface

Between August 2006 and April 2007, the Pacific-Asia Transect Biodiversity Network (PABITRA) in collaboration with the Palau Natural Resources Council, held two workshops in the Republic of Palau. The primary objective of this project was the enhancement of Palauan capability to conduct the scientific analysis of their ecosystems so necessary for the development of appropriate management and conservation initiatives needed for sustainable environmental protection. This report presents the background and details of the PABITRA capacity building project in Palau that follows similar PABITRA workshops held previously in Fiji and Samoa.

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1. Introduction

The Republic of Palau is a small, tropical, biotically diverse island archipelago located in the Western Pacific. The largest island is Babeldaob, where rapid population growth (2.78%/yr) and habitat loss due to fires, agriculture, hunting, and invasive species, construction of a trans-island road, coupled with the pressures for economic growth and modernisation, are severely affecting the viability of the island's ecosystems, its biodiversity and high rate of endemism. Recent assessments of Palau's conservation needs by the Palau National Resources Council (PNRC) indicate that critical data (i.e., distribution of rare endemic species) is needed for sustainable ecosystem management and that trained personnel to collect such data were unavailable.

Much of the German and Japanese research prior to WWII are mainly taxonomic descriptions of species, species lists for the major vegetation types or general descriptions of the island environments (See for example, Kawagoe, 1919). There are general descriptions and baseline data on the soils (Smith 1983), geology (IDOE 1956), vegetation (Mueller-Dombois and Fosberg 1998), vegetation distribution (Cole et al 1987), hydrology, freshwater resources (SCS 1991) and freshwater habitats and organisms (Bight 1979; Fehlmann 1960), fauna (Engbring 1988; Owen 1977; Gressitt 1954) and flora (Fosberg, et al 1979, 1980, 1987), traditional Palauan land use and agricultural practices (McCutcheon 1981), and a State of the Environment report (Otobed and Maiava 1994). While environmental impact assessments associated with

the construction of the Compact road have provided some data (for example, Nelson et al 1995), Raulerson et al (1996:8) noted that: "Palau has no list or proposed list of endangered plant species or ecosystems/communities," and there are few in-depth studies of Palau's terrestrial ecosystems.

PABITRA is an international network of conservation scientists based mainly in the tertiary training and research institutions in the Pacific Basin. The network is associated with the Ecosystem Division of the Pacific Science Association (PSA) and works in close collaboration with Pacific Islanders and SPREP (South Pacific Regional Environment Programme). PABITRA is also linked with DIVERSITAS, the global program of biodiversity science and with DIWPA (Diversitas in the Western Pacific and Asia) through its east to west "Tropical Island Belt" transect. PABITRA's scientific objectives are closely related to the ten research elements of DIVERSITAS as endorsed by IGBP and its core project on Global Change and Terrestrial Ecosystems (GCTE). PABITRA's primary research focus is the role of biodiversity in the functioning of ecosystems and the human dimensions of biodiversity.

PABITRA believes that these research objectives can be best accomplished by training local/indigenous scientists to analyse and monitor their ecosystems themselves as they best understand indigenous aspirations for economic improvement and their impacts on their ecosystems. Economic development and sustainability involves a thorough understanding the interactive functions of island ecosystems using the watershed concept as the linkage between the upland forests and the lowland coastal zones. Thus, since its formation in 1997, PABITRA has conducted capacity building workshops in Fiji and Samoa. In 2002, an APN/PABITRA Initial Synthesis Meeting was held in July in Fiji followed by a Joint Analysis Workshop there in Nov/Dec. Similar APN sponsored meetings and training workshops were held in Samoa in 2003. These concepts and approaches have been presented and developed at various international fora (Pacific Science Association Congresses and Inter-Congresses-Taiwan 1998, Sydney 1999, Guam 2001, Bangkok 2003; 43rd and 47th IAVS Symposiums in Nagano in 2000, and in Hawaii in 2004, respectively). In 2005, the journal *Pacific Science* featured a number of articles on the PABITRA theme. Almost half of these were written by Fijians following the establishment of PABITRA Net there. The work of PABITRA can be found on its website www.botany.hawaii.edu/pabitra/.

This project follows on the success of PABITRA capacity building workshops in Fiji (and later Samoa). Beginning in 2003 and in collaboration with the Palau Natural Resources Council, PABITRA wrote a proposal to bring a series of capacity building workshops to Palau with the aim of training Palauans to conduct the analysis of their ecosystems. This proposal was funded by APN for 2006.

2. Methodology

Two workshops were proposed for funding. They included the following:

- A. A planning and scoping workshop (Initial Meeting) to initiate a synthesis of existing work on Palau ecosystems and to promote the analysis of new research on the ecology of global change in island landscapes. The meeting would also be used to assess suitability of field sites for research, to plan for the Joint Workshop, and to introduce the PABITRA online Manual (*Biodiversity Assessment of Tropical Island Ecosystems: PABITRA Manual for Interactive Ecology and Management*).
- B. Capacity building (Joint Synthesis Workshop) to initiate studies of the ecosystem using a transect and the watershed approach. Using the PABITRA

manual listed earlier, participants would receive instruction and field training in sampling methods and techniques of analysing natural, traditional agroecosystems and other human-modified ecosystems.

The meetings were organised by the PABITRA Co-ordinator for Micronesia, Dr. Harley Manner, and Ms. Tarita Holm, the Chairperson of the Palau Natural Resources Council.

3. Results & Discussion

A. The Initial Meeting

The Initial planning and scoping workshop was held in Koror, Palau on August 7-11, 2006. A total of 26 local participants attended the first day's presentations (August 9) which included presentations on: PABITRA's history, goals and prior accomplishments in other Pacific Islands Hawaii, Fiji and Samoa; the need for biodiversity science in managing ecosystems and the threats of global change; the task of biodiversity assessment and monitoring as a fundamental learning activity; the introduction of the PABITRA online Manual; methods of analysing vegetation and ecosystem threats; agroecosystems; and displaying ecosystem features. Already existing information on the Palauan environment and base data were brought together and the needs for new ecological approaches were clarified.

Methods of ecosystem analysis were presented on the fieldtrip to Lake Ngardok on the following day. The participants were shown how to recognize vegetation patterns (entitation) and were then made to do a hands-on determination of the minimal plot size for a relevé in a seasonal swamp forest. It was found that the minimal area for the analysis of this forest type exceeded 64 m² by far. A rapid method for structuring vegetation cover vertically by horizontal strata was also demonstrated.

The final day (August 11) attracted 13 local participants. The topics included a general discussion on the factors affecting vegetation; Walter-type climate diagrams with regard to the world position of Palau's rain forest; a first attempt to synthesize existing information of Palauan ecosystems; the identification of potential PABITRA transects and landscape segments from the central mountain range to the coast; and planning of the follow-up 2007 Joint Analysis Workshop.

The Palau PABITRA group selected the Ngerikiil and Diongradid watersheds as PABITRA study sites for the 2007 Joint Analysis Workshop. In preparation for this workshop, the group decided to prepare climate diagrams (both manually and using GIS) for the two watersheds and to list and collect the available information on the two watersheds (e.g. plant checklists, air photos, maps, climatic records). PALARIS (Palau Automated Land and Resource Information System) offered to prepare three dimensional profile diagrams of the two watersheds. In addition, a list of supplies (up to \$1000) in terms of field survey equipment was suggested to be prepared soon so that this material will be available for the 2007 workshop. The group was asked to review the PABITRA Manual and to begin a consultation process with the local communities about the 2007 workshop and the potential study sites, and to recruit students from PCC (Palau Community College) and interested villagers in an effort to build capacity for ecological biodiversity assessment. Potential sources of funding for future activities were also discussed. The participants also suggested that the following scientists be invited: Dr. Margie Falanruw (Biology and Agroforestry), Dr. Jim Juvik (Climatology/Hydrology), Dr. Art Whistler (Botany), and Dr. Kim Bridges (Quantitative Ecology). Expertise on photography and methodology for data management was also suggested. Dr. Manner noted that social-cultural-economic aspects of landuse needed to be incorporated.

B. The Joint Synthesis Workshop

This workshop was held on Palau between March 25 to April 2, 2007. In addition to the three PABITRA core members (Drs. Manner, Mueller-Dombois and Daehler) who attended the initial planning and scoping meeting in August 2006, Dr. W. Art Whistler (Pacific Islands' botanist), Dr. Kim Bridges (quantitative ecologist), and Dr. James Juvik (hydrometeorologist) were able to accept the invitation to provide training in their areas of expertise in Palau. Dr. Marge Falanruw of Yap, Federated States of Micronesia was not able to join the group because of a previous assignment. Dr. Sonia Juvik (ethnoscience planning), who travelled to Palau on outside funding, provided additional expertise to the meeting activities.

March 25 was spent on a reconnaissance trip of the island of Babeldaob. Babeldaob which contains the largest intact stands of native tropical lowland forest in Micronesia, is experiencing rapid development associated with the near completion of the Compact Road. This reconnaissance was useful in selecting the potential sites for field training, long-term monitoring and the installation of the meteorological station.

The meeting began on March 26 with opening remarks by the Minister of Resources and Development, Fritz Koshiba, followed by self introductions by all participants, and statements by Professors Manner and Mueller-Dombois about the objectives of the Joint Workshop. Presentations were then made by the Palauan participants of the work accomplished since the Initial Meeting in August 2006. These included presentations on the soils of Palau, a forest inventory assessment, and a topographic profile diagram. In accordance with the meeting agenda on March 26 and 29 (Appendix 9), the invited PABITRA experts made presentations on: hydrometeorology; basic statistics and their ecological applications; mapping with PowerPoint; a review and update of the Palauan plant database, with a focus on introduced species; methods of analysing vegetation; displaying ecosystem features; the analysis of ecosystem threats; agroecosystems; map construction using the pace and compass method; relevé data analysis using the Excel program and PAST, a multivariate analysis program that can be downloaded free of charge from the Internet; analysis and interpretation of precipitation and evapo-transpiration data; downloading and filing meteorological information from data loggers; and curating herbarium specimens.

Informal and lively discussions accompanied each of the seminar topics. Often, these topics were re-examined and clarified when the fieldwork occurred in a new watershed or land-use context.

Two days (March 27 and 28) were spent in the field where the participants were given instruction in: transect reconnaissance; vegetation and land use assessment; the relevé and ecological tree inventory methods; the Braun-Blanquet method of cover abundance estimation; and field mapping exercise using pace and compass traverse. An automated data logging meteorological station was established in the Ngerikiil forest watershed of Airai State, SW Babeldaob. This site has been highly impacted by burning and other non-forest land use activities (See accompanying photos). Near the meteorological station, a discharge rating curve, stream cross-sectional area, and stream velocity measurements were made at a tributary stream where a stream depth (pressure) logger was installed. The meteorological station was purchased with funds from the CAPaBLE grant and augmented by a \$2015 equipment contribution from PABITRA core member, Dr. James Juvik.

March 30 was spent in the field in Ngardmau State in northwestern Babeldaob. This part of Palau is considered to be less impacted than Ngerikiil although the landscape is dotted with *ked* (fern savanna) and evidence of bauxite mining. An automated tipping

bucket rain-gauging station was established at Mt. Ngerchelchus, the highest point in Babeldaob (216 m in elevation) and a 10 m lizard trap was established in the Ngardemau State Waterfall Forest. Professor Mueller-Dombois taught the point-centered quarter vegetation survey method at this site.

The PABITRA core members also participated in less formal training activities. For example, Professors Manner, Mueller-Dombois and Juvik were guests on a popular local television talk show where the topic of conversation was the PABITRA capacity building project in Palau. On another evening, Professors Mueller-Dombois and Daehler made a presentation at Palau Community College on the PABITRA project. Professors Manner and Juvik spoke with a reporter from the Palau Horizon (newspaper) about the PABITRA project and the importance of conservation and biodiversity. Professor Art Whistler led a botanical tour for students at Palau Community College and he worked closely with Ms Kitalong at the Belau National Museum Herbarium on specimen curating. At the museum he helped identify unknown museum specimens and contributed specimens to the museum's collection, including *Medinilla blumeana*, a rare endemic species from Ngardemau.

March 31. On one of its free days, the PABITRA group visited the limestone Rock Islands of Palau, which are widely acclaimed for its unique vegetation. We visited both pristine and impacted islands, including Jellyfish Lake, a brackish inland lake.

The final day of the workshop (April 2) was spent reviewing the work activities of the previous week, and discussing the future role of PABITRA in Palau. There was much discussion on interpreting already existing data and the graphic presentation of available, pre-existing information on climate and vegetation. The applicability of the US Forest Inventory of Palau to the conservation needs of Palau was noted. Dr. Bridges demonstrated the applicability of Google Earth to the PABITRA field sites on Palau. The meeting passed a resolution (attached) asking the host Palau Natural Resources Council to nominate one to two scientists from Palau to attend the 21st Pacific Science Congress in Okinawa, June 12-18, 2007. In order for these scientists to attend the Congress, the participants at the meeting asked Dr. Manner, the PABITRA Co-ordinator to seek support from the APN (Asia Pacific Network for Global Change Research) to fund the Palauan scientists' participation at the Okinawa Congress. It was concluded that the Joint Synthesis Workshop was a success with 14 Palauan participants being awarded certificates of accomplishment.

In the early morning of April 3, except for Professor Manner, the overseas delegation left Palau for home. Dr. Manner stayed on in Palau to instruct two Palauan scientists on research methodology for the Rock Islands of Airai State, before leaving for Guam on April 6. On April 5, Dr. Manner and Palauan PABITRA participants Ms. Ann Kitalong and Ms. Kimie Ngirchchol returned to the recently established automated meteorological station in the Ngerikiil forest watershed and successfully downloaded the recorded meteorological data. In mid-May, Ms. Kitalong revisited the field site and collected meteorological and stream discharge data. Using the knowledge gained at the workshop, she continues to analyse Palauan vegetation.

2. Conclusions

Beginning in mid-2006, PABITRA successfully held two capacity building workshops in the Republic of Palau: a Planning and Scoping Workshop (August 7- 11, 2006) to initiate a synthesis of existing work on Palau ecosystems and to promote the analysis of new research on the ecology of global change in island landscapes; and, a Joint Synthesis Workshop (March 25-April 2, 2007) to initiate studies of selected Palauan ecosystems using a transect and the watershed approach. These workshops were

conducted in collaboration with the Palau Natural Resources Council and received generous in-kind support from the Government of Palau through its Ministry of Resources and Development. The goal of the workshops was the development of scientific capacity so that Palauans would be able to study and analyse their ecosystems and then develop the management and conservation policies needed for sustainable environmental protection. Using the online manual *Biodiversity Assessment of Tropical Island Ecosystems: PABITRA Manual for Interactive Ecology and Management* PABITRA ecologists gave instruction and field training in sampling methods and techniques of analysing natural and human-modified ecosystems. This manual will be soon published with partial funding from APN. PABITRA also established an automated meteorological and a stream gauging station in the Ngerikiil Forest watershed. PABITRA also established a rain-gauging station at Mt. Ngerchelchuus in NW Babeldaob and a lizard trap in the Ngardemau State Waterfall Forest.

On the final day of the workshop, the meeting passed a resolution requesting PABITRA to seek financial support from APN for Palauan scientists to attend and present the results of their studies at the 21st Pacific Science Congress in Okinawa, June 12 to 18, 2007. The meeting ended with fourteen Palauan scientists receiving certificates of participation.

3. Future Directions

Observations from the workshop suggest a number of potentially fruitful directions for future capacity building projects. These are briefly described below.

A. The need for training in basic geographic and ecological methods.

The educational levels of the participants were quite variable, ranging from high school graduates to university graduates. While this variability was partially overcome by the enthusiasm of the participants, observations made during the training sessions indicated that most participants lacked certain basic skills and knowledge normally found in field scientists. Most participants were very well trained in their specialised areas of expertise, but lacked the general geographic competencies, particularly basic mapping skills and topographic map interpretation, required of field scientists. Few participants, including PALARIS, the local GIS group did not know how to construct a topographic profile or how to use a compass in order to make a map. Most of the participants were familiar with and used GPS (global positioning system) hardware, but few understood the basic skills of topographic map interpretation, including the differences between magnetic, true and grid north. Future projects should consider offering such fundamental training skills.

B. The need for meteorological, hydrologic and other field equipment.

Climate, stream discharge, and other kinds of environmental data are routinely collected by various US government agencies, including the USGS, NOAA, and the US Forest Service to name a few. As the data are sent off island for processing, the Palauan participants at the workshop stated that they had difficulty accessing the data needed for decision making and that data sharing was not a common practice among the agencies. PABITRA core members based in Honolulu said that they would meet with the appropriate agencies and try to get the data back to Palau. The difficulty in accessing meteorological and hydrologic data and the fact that there are too few meteorological and stream data collecting stations throughout Palau validates PABITRA's efforts in establishing weather and stream recording stations for the Palauan participants. Without a doubt, more data collecting stations will be needed in order for Palau to understand the structure and function of their ecosystems. The cost

of such equipment is inexpensive. As a general rule, commonplace scientific field equipment is usually not available and should be priority expenditures for future capacity building projects.

C. Capacity building projects must attract younger participants in environmentally related activities.

Fourteen Palauan participants received certificates from PABITRA for participating in the workshops. All participants were employed in environment-oriented government agencies, environmental NGOs, or environmental consultants. None of the participants were tertiary level students, perhaps because of the absence of a four-year university, the timing of the workshops during university's academic term, and/or the perception that there are too few career opportunities in the environmental sciences in a developing country. Indeed, the number of scientifically trained personnel in Palau appears to be too little in light of the many environmental problems engendered by the country's growth and development. Despite the presentations by the PABITRA scientists at the Palau Community College (PCC) and requests for student participation by the Palauan PABITRA, there were no participants from the local junior college or high schools who attended the workshops. Future capacity building efforts in Palau (and perhaps in other island countries) must be directed to attracting younger, secondary and tertiary level students pursue degrees in the environmental sciences and related careers as well as participating in field ecological studies. Incentives may be a necessary step to attract young student to participate in environmental and capacity building projects as well as increasing environmental awareness. Until such a core of young scientists is available, the currently active scientists must be funded to carry out the work of ecological assessment and monitoring. PABITRA has ample evidence that the Palauan scientists who attended the APN funded workshops described herein are actively using their newly attained skills and equipment to acquire data and thus, to better understand their ecosystems.

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Appendix 1.

Funding sources outside the APN

A list of agencies, institutions, organisations (governmental, inter-governmental and/or non-governmental), that provided any in-kind support or co-funding for the project and the amount (s) awarded.

Organisation	Type	Support	Amount
PABITRA (Dr. James Juvik)	Private	Meteorological Equipment *	\$2015
Palau Conservation Society	NGO	Vehicle, 4 wheel drive @ \$125/day	375
Palau Conservation Society	NGO	Digital Projector @ \$25/day	75
Belau National Museum	Govt	Vehicle, 2 wheel drive @ \$50/day	150
Bureau of Agriculture/Forestry	Govt	Vehicle, 4 wheel drive @ \$125/day	750
Tarita Holm	Private	Vehicle, 2 wheel drive @ \$50/day	200
Ann Kitalong	Private	Vehicle, 2 wheel drive @ \$50/day	100
Airai State Government	Govt	Vehicle, 4 wheel drive @ \$125/day	250
Ngardmau State Government	Govt	Vehicle, 4 wheel drive @ \$125/day	125
Palau Env. Quality Protect. Bd	Govt	Vehicle, 4 wheel drive @ \$125/day	375
Ministry of Res. & Dev.	Govt	Secretarial Support @ \$75/day	375
PABITRA (7 Instructors)**	Private	Scientific Expertise (In-kind)	23600
Total			\$28390

** In-kind contribution of scientific expertise estimated at \$400/day x 59 man-days

*Equipment Contributed by Dr. James Juvik, PABITRA

Item	Amount
3 Hobo recording raingauges @\$400 each	\$1200
Hoboware/Hobopro software	200
Solar sensor	125
Temperature/humidity sensor	125
Hoboware Optical reader	100
Serial/USB Connector	40
Air pressure sensor	90
Soil moisture sensor	135
Total	\$2015

Appendix 2.

Glossary of Terms

APN	Asia-Pacific Network for Global Change Research
BOA	Bureau of Agriculture
DIWPA	Diversitas in the Western Pacific and Asia
EQPB	Environmental Quality Protection Board
GCTE	Global Change and Terrestrial Ecosystems
GIS	Geographic Information System
IAVS	International Association of Vegetation Science
MRD	Ministry of Resources and Development
OERC	Office of Environmental Response and Coordination
NGO	Non-Governmental Organisation
PABITRA	Pacific-Asia Biodiversity Transect Network
PALARIS	Palau Automated Land Resource Information System
PAST	Paleontological Statistics
PCC	Palau Community College
PCS	Palau Conservation Society
PNCC	Palau Natural Resources Council
PSA	Pacific Science Association
SPREP	South Pacific Regional Environment Programme
TNC	The Nature Conservancy
USDA	United States Department of Agriculture

Our mission: To provide leadership for the wise use and sustainable management of Palau's land-based natural resources using appropriate technology.

Chairperson:
Tarita Holm, BOA/PAN-MRD

Vice-Chairperson:
Vernice Stefano, PALARIS

Secretary:
Umich Sengebaw, TNC

Members:
Bureau of Agriculture

Bureau of Marine Resources

Bureau of Public Works

Bureau of Lands & Survey

Palau Public Lands Authority

Div. of Design & Engineering

Environmental Quality Protection Board

Palau Community College, Cooperative Research and Extension Service

Palau Community Action Agency

PALARIS

Palau Conservation Society

Belau National Muséum

Governors' Association

Council of Chiefs

PALAU NATURAL RESOURCES COUNCIL
C/O MINISTRY OF RESOURCES AND DEVELOPMENT
P.O. BOX 100
KOROR, PALAU 96940

July 28, 2006

Mr. Rick Mangham
CIP Manager
Division of Design and Engineering/CIP
P.O. Box 100
Koror, Palau 96940

Subject: Invitation to Participate in the Pacific Asia Biodiversity Transect (PABITRA) Network Initial Synthesis Meeting, 9-11 August, Koror, Palau.

Dear Mr. Mangham

We are pleased to invite your agency/organization to participate in the upcoming meeting to be held at the **Penthouse Conference Room from August 9-11, 2006**. Attached to this invitation are the provisional agenda and meeting overview document.

Please contact either myself or Ms. Vicky Riungel at 488-8681 if you need any further information regarding this invitation. We hope to see you at the meeting.

Kind regards,

Ms. Tarita Holm
Chairperson
Palau Natural Resources Council

Pc: file

Our Vision: "People working together to ensure the use and management of natural resources in harmony with Palau's environment and culture"

Appendix 4.

List of Invitees to the PABITRA Initial Meeting, August 7-12, 2006, Koror, Palau

Name	Title	Organisation
Mr. Rick Mangham	CIP Manager	Division of Design and Engineering/CIP P.O. Box 100, Koror, Palau 96940
Tiare Holm	Executive Director	Palau Conservation Society P.O. Box 1811, Koror, Palau 96940
Vernice Stefano	Program Manager	PALARIS P.O. Box 100, Koror, Palau 96940
Porita Franz	Executive Director	Environmental Quality Protection Board P.O. Box 8086, Koror, Palau 96940
Thomas Taro	Vice President	PCC- Cooperative Research & Extension P.O. Box 9, Koror, Palau 96940
Lazarus Kodep	Chairman	Governors' Association P.O. Box 6042, Koror, Palau 96940
Ibedul Yutaka Gibbons	Paramount Chief	Council of Chiefs P.O. Box 1257, Koror, Palau 96940
Yousau Bells	Nat'l Environment Planner	Office of Environmental Response & Coordination P.O. Box 7086, Koror, Palau 96940
Grace Yano	Executive Director	Palau Public Lands Authority P.O. Box 100, Koror, Palau 96940
Faustina Rechucher	Director	Belau National Museum P.O. Box 666, Koror, Palau 96940
Umiich Sengebau	Conservation Coordinator	The Nature Conservancy P.O. Box 1738, Koror, Palau 96940
Ann Kitalong	Environmental Consultant	The Environment, Inc P.O. Box 1696, Koror, Palau 96940
Joe Reklai	Acting Director	Bureau of Public Works P.O. Box 100, Koror, Palau 96940
Gilbert Demei	Director	Bureau of Lands & Survey P.O. Box 100, Koror, Palau 96940
Fernando Sengebau	Acting Director	Bureau of Agriculture P.O. Box 460, Koror, Palau 96940
Theo Isamu	Director	Bureau of Marine Resource P.O. Box 359, Koror, Palau 96940
Fabian Iyar	Chief Executive Officer	Palau International Coral Reef Center P.O. Box 7086, Koror, Palau 96940
Ebais Sadang	Forester II	Bureau of Agriculture / Forestry Unit P.O. Box 460, Koror, Palau 96940
Lazarus Kodep	Governor	Melekeok State Office P.O. Box 6042, Koror, Palau 96940
Vicky Kanai	Governor	Airai State Office P.O. Box 8009, Koror, Palau 96940
Akiko Sugiyama	Governor	Ngardemau State Office P.O. Box 6015, Koror, Palau 96940
Brownly Salvador	Governor	Ngarchelong State Office P.O. Box 1504, Koror, Palau 96940
Shallum Etpison	Governor	Ngatpang State Office P.O. Box 6025, Koror, Palau 96940
John Skebong	Governor	Ngeremlengui State Office P.O. Box 74, Koror, Palau 96940
Jackson Ngiraingas	Governor	Peleliu State Office P.O. Box 6035, Koror, Palau 96940
Yoshitaka Adachi	Governor	Koror State Office P.O. Box 116, Koror, Palau 96940
Demei Obak	Governor	Aimeliik State Office P.O. Box 458, Koror, Palau 96940

Appendix 4 (continued).

Laurentino Ulechong	Governor	Ngaraard State Office P.O. Box 6026, Koror, Palau 96940
Theodora Nagata	Executive Director	Palau Community Action Agency P.O. Box 3000, Koror, Palau 96940
Robin DeMeo	USDA	Natural Resource Conservation Service Koror, Palau 96940
Phoebe Sengebau	Administrative Assistant	Marine Conservation & Protected Areas Program P.O. Box 100, Koror, Palau 96940

Appendix 5.

PABITRA - Initial Synthesis Workshop
First Seminar Day - August 9, 2006 Sign In Sheet

Name	State/Agency/ Organisation	Phone #	Email Address
Larry Mamis	Bureau of Agriculture	488-8171	palauforestry@palaunet.com
Ebais Sadang	Bureau of Agriculture	488-8171	palauforestry@palaunet.com
Ann Kitalong	The Environment Inc.	567-3451	kitalong@palaunet.com
Leilani Rechellul	PCC- Cooperative Research & Extension	488-2746	leir@palau.edu
Fritz Koshiba	Minister, Resources & Develop.	488-2701	mrd@palaunet.com
Sarah Klain	Bureau of Marine Resource	488-3125	s.klain@gmail.com
Gillian Johanes	Palau Conservation Society	488-3993	pcs@palaunet.com
Vernice Stefano	Palaris	488-6654	palaris@palaunet.com
Mike Aulerio	Palaris	488-6654	palaris@palaunet.com
Adlbert Eledui	Koror State Government	488-4001	korrangers@palaunet.com
Vicky Riungel	MRD- BOA- PAN	488-5435	pan@palaunet.com
Lukes Isechal	Palau Conservation Society	488-3993	pcs@palaunet.com
Jackson Ngiraingas	Governor, Peleliu State	775-2500	aspacific@palaunet.com
Sean Austin	The Nature Conservancy	488-2017	saustin@tnc.org
Umiih Sengebau	The Nature Conservancy	488-2017	fusengebau@palaunet.org
Akiko Sugiyama	Governor, Ngardemau State	488-1401	ngargov@palaunet.com
Yalap Yalap	Palau Conservation Society	488-3993	pcs@palaunet.com
Tarita Holm	MRD/BOA/PAN	488-8171	pan@palaunet.com
Portia Franz	EQPB	488-1939	eqpb@palaunet.com
Collin Joseph	Palau Conservation Society	488-3993	pcs@palaunet.com
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Meked Besbes	Bureau National Museum	488-2841	bnm@palaunet.com
Tina Rechucher	Bureau National Museum	488-2841	bnm@palaunet.com
Joel Miles	Office of Env. Response and Coordination	488-6950	jmiles@palau-oerc.net
Michael Balich	NY Botanical Garden		MBALICK@NYBG.org

Appendix 6.

PABITRA (Pacific Asia Biodiversity Transect Network) Initial Meeting (Planning and Scoping Workshop Sponsored by the Asia Pacific Network) 7-11 August 2006, Koror, Palau

6 August 2006, Sunday: Arrival

Accommodations at the Palau International Coral Reef Center. Contacts: Sirino Hideo (PICRC) and Tarita Holm (Forestry)

7 August 2006, Monday

10:00 AM Departure from PICRC dock to Rock Islands field trip: German Lighthouse Trail.

August 8, 2006, Tuesday

9:00 AM Meeting with Minister of Resources and Development: Fritz Koshiha.

10:30 AM Meeting with Palau Conservation Society Board of Directors

11:00 AM Reconnaissance visit to Babeldaob watersheds. Return to Koror by 6pm.

9 August 2006, Wednesday

Penthouse Conference Room

9:00 AM Opening Remarks

Minister Fritz Koshiha

9:30 AM Greetings and Introduction to PABITRA

Prof. Manner

10:00 AM History and goals of PABITRA

Prof. Mueller-Dombois

Self-Introductions of Palau Participants

10:30 AM Morning Tea

10:45 AM Need for Understanding Ecosystems & Global Change

Prof. Curtis Daehler

11:15 AM Introduction to the PABITRA Manual

Prof. Mueller-Dombois

11:45 AM Q&A session with participants

12:00 PM Interview with local newspapers

Prof. Manner, Dombois
and Daehler

12:00-1:30 PM Lunch (will be provided at Penthouse)

1:30 PM Informal discussion on analysis of vegetation and ecosystems

Prof. Mueller-Dombois

2:30 PM Informal discussion on threats to natural ecosystems and
how to cope with them. Afternoon Tea available

Prof. Curtis Daehler

3:30 PM Informal discussion on how to evaluate agroecosystems

Prof. Manner

4:30 PM General follow-up discussion and planning for next day's field visit to sites

10 August 2006, Thursday

8:00 AM Radio talk show at Eco-Paradise (Public Radio Station) in Meyuns

10:00 AM FIELD VISIT to Babeldaob Potential PABITRA Transect Sites: Ngardok Lake
Presentation of field techniques including minimal area concept, releve method

11 August 2006, Friday

Penthouse Conference Room

9:00 AM Assembly of existing Palau maps: Topographic base maps, soil, geology,
climate, vegetation, landuse, including air photos and climatic data

10:00 AM Pinpointing potential transect sites on existing maps. Morning Tea available

11:00 AM Establishing research gaps: including how to make ecological
climate diagrams and how to portray ecosystem features

11:45 AM Meeting with Vice President of Palau, Elias Camsek Chin

12:00-2:00 PM Lunch (will be provided at Penthouse)

1:00 – 4:00 PM Discussion on Site Selection Finalisation

2:00 PM Meeting with Billy Kuartei, Chief of Staff of President Remengesau
Afternoon Tea available.

4:00-5:00 PM Preparation for future meeting and collaboration

12 August 2006 Departure

Appendix 7.

PABITRA - Initial Synthesis Workshop
 Field Trip
 August 10, 2006
 Sign in Sheet

Name	Title
Ann Kitalong	Environment Consultant
Sarah Klain	Peace Corps
Leilani Rechellul	Extension Agent
Vicky Riungel	Administrative Assistant
Tarita Holm	Forest Management Coordinator
Larry Mamis	Forest Extension Agent
Ebais Sadang	Forester II
Chris Kitalong	Environment Officer
Michael Balick	Botanical Consultant
Rafael Maior	

PABITRA - Initial Synthesis Workshop
 Second Seminar Day
 August 11, 2006
 Sign in Sheet

Name	State/Agency/Organisation	Phone #	E-mail Address
Umich Sengebau	TNC	488-2017	fusengebau@palaunet.com
Mike Aulerio	PALARIS	488-6654	Palaris@palaunet.com
Ebais Sadang	Bureau of Agriculture	488-8171	palauforestry@palaunet.com
Simeon Skilang	Ngardmau State Gov.	488-1401	
Gillian Johanes	PCS	488-3993	Gilljoh@hotmail.com
Larry Mamis	Bureau of Agriculture	488-8171	palauforestry@palaunet.com
Joel Miles	OERC	488-6950	jmiles@palau-oerc.net
Leilanie Rechelluul	Palau Community College- Coop. Research/Extension	488-2746	leir@palau.edu
Portia Franz	EQPB	488-1639	eqpb@palaunet.com
Collin Joseph	PCS	488-3993	
Sarah Klain	Belau Marine Resources/Peace Corp	488-6747	sklain@gmail.com
Tarita Holm	Palau Natural Resources Council		Tarita@palaunet.com
Ann Kitalong	TEI	587-3451	kitalong@palaunet.com

Appendix 8.

PARTICIPANTS AT THE PABITRA SEMINAR IN PALAU AUGUST 9, 2006



Ms. Tarita Holm kneeling in front. Professor Harley Manner (with glasses) seated behind. The lady Governor Akiko Sugiyama seated on H. Manner's right. Seated on his left is the Minister of Resources & Development, Mr. Fritz Koshiba. Professor Mueller-Dombois seated at his left (with hat). Dr. Curt Daehler, the third core member of PABITRA, standing at door. Other names on the meeting attendance list.

Fieldtrip group resting at Ngardok Lake



For names of participants see participant's list for August 10, 2007.

Appendix 9.

MEETING AGENDA

Palau Joint Analysis Workshop March 26-April 3, 2007

3/24/07	Saturday evening arrival of five PABITRA scientists in Koror, Palau. Contact: Tarita Holm (Palau Natural Resources Council).	
3/25/07	Reconnaissance Trip around Babeldaob Island.	
3/26/07	Penthouse Conference Room	
9:25 am	Opening Remarks	Minister Fritz Koshiba
9:35 am	Self-introduction of all participants	Ms Tarita Holm
9:45 am	Greetings and Summary of the Initial Meeting	Prof. Harley Manner
10:00 am	Summary of PABITRA Objectives and this Meeting	Prof. Dieter Mueller-Dombois
10:30 am	Morning Tea	
10:45 am	Hydrometeorology in Watersheds	Prof. James Juvik
11:30 am	Work accomplished by the Palau Group (Profiles and available data)	All Participants, A. Kitalong, Tarita Holm
12:00	Lunch (provided at Penthouse)	
1:30 pm	NRCS study on Soil Fertility, Landslide Impact and Percolation of Palauan Soils (B. Gavendra)	Ann Kitalong
	Forest Inventory-Babeldaob Forest Assess. 2005-2006	Ann Kitalong
2:15 pm	Discussion on information needs (human disturbance indicators, photo point surveys, species dispersal prediction)	
	Transect Sites, Available data and information	All participants
2:50 pm	Basic Statistics and Application to Field Ecology	Prof. C. Daehler
3:30 pm	Relevé analysis with PAST software	Prof. Kim Bridges
	Map Drawing with PowerPoint (Afternoon tea available)	
4:00 pm	Discussion on next day's fieldtrip and methods to be presented in Ngerikiil Watershed	
3/27/07	Field Day in Ngerikiil Watershed, Airai State, Babeldaob	
9:00 am	Departure for field from Airai Shell	
10:00 am	Transect reconnaissance, assessment of vegetation & land use pattern, site selection for climatic and hydrological instrumentation, plant identification with collection and digital photography).	All participants
	Relevé method and ecological tree inventory methods.	Professor Mueller-Dombois
7:00 pm	Television talk show appearance	Profs.Manner, Mueller-Dombois and Juvik
3/28/07	Field Day in Ngerikiil Watershed (continued).	
10:00 am	Establishment and construction of meteorological instrumentation with data loggers.	Professor Juvik
	Field mapping using pace and compass method.	Professor Manner
1:00 pm	Establishment of discharge rating curve, stream velocity measurement, stream cross-sectional area. Placement of stream depth (pressure) logger.	Professor Juvik
3/29 /07	Penthouse Conference Room	
9:15 am	Construction of Pace and Compass Map	Professor Manner
10:45 am	Analysis of relevé data (cluster analysis using Excel).	Professor Bridges
12:00	Lunch. Palau Horizon interview.	Professors Manner and Juvik
1:30 pm	Analysis/interpretation of precipitation and evapo-transpiration data; downloading data from loggers.	Professor Juvik
3:00 pm	Curating herbarium specimens	Professor Whistler
4:30 pm	Discussion of next day's field activities.	All participants
5:00pm	Botany tour with Palau Community College students.	Professor Whistler
6:00 pm	PABITRA presentation at PCC	Professors Mueller-Dombois and Daehler
3/30/07	Field Day in Ngardmau State, NW Babeldaob	
10:00 am	Establishment of raingauge at Mt. Ngerchulchuus.	
1:30 pm	Construction and establishment of lizard trap set at Ngardmau Forest (waterfall)	Professor Juvik
	Vegetation analysis using the point-centred quarter method	Professor Mueller-Dombois
3/31/07	Trip to Rock Islands including Jellyfish Lake	
3/1/07	PABITRA (Hawaii) Group greets Hōkūle'a arrival	

Appendix 9 (continued).

4/2/07	Penthouse Conference Room	
9:30 am	PABITRA transects on Google Earth	Professor Bridges
10:00 am	Data assembly, analysis and interpretation of work Holdridge system, Climate diagrams and Topographic Profiles; Stand level profile diagrams	Professor Mueller- Dombois
11:40 am	Discussion: Pit fall traps/faunal surveys/bird surveys and data acquisition strategies	Professor James Juvik
12:35 pm	Lunch	
	Instruction: downloading meteorological data	Professor James Juvik
	Discussion: Future directions for PABITRA Palau	
	Certificates of Participation and awards	Minister Fritz Koshiba Ms Tarita Holm Professor Manner Professor Mueller-Dombois
4/3/07	Early morning departure of overseas delegation	
4/5/07	Downloaded logged data from Ngerikiil forest meteorological station	Professor Manner Ms Ann Kitalong Ms Kimie Ngirechechol

Appendix 10.

**LIST OF PARTICIPANTS/AGENCIES PRESENT AT THE PABITRA JOINT
SYNTHESIS WORKSHOP, KOROR, REPUBLIC OF PALAU
MARCH 25 – APRIL 2, 2007**

Name	State/Agency/ Organisation	Phone #	Email Address
Portia K. Franz	Palau Environmental Quality Protection Board	488-1639	eqpbfranz@yahoo.com
Kimie Ngirchechol	PEQPB	488-1639	Eqpb@palaunet.com
Ebais Sadang	Bureau of Agriculture	488-8171	palauforestry@palaunet.com
Ann Kitalong	The Environment Inc.	567-3451	kitalong@palaunet.com
Fritz Koshiba	Minister, of Resources & Development	488-2701	mrd@palaunet.com
Gillian Johanes	Palau Conservation Society	488-3993	pcs@palaunet.com
Flavin Uro	Ariai State Public Land Authority	587-3511	Araigov@palaunet.com
Annette Mueller- Dombois	Hawaii		Amdhawaii@aol.com
Dieter Mueller-Dombois	UHManoa, Botany		Amdhawaii@aol.com
Jim Juvik	Univ. of Hawaii Hilo, Geography		jjuvik@hawaii.edu
Sonia Juvik	Univ. of Hawaii Hilo, Geography		juvik@hawaii.edu
Kim Bridges	Univ. of Hawaii Manoa, Botany		kim@hawaii.edu
Yalap Yalap	Palau Conservation Society	488-3993	pcs@palaunet.com
Tarita Holm	BOA/Forestry	488-2332	tarita@palaunet.com
Art Whistler	Univ. of the South Pacific, Suva Fiji		Whistler@hawaii.edu
Curtis Daehler	Univ. of Hawaii Manoa, Botany		Daehler@hawaii.edu
Jack Masters	Airai State	587-3511	
Liz Matthews	Palau Conservation Society	488-3993	Pcs@palaunet.com
Umai Basilius	Palau Conservation Society	488-3993	Pcs@palaunet.com
Tiare Holm	Palau Conservation Society	488-3993	Pcs@palaunet.com
Lukes Isechal	Palau Conservation Society	488-3993	pcs@palaunet.com
Alan Olsen	Belau National Museum	488-2265	Bnm@palaunet.com
Harley Manner	Univ. of Guam, Geography		Hmanner@uog9.uog.edu
Jerome Sakurai	PEQPB		Eqpb@palaunet.com
Ngiracheues Aderkeroi	Ngardmau State		Palau_man@yahoo.com
Johnston Aderkeroi	Ngardmau State		Palau_man@yahoo.com
Maile Ngiriou	PEQPB		Eqpb@palaunet.com
Keriik Kitalong	Belau National Museum		Bnm@palaunet.com

Appendix 11.

JOINT SYNTHESIS WORKSHOP PARTICIPANTS BY DATE, MARCH 26-APRIL 2, 2007

Name	Mar 26	Mar 27	Mar 28	Mar 29	Mar 30	Apr 2
Lukes Isechal		X	X	X		
Flavin Uro	X	X	X	X		X
Ebais Sadang	X	X	X	X	X	X
Kim Bridges	X	X	X	X	X	X
Kimie Ngirchechol	X	X	X	X	X	X
Ann Kitalong	X	X	X	X	X	X
Tarita Holm	X	X	X	X	X	X
Liz Matthews	X	X	X	X		
Alan Olsen	X	X	X	X	X	X
Art Whistler	X	X	X	X	X	X
Jack Masters	X	X	X	X	X	
Curt Daehler	X	X	X	X	X	X
Sonia Juvik	X	X		X		X
Jim Juvik	X	X	X	X	X	X
Jerome Sakurai		X	X			
Edesdei				X		
Harley Manner	X	X	X	X	X	X
Fritz Koshiba	X					X
Annette Mueller-Dombois	X			X	X	X
Dieter Mueller-Dombois	X	X	X	X	X	X
Jessie Czekanski-Moir		X	X	X	X	X
Gillian Johanes	X	X	X			X
Tiare Holm	X					
Umai Basilius	X	X				
Portia Franz	X					
Ngiracheues Aderkeroi					X	
Johnston Aderkeroi					X	
Keriik Kitalong		X	X			
Maile Ngiriou		X				
Yalap Yalap	X	X				

Appendix 12.

Resolution on Representation of Palau at the 21st Pacific Science Congress

Whereas the Palau Natural Resources Council has successfully hosted two PABITRA workshops, and

Whereas the Palau government administrators, agency researchers and members of the conservation NGOs have shown a high level of interest and ability in participating in cross-Pacific networks studying island biodiversity, and

Whereas the Pacific Science Association has established the Pacific Science Congress as a venue to promote scientific exchange among island nations and peoples, and

Whereas the 21st Pacific Science Congress to be held in Okinawa, Japan, will include a session on PABITRA activities,

Be it therefore resolved that

The Palau Natural Resources Council be encouraged to participate in the 21st Pacific Science Congress, and that

The PABITRA leadership should seek funding to support this participation.

Approved on April 2, 2007 by the participants of the PABITRA Joint Synthesis Meeting held in Koror, Republic of Palau.

Photos of the Joint Synthesis Workshop



Participants at the PABITRA Joint Synthesis Meeting in Koror, Republic of Palau, March 26, 2007. Seated, L to R: Dr. Dieter Mueller-Dombois, Fritz Koshiba (Minister of Resources and Development), Dr. Harley Manner, and Yalap Yalap. Standing, L to R: Flavian Uro, Kimie Ngirchchol, Ann Kitalong, Ebais Sadang, Jack Masters, Dr. Curtis Daehler, Annette Mueller-Dombois, Dr. Kim Bridges, Tarita Holm, Dr. Sonia Juvik, Dr. Jim Juvik and Dr. Art Whistler.



Dr. Art Whistler of the University of the South Pacific (Suva, Fiji) explains the finer points of species identification. PABITRA conducted this field training exercise in tropical lowland forest in the Ngerikiil Watershed, Airai State, Babeldaob on March 27, 2007.

Appendix 13 (continued).



Meteorological Station being set up in the Ngerikiil Watershed, Airai State, Babeldaob Island, March 28, 2007. The meteorological station was made possible by a CAPaBLE grant from APN and an equipment contribution from Dr. James Juvik (left foreground wearing the hat).



Ms Kimie Ngirchechol preparing to open up the Ngerikiil watershed meteorological station's automated logger to download the data, April 5, 2007. Note the rain gauge near the bottom right of the photograph.

Appendix 13 (continued).



Ms. Kimie Ngirchchol receiving her PABITRA Joint Synthesis Workshop certificate of participation from Ms Tarita Holm, Dr. Harley Manner, Minister Fritz Koshiba, and Dr. Dieter Mueller-Dombois on the afternoon of April 2, 2007, Koror, Palau.



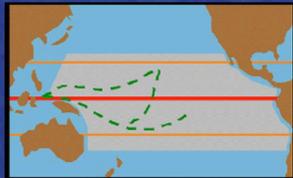
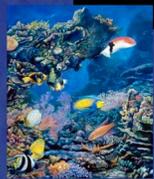
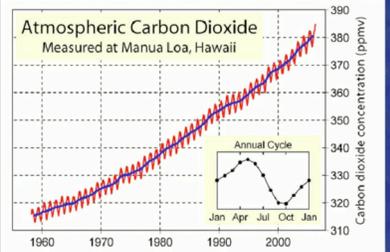
Ebais Sadang beams upon receiving his PABITRA Joint Synthesis Workshop certificate of participation from Ms Tarita Holm, Dr. Harley Manner, Minister Fritz Koshiba, and Dr. Dieter Mueller-Dombois on the afternoon of April 2, 2007, Koror, Palau.

Appendix 14 (continued).

<p>APN-PABITRA-Palau Natural Resources Council Asia Pacific Network for Global Change Research – Pacific Asia Biodiversity Transect Network</p> <p>Certificate of Participation </p> <p>Ecological Management Training</p> <p>This is to certify that</p> <p>Aderdei Gillian Johanes</p> <p>has successfully completed the Field Biology and Biodiversity Assessment Training and PABITRA Joint Analysis Workshop</p> <p>Co-funded by the Asia Pacific Network for Global Climate Change Research and the Government of Palau</p> <p>March 25 to April 2, 2007</p> <p>Prof. Dieter Mueller-Dombois International PABITRA Coordinator</p> <p>Minister Fritz Koshiba Ministry of Resources & Development Republic of Palau</p> <p>Prof. Harley Manner Micronesia PABITRA Coordinator</p> <p>A joint collaboration with the Palau Natural Resources Council, University of Guam, University of Hawaii at Manoa, University of Hawaii at Hilo, and University of the South Pacific at Suva</p>	<p>APN-PABITRA-Palau Natural Resources Council Asia Pacific Network for Global Change Research – Pacific Asia Biodiversity Transect Network</p> <p>Certificate of Participation </p> <p>Ecological Management Training</p> <p>This is to certify that</p> <p>Jesse Czekanski-Moir</p> <p>has successfully completed the Field Biology and Biodiversity Assessment Training and PABITRA Joint Analysis Workshop</p> <p>Co-funded by the Asia Pacific Network for Global Climate Change Research and the Government of Palau</p> <p>March 25 to April 2, 2007</p> <p>Prof. Dieter Mueller-Dombois International PABITRA Coordinator</p> <p>Minister Fritz Koshiba Ministry of Resources & Development Republic of Palau</p> <p>Prof. Harley Manner Micronesia PABITRA Coordinator</p> <p>A joint collaboration with the Palau Natural Resources Council, University of Guam, University of Hawaii at Manoa, University of Hawaii at Hilo, and University of the South Pacific at Suva</p>	<p>APN-PABITRA-Palau Natural Resources Council Asia Pacific Network for Global Change Research – Pacific Asia Biodiversity Transect Network</p> <p>Certificate of Participation </p> <p>Ecological Management Training</p> <p>This is to certify that</p> <p>Alan Olsen</p> <p>has successfully completed the Field Biology and Biodiversity Assessment Training and PABITRA Joint Analysis Workshop</p> <p>Co-funded by the Asia Pacific Network for Global Climate Change Research and the Government of Palau</p> <p>March 25 to April 2, 2007</p> <p>Prof. Dieter Mueller-Dombois International PABITRA Coordinator</p> <p>Minister Fritz Koshiba Ministry of Resources & Development Republic of Palau</p> <p>Prof. Harley Manner Micronesia PABITRA Coordinator</p> <p>A joint collaboration with the Palau Natural Resources Council, University of Guam, University of Hawaii at Manoa, University of Hawaii at Hilo, and University of the South Pacific at Suva</p>
<p>APN-PABITRA-Palau Natural Resources Council Asia Pacific Network for Global Change Research – Pacific Asia Biodiversity Transect Network</p> <p>Certificate of Participation </p> <p>Ecological Management Training</p> <p>This is to certify that</p> <p>Tarita Holm</p> <p>has successfully completed the Field Biology and Biodiversity Assessment Training and PABITRA Joint Analysis Workshop</p> <p>Co-funded by the Asia Pacific Network for Global Climate Change Research and the Government of Palau</p> <p>March 25 to April 2, 2007</p> <p>Prof. Dieter Mueller-Dombois International PABITRA Coordinator</p> <p>Minister Fritz Koshiba Ministry of Resources & Development Republic of Palau</p> <p>Prof. Harley Manner Micronesia PABITRA Coordinator</p> <p>A joint collaboration with the Palau Natural Resources Council, University of Guam, University of Hawaii at Manoa, University of Hawaii at Hilo, and University of the South Pacific at Suva</p>	<p>APN-PABITRA-Palau Natural Resources Council Asia Pacific Network for Global Change Research – Pacific Asia Biodiversity Transect Network</p> <p>Certificate of Participation </p> <p>Ecological Management Training</p> <p>This is to certify that</p> <p>Ngiracheues Aderkeroi</p> <p>has successfully completed the Field Biology and Biodiversity Assessment Training and PABITRA Joint Analysis Workshop</p> <p>Co-funded by the Asia Pacific Network for Global Climate Change Research and the Government of Palau</p> <p>March 25 to April 2, 2007</p> <p>Prof. Dieter Mueller-Dombois International PABITRA Coordinator</p> <p>Minister Fritz Koshiba Ministry of Resources & Development Republic of Palau</p> <p>Prof. Harley Manner Micronesia PABITRA Coordinator</p> <p>A joint collaboration with the Palau Natural Resources Council, University of Guam, University of Hawaii at Manoa, University of Hawaii at Hilo, and University of the South Pacific at Suva</p>	

Appendix 15.

<p><i>Capacity Building and Meeting Research Needs on the Ecology of Global Change in Island Landscapes of the Republic of Palau.</i></p> <p><i>PABITRA Initial Meeting</i> <i>August 7-11, 2006</i> <i>Koror, Palau</i></p> <p>Harley I. Manner, Ph.D. Professor of Geography and Micronesian Studies College of Liberal Arts & Social Sciences University of Guam</p>	<p>Initial Meeting Objectives</p> <p>Introduction of the PABITRA concept and its work in the Pacific Islands.</p> <p>For PABITRA, to learn more of Palau's ecological problems and needs (a mutual learning process).</p> <p>Begin a synthesis of existing work on Palau ecosystems and incorporate a transect approach.</p> <p>Present techniques for data collection and interpretation using the PABITRA online manual for integrated assessment of biodiversity</p> <p>To plan for the Joint Workshop (late March/early April 2007).</p>
	
 <p>Examples of Questions PABITRA can help you find answers to.</p> <p>How has the Compact Road affected this mangrove forest?</p> <p>What is the composition of this forest?</p> <p>How do you quantify the impacts of development on forests?</p>	<p>Long term objectives</p> <p>To generate new ecological knowledge by Palauans that compares with other Pacific Island archipelagoes.</p> <p>To bring Palau into the Pacific Island PABITRA ecosystem network and the Pacific Science Association.</p> <p>To generate interest among Palauan scientists in participating in the wider Pacific scientific fora.</p> <p>To train Palauans so that they can make the assessments and measurements of their own ecosystems and thus decide on the most viable and sustainable land use options for Palau.</p>
<p>Acknowledgements:</p> <p>Mr. Sirino Hideo (PICRC) Ms. Tarita Holm (Bureau of Agriculture- Forestry) Palau Natural Resources Council Robin DeMeo (NRCS)</p> <p>We thank all those who helped put this workshop together. Mesulang.</p> <p>Any Question or Comment is welcomed.</p>	

<p>PABITRA: Understanding ecosystems and the influence on global change</p>  <p>Curt Daehler University of Hawai'i daehler@hawaii.edu</p>	   
<p>Global Change</p> <p>Challenges for Pacific Islands</p>  <p>Climate change</p> <p>Human land use ↔ Invasive species</p>	<p>Global Change</p> <p>Population growth Urbanization</p>  <ul style="list-style-type: none"> • Increased natural resource needs • Waste disposal problems 
<p>Global Change</p> <p>Human land use</p>  <ul style="list-style-type: none"> • Tourism 	<p>Global Change</p> <p>Agricultural practices</p> <p>Traditional shifting cultivation → Intensive cultivation</p> <ul style="list-style-type: none"> • Fallow periods • Fertilizer loading • Soil erosion  
<p>Global Change</p> <p>Challenges for Pacific Islands</p>  <p>Climate change</p> <p>Human land use ↔ Invasive species</p>	<p>Global Change</p> <p>Climate</p>  <p>greenhouse gasses</p> 

Sample of eight out of 36 slides is presented in this appendix.

Appendix 17.

Capacity Building and Meeting Research Needs on the Ecology of Global Change in Island Landscapes of the Republic of Palau.

PABITRA Joint Synthesis Meeting

March 25 to April 2, 2007

Koror, Palau

Harley I. Manner, Ph.D.

Professor of Geography and Micronesian Studies

College of Liberal Arts & Social Sciences

University of Guam

Summary of the PABITRA Initial Meeting, August 7-11, 2006

The objectives of the meeting were:

To introduce the PABITRA concept and its capacity building work in the Pacific Islands.

For PABITRA, to learn more of Palau's ecological problems and needs (a mutual learning process).

To initiate a synthesis of existing work on Palau ecosystems (geology, hydrology, climate, soils, anthropology, economics, landuse, etc) incorporating a transect approach.

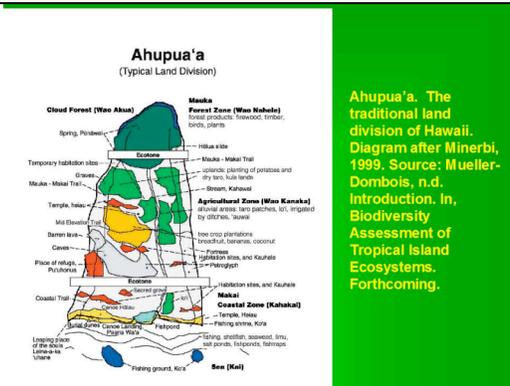
To present techniques for data collection and interpretation using the PABITRA online manual for integrated assessment of biodiversity in tropical island ecosystems.



Initial Meeting, August 9, 2006



Lake Ngardok Fieldtrip, August 10, 2006



Ahupua'a. The traditional land division of Hawaii. Diagram after Minerbi, 1999. Source: Mueller-Dombois, n.d. Introduction. In, Biodiversity Assessment of Tropical Island Ecosystems. Forthcoming.



To plan for this Joint Synthesis Workshop....

The discussions included threats to natural ecosystems, analysis of agroecosystems, construction of ecological climate diagrams, field training on the minimal area concept at Lake Ngardok, the watershed-transect concept, amongst others.

Biodiversity assessment and Long term ecological monitoring - are necessities for understanding ecosystems. Research is needed in order to determine the parameters that foster their protection.... Economic pressures will undoubtedly increase, and without appropriate research data, even protected ecosystems will be prone to "development".

More long term objectives are:

To generate new ecological knowledge by Palauans that compares with other Pacific Island archipelagoes.

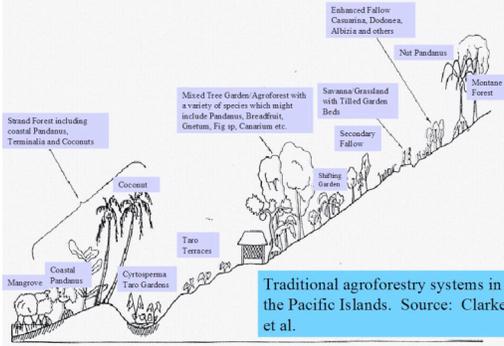
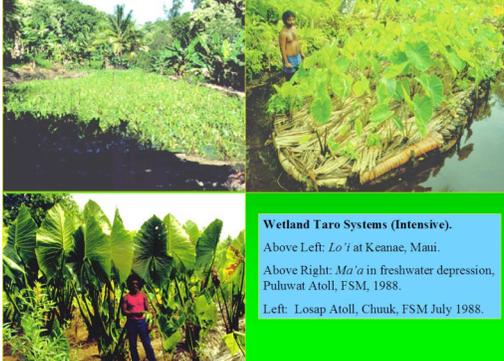
To bring Palau into the Pacific Island PABITRA ecosystem network and the Pacific Science Association.

To generate interest among Palauan scientists in participating in the wider Pacific scientific fora.

To train Palauans so that they can make the assessments and measurements of their own ecosystems and thus decide on the most viable and sustainable land use options for Palau.

Sample of eight out of 12 slides presented in this Appendix.

Appendix 18.

<p>Measurement of Tropical Agroforestry Systems</p> <p>PABITRA Initial Meeting (Scoping and Planning Workshop) Koror, Palau August 7-11, 2006</p> <p>Dr. Harley I. Manner, Ph.D. Professor of Geography and Micronesian Studies College of Liberal Arts and Social Sciences University of Guam</p>	<p>A major problem in quantifying traditional agroforestry or agricultural systems is the diversity and complexity of the systems in the Pacific Islands...</p> <p>So how do we go about measuring these systems?</p>
 <p>Traditional agroforestry systems in the Pacific Islands. Source: Clarke et al.</p> <p>Source: Derived from Garrau (1958 and 1961)</p>	<p>Within a traditional (agricultural) system, often there is more than one system of cultivation.</p> <p>Dependence of any one system varies from place to place, as affected by natural, geographic/ecological and socio-cultural factors.</p> <p>The species and varietal diversity of traditional systems is high: Many systems are polycultural containing a wide range of species and varieties which differ in ecological requirements have different life cycle strategies.</p> <p>Examples of traditional agroforestry systems in the Pacific Islands are seen in the following slides....</p>
 <p>Upper left: Intermittent garden (swidden), Rotuma, Fiji.</p> <p>Lower left: Three months old intermittent garden, with an older 1.5 year garden in the background. Kompiai, PNG. 1972.</p> <p>Above: Colocasia and Cyrtosperma taro in a Mokilese intermittent garden at Sokehs, Pohnpei. 1992.</p>	 <p>Above left: Intermittent garden close to abandonment. Kompiai, PNG 1967.</p> <p>Above: Dryland (open field) taro on Tutuila Island, Am. Samoa. 1990.</p> <p>Left: Dryland taro on a coral limestone island, Basakana Island, Malaita Province, Solomon Islands.</p>
 <p>Wetland Taro Systems (Intensive).</p> <p>Above Left: <i>Lo'i</i> at Keanae, Maui.</p> <p>Above Right: <i>Ma'a</i> in freshwater depression, Puluwat Atoll, FSM, 1988.</p> <p>Left: Losap Atoll, Chuuk, FSM July 1988.</p>	 <p>Mixed Tree Garden. Left: Taga, Samoa. Right: Pohnpei</p>

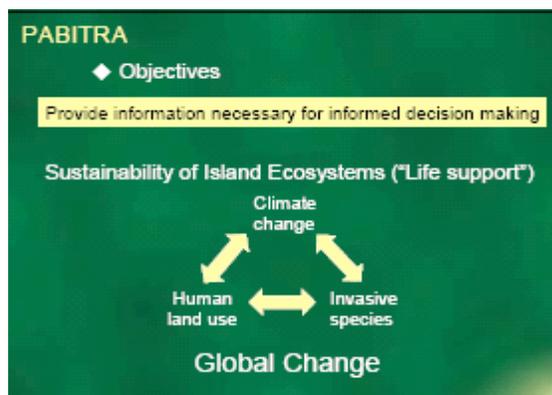
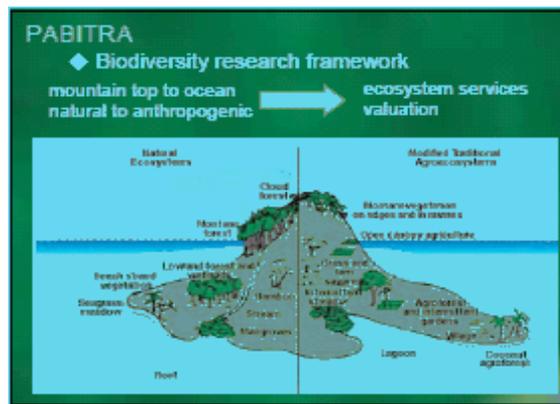
Sample of eight out of 24 slides is presented in this Appendix.

Appendix 19.

Review of Basic Statistics and Application to Field Ecology



Curtis C. Daehler
University of Hawai'i
daehler@hawaii.edu



Sample of three out of 34 slides in this presentation.

 <p>PABITRA PALAU WORKSHOP MARCH 2007 "BOTANISTS IN PARADISE"</p> <p><i>Dr. Art Whistler</i> <i>University of the South Pacific</i></p>	 <p>COLLECTING & PRESERVING SPECIMENS</p> 
<p>The Flora of Palau</p> <p>Palau has the largest flora in Micronesia Probably closer to 550 native flowering plants rather than 100</p> <ul style="list-style-type: none"> •The largest in Polynesia is Hawaii, with ca. 950 native species •Second largest is Samoa, with ca. 550 species <p>Several problems in doing a checklist Separate work by German, Japanese, and American botanists</p> <ul style="list-style-type: none"> •Botanists worked at different times and did not interact •Many specimens probably lost in Germany and Japan •No one botanist has concentrated on the flora •A number of species may have been lost •Few botanists have tried to equate the different collections to reduce the most recent names to synonymy 	<p>Why do botanists collect plant specimens?</p> <p>Specimens are collected for a variety of reasons</p> <ul style="list-style-type: none"> •Need to identify a plant not recognized in the field by taking it to a lab for analysis and identification •Need proof that the plant exists in the area •Need specimens for comparisons with other species or specimens (i.e., for writing a flora) <p>Plant specimens are important to several fields of botany</p> <ul style="list-style-type: none"> •Ethnobotanists who want to identify useful plants •Farmers and Ag extension officers need to identify weeds •Ecologists who want to know forest composition •Taxonomists who do floras and must identify all the plants in a particular place <p>Specimens collected may be either temporary or permanent</p> <ul style="list-style-type: none"> •Temporary specimens are thrown away after use •Permanent specimens need to be preserved from decay
 <p>Permanent specimens used as a reference are called a voucher specimens</p> <p>A properly annotated voucher specimen can be used for proof that a certain plant exists in an area</p> <p>Vouchers are dried, identified, mounted, labeled (based upon field notes), and stored in a place called an herbarium</p> <ul style="list-style-type: none"> •I have over 11,000 voucher specimens stored in Hawai'i 	 <p>Herbarium is basically a plant morgue</p> <p>Kew is the "Mecca" of herbaria</p> <p>Several major herbaria have large Pacific collections</p> <ul style="list-style-type: none"> •USP Herbarium, which might have 50,000 •Bishop Museum in Honolulu, which has about 182,500 •Kew Gardens near London, which might have ten million
<p>Making Herbarium Specimens</p> <ol style="list-style-type: none"> 1. Collection of plants 2. Recording collection notes 3. Pressing and drying specimens <ul style="list-style-type: none"> •Putting specimens into newspapers •Putting newspapers into a press •Drying the specimens 4. Mounting and labeling specimens 5. Storing specimens in herbaria 	<p>1. Collection of Specimens</p> <p>Plants can be collected by simply breaking off branches or pulling up plants</p> <p>Tools may be used, especially to gather hard to collect specimens</p> <ul style="list-style-type: none"> •Knives, clippers, saws, or other sharp instruments •For hard-to-get specimens, as in tree tops, shotguns, monkeys, tree climbers, ropes, and even rocks 

Community Analysis Techniques, March 26-April 2, 2007

Community Analysis Techniques

K. W. Bridges, March 2007

Site 1 Site 2 Site 3 Site 4 Site 5 Site 6

Site locations useful, not essential

If possible, pair sites (win site variability)

Total species at least 35

2-way table

Species	1	2	3	4	5	6
A	X	X	X	X	X	X
C	X					X
D			X	X	X	X
F	X	X	X	X	X	X
G						X
H	X		X	X	X	X
K	X	X	X	X	X	X
M	X	X		X	X	X
P	X	X	X	X	X	X
S	X	X	X	X	X	X
T		X	X	X	X	X
W			X	X	X	X
Z	X		X	X	X	X

Enter data in Excel

0 = absent, 1 = present

Highlight data & Copy

Both edit boxes checked, then Paste

Uncheck Edit boxes

Transpose to swap rows & columns

Select sites/species for analysis

Choose analysis method: Cluster analysis

Similarity Indices

Good for Gradients
Jaccard: presence/absence data
Bray-Curtis

Good when Sample Sizes Differ
Minirist: integer counts
Raup-Crick: presence/absence

Avoid
Euclidean
Manhattan

Choose algorithm & similarity measure

Right click to format

Copy for use in PowerPoint

Groups

Draw an assessment line based on site similarities established at start of the study

Paired group, Euclidean similarity

Optional Mapping

Arbitrary grid to locate sites

	1	2	3	4	5	6	7	8	9
6									
5									
4									
3									
2									
1									

Location (X,Y) & group number (Values)

Directlet Tessellations

3Dfield Steps

New Map

Grid (right click) ? establish grid size, spacing (may need Advanced)

Data Points (right click)

alternatives { Add ? fill in menu
Add from File ? (format: x, y, value, name)

Map List

Directlet Tessellations (right click)

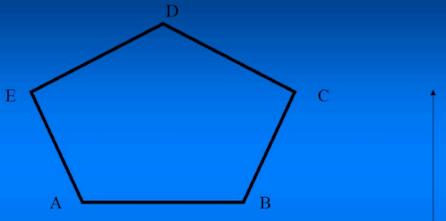
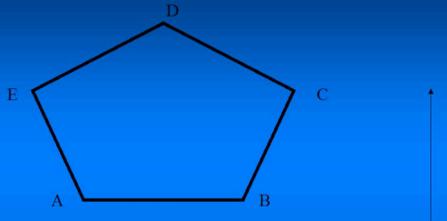
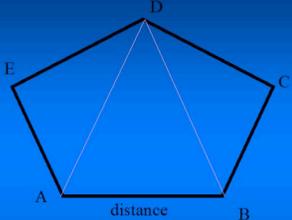
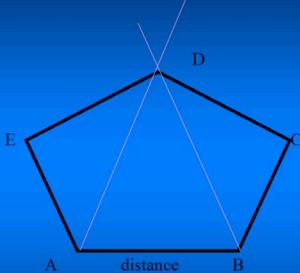
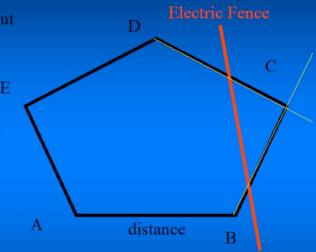
? Draw
? Color Directlet Tessellations

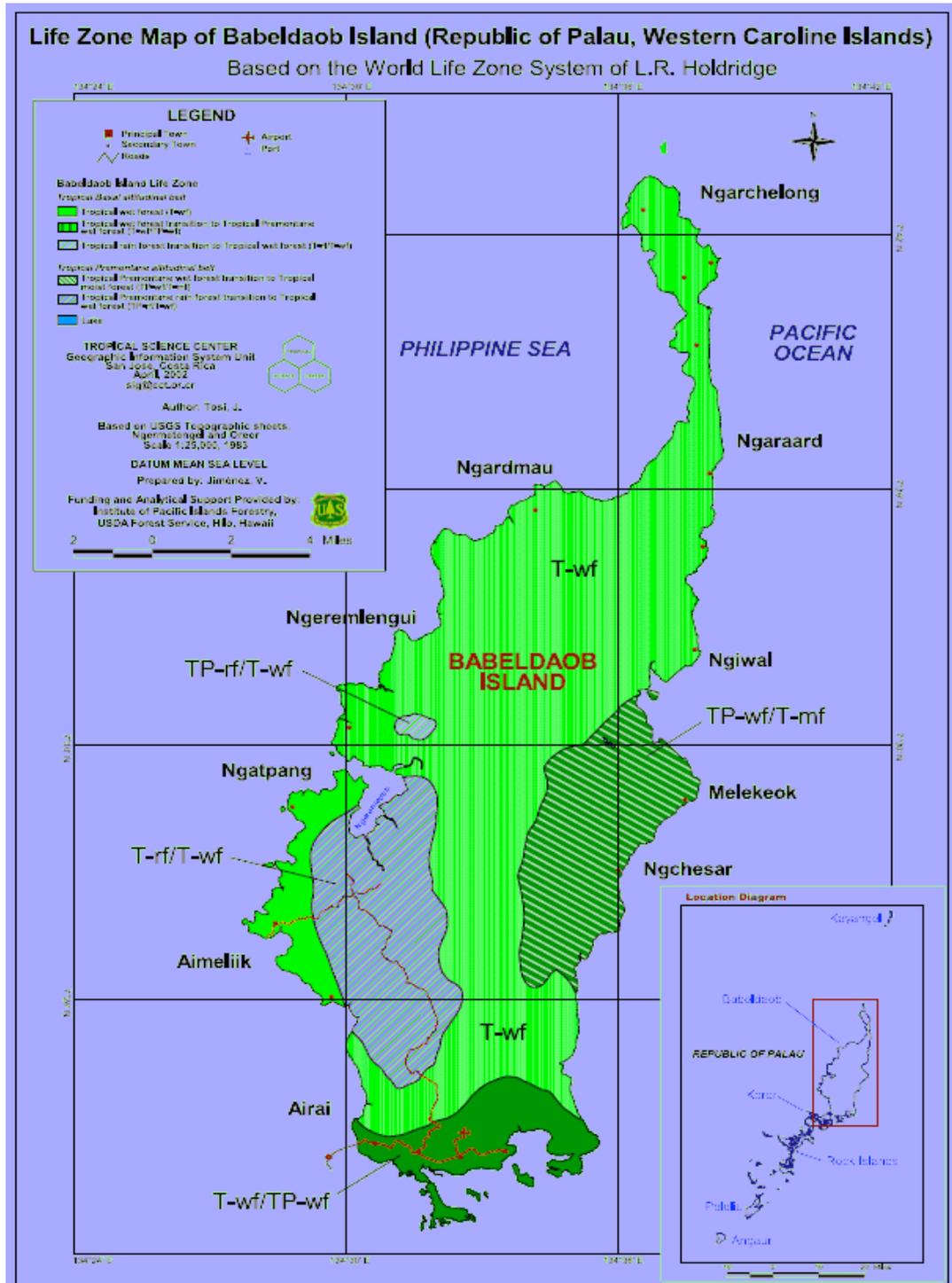
Color Scale

Adjust as necessary

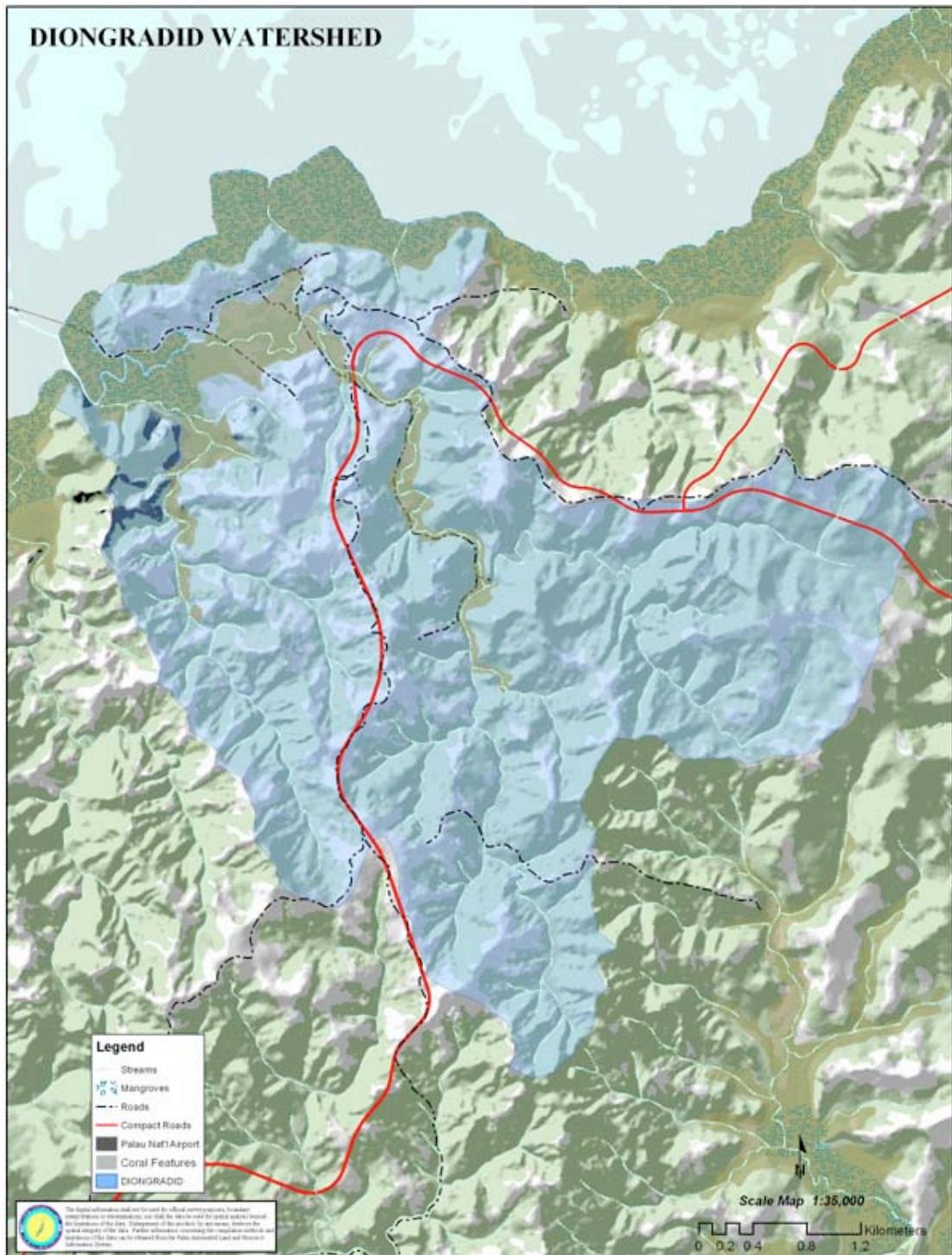
3.0	3.8	4.1
8.5	4.8	2.2
6.0	5.4	3.3
7.3	2.8	1.4
6.6	4.0	3.5
2.1	2.3	4.6

Field Mapping Using Pace and Compass Joint Synthesis Workshop, March 26-April 2, 2007

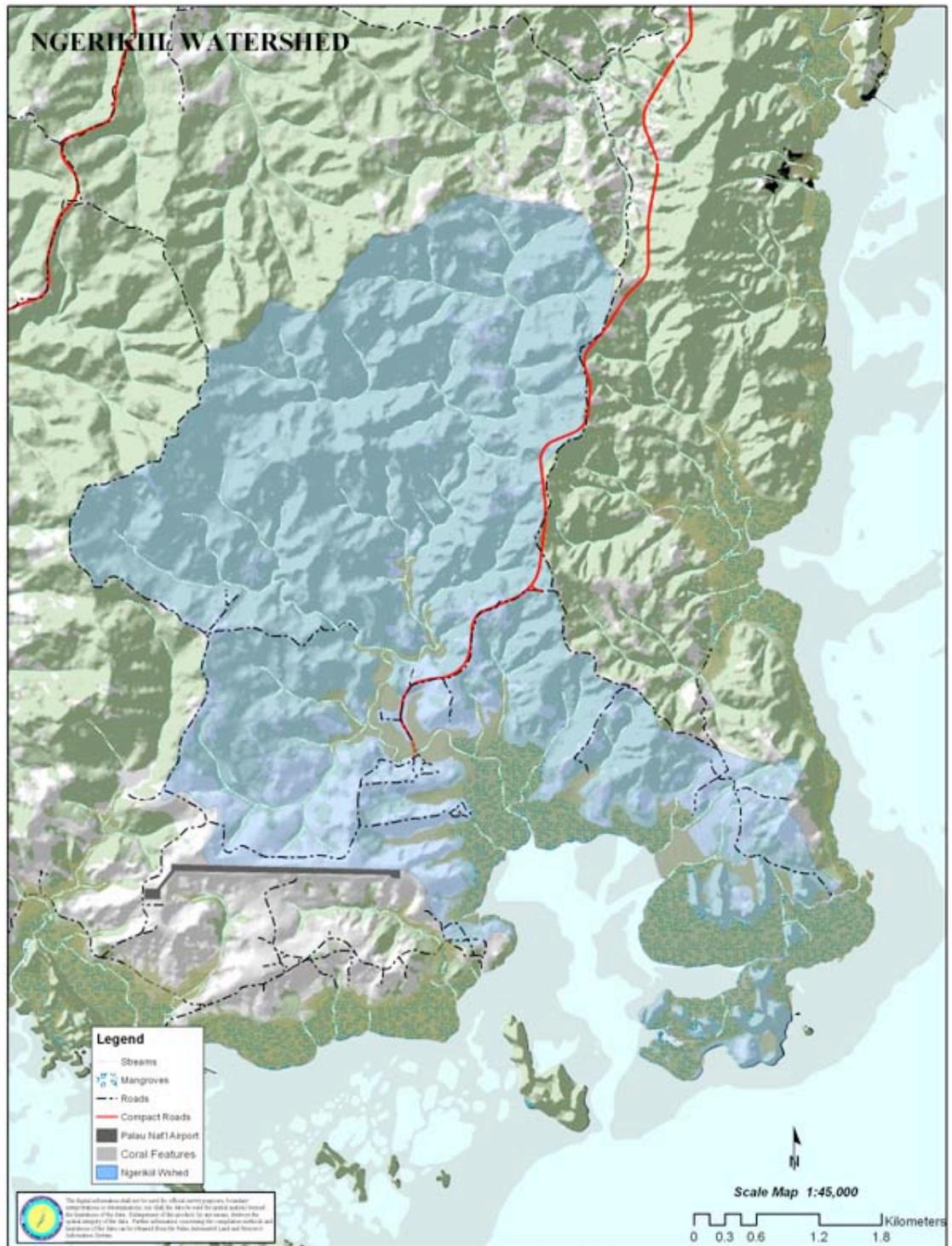
<p>Field Mapping Using Pace and Compass</p> <p>PABITRA Joint Synthesis Workshop</p> <p>Koror, Republic of Palau</p> <p>March 26-April 2, 2007</p> <p>Dr. Harley Manner</p> <p>PABITRA Coordinator for Micronesia</p>	<p>Rules</p> <p>The needle in a compass always points to MN or magnetic north.</p> <p>All bearings are reckoned in degrees from MN in a clockwise direction.</p> <p>MN is either 0° or 360°</p> <p>Often MN will deviate from TN (true north) or GN (grid north) by a small amount</p>
<div style="text-align: center;">  </div> <p>Given: Point A, B, C, D, and E.</p> <p>How can we locate these points accurately using pace/tape and compass?</p> <p style="text-align: right;">Scale: 1"= 500 feet</p>	<div style="text-align: center;">  </div> <p>But that may take too much time, so a method called triangulation can be used instead.</p> <p style="text-align: right;">Scale: 1"= 500 feet</p>
<p>All objects in geographic space can be located as being corners of a triangle.</p> <p>To locate any point in geographic space you need to know a little bit of trigonometry:</p> <p style="text-align: center;">1 angle and the distance of 2 sides, or 2 angles and the distance of 1 side.</p>	<div style="text-align: center;">  </div> <p>To apply these principles, let's take a bearing from Point A to Point B. Then let's measure the distance between Points A and B.</p> <p>Let's say we then want to determine the position of Point D in relationship to Points A and B.</p> <p>All you need to do is to take a bearing from Point A to Point D, and then take a bearing from Point B to Point D.</p>
<p>When you draw these Points of graph paper according to scale, and lay out the bearings in relation to magnetic north, the intersection of lines AD and BD will locate the position of Point D.</p> <div style="text-align: center;">  </div>	<p>Another Example.</p> <p>How to locate C without getting electrocuted?</p> <p>If you have located Points A, B and D, the safest way to do this is to take a bearing from Point B to Point C and then take bearing from Point D to Point C.</p> <div style="text-align: center;">  </div> <div style="border: 1px solid white; padding: 5px; width: fit-content; margin: 10px auto;"> <p>The intersection of the two yellow lines will locate Point C.</p> </div>



Appendix 25.



Appendix 26.





First PABITRA meeting held in Palau

Over 20 people representing government agencies and non-government organizations (NGOs) gathered to participate in the first meeting of the Pacific Asia Biodiversity Transect (PABITRA) in Palau being hosted by the Palau National Resources Council (PNRC). Addressing the shortage of information needed to analyze, evaluate and manage threats to natural ecosystems, the two-day workshop was held at the Peothouse Hotel on Tuesday and Wednesday, August 9 and 10, with a second, Joint Synthesis Meeting scheduled for April 2007.

Dubbed as the Pacific Asia Biodiversity Transect Network (PABITRA) Initial Synthesis Meeting, the workshop introduced to Palau PABITRA concept, its work in the other 10 PABITRA, page 15

PABITRA...

From page 1
Pacific Islands, and its focus on capacity building and sharing information of information on the gathering and analysis of data.

The workshop is also aimed at initiating a synthesis of existing work on Palau ecosystems and to promote the analysis of new research on the ecology of global change with a focus on the ecology of landscape disturbance, its recovery and impact on the traditional human support systems; assess the suitability of field sites for research using the transect approach; present the techniques for data collection and interpretation using the PABITRA online manual for integrated assessment of biodiversity in tropical island ecosystems which will help train Palau in standard methods of ecological field analysis.

The main speakers of the workshop included Professors Mueller-Dombois and Curtis Daehler from the University of Hawaii as well as Professor Harley Manner from the

University of Guam who discussed out how to analyze vegetation and ecosystems, how to cope with threats to natural ecosystems and on how to evaluate agro-ecosystems respectively.

The professors explained that the main aim of promoting analysis of new research is to allow for better informed choices to be taken by Palau in its national development, taking into consideration its ecology and environment.

"The aim for us is to train appropriate agencies about researching and analyzing data, which would provide for better management of the ecosystems and for better decision making on development," explained Professor Mueller-Dombois.

PNRC Chairperson, Tarita Holm of the Ministry of Resources and Development, explained that there are lots of unknown species as well as data yet to be analyzed in Palau. She said that the PABITRA would enable Palau to study and fully understand its ecosystems, allowing for proper management. (By SOVIG J Uherbelau)

Tosi...

From page 1
si. He was born on New Year's Day in 1943 in the state of Ngrgaard. He attended the Seventh Day Adventist Elementary School as well as Palau High School, and Palau Mission Academy. He later received his Bachelor of Arts degree in Philosophy and History from the Philippine Union College in 1968.

Tosi had begun his career at Palau High School as a Senior Teacher, a position he held for 19 years until 1987. He ventured into a political career in 1989 where he served as a researcher and committee assistant for the 1989 Political Education Committee. He then worked as an office clerk in 1990 in the Office of Planning and Statistics. In 1995 he became a senior counselor in the then Bureau of Education, serving the position until 2004. Tosi also served as the chairman of the Belau Teachers' Association, and President of the Palau Association of Government Employees during the early 1980's at the height of government employees struggle to

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Scientists here to help locals cope with global change

By AGNES W. ABRAU
Horizon News Staff

THREE noted scientists are here to present to locals the effects of global change in the Pacific islands and to promote the analysis of new research on the ecology on Palau ecosystems.

Dr. Dieter Mueller-Dombois, emeritus professor of Botany and Ecology in the University of Hawaii at Manoa, Dr. Harley I. Manner, professor of geography and Micronesian Studies at the University of Guam and Dr. Curtis C. Daehler, associate professor in the Department of Botany of the University of Hawaii Manoa were here since Monday also to present the Pacific-Asia Biodiversity transect Network (PABITRA) to local officials and stakeholders that would help in its capacity to handle Palau's ecological problems and needs.

PABITRA is a program of the Ecosystem Division in the Pacific Science Association Task Force on Biodiversity whose aim is to collaborate with resident Pacific Islanders on biodiversity research and ecosystem conservation.

At the initial meeting held at Penthouse Hotel, the experts discussed their field of expertise imparting to representatives from local concerned agencies discussions on how to analyze vegetation and ecosystems, threats to natural ecosystems and how to cope with them; and how to evaluate agroecosystems.

According to Dr. Manner, their research suggests that islands in the Pacific are changing rapidly due to three factors—heavy human land use due to tourism and urbanization, climate change and invasive species.

Dr. Mueller-Dombois, for his part, said that they are going to introduce PABITRA to Palau to network researchers whose studies could be used by government officials in terms of development and future changes.

Mueller-Dombois, founder of PABITRA and award-winning scientist because of his noted research and publications, said by introducing the PABITRA online manual it could help researchers on the island on using proper techniques for data collection and interpretation with regard to

assessing Palau's biodiversity.

Dr. Daehler, on the other hand, said that presently Palau has no available data that would help young researchers here to understand the structure and functioning of its ecosystems. They said that with the grant they obtained, they could fill the void in Palau to train researchers and village leaders to collect data and generate interest among the local scientists methods of ecological field analysis.

"We need to develop young scientists in Palau," Daehler said.

The three scientists have proposed the capacity-building workshop titled "Capacity Building and Meeting Research Needs on the Ecology of Global Change in Island Landscapes of the Republic of Palau."

Participants of the workshop along with the PABITRA scientists visited field sites in Babeldaob to move forward its goal as potential PABITRA transect sites.

Dr. Mueller-Dombois added that they also aim to make ecological climate diagrams.