Appendix E

Pre-Conference Paper

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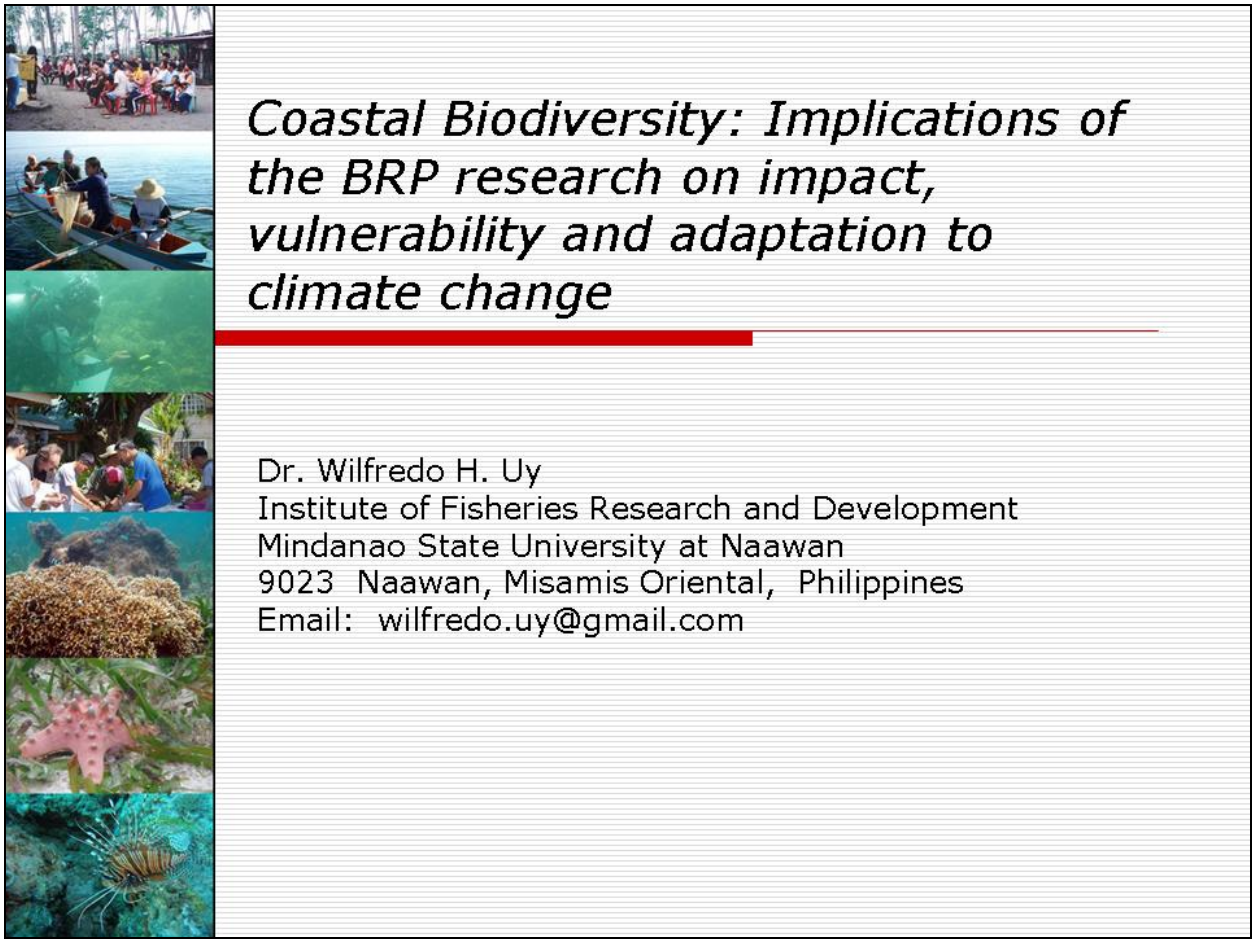
Dr. Uy obtained his MS degree in Marine Science from the University of the Philippines Diliman, and his PhD in Aquatic Ecology at IHE-Delft and Waginengen University in the Netherlands.

Dr. Uy is actively involved in several research programs in Mindanao. These include the Marine Protected Area (MPA) Networking and Integrating Fisheries Management Initiatives in Zamboanga del Sur – Iliana Bay through the ECOGOV project funded by the USAID; and the Fisheries Assessment for Sustainable Management of Lake Mainit, with funds coming from PCARRD and the LGU. He was also involved in the BRP Project for Mt. Malindang as Study Leader for the coastal component.



Realizing Challenges, Exploring Opportunities
Proceedings of the International Conference-Workshop on Biodiversity and Climate Change in Southeast Asia: Adaptation and Mitigation
19-20 February 2008 • Sofitel Philippine Plaza Hotel • CCP Complex, Pasay City, Philippines

Outline

- What is BRP?
- Findings of BRP – current levels of biodiversity from the mountain to the sea
- Global climate change – its impact to coastal biodiversity
- How can we mitigate climate change impact on coastal biodiversity
- What's next after BRP?

What is BRP?

- The **Biodiversity Research Programme** for Development in Mindanao: focused on Mt Malindang and its environ.
- A five year program 2000-2005
- BRP envisions economically and culturally prosperous community living harmoniously in a sustainable environment where biodiversity conservation is founded on an integrative and participatory research model.

What are the BRP's objectives?

BRP seeks to:

- Contribute to conservation, management, and sustainable use of biological resources;
- Build and strengthen capacity for biodiversity research;
- Promote research cooperation on equal footing among north and south researchers.

Implementation of BRP

- Location-derived and development-oriented
- Promoted multi-stakeholder participation
- Systems-oriented and interdisciplinary
- Used the landscape approach

How was the BRP developed?

- Initiated by RAWOO in 1996, The Netherlands Development Assistance Research Council
- Technical Mission recommended collaborative Philippine - Netherlands biodiversity research programme
- Philippine Working Group (PWG) was created coordinated by SEARCA
- the Pre-Implementation Phase (PIP) in 1997-2000: The PRA studies for coastal, lowland and upland ecosystems in Mt Malindang

Why Mt Malindang?

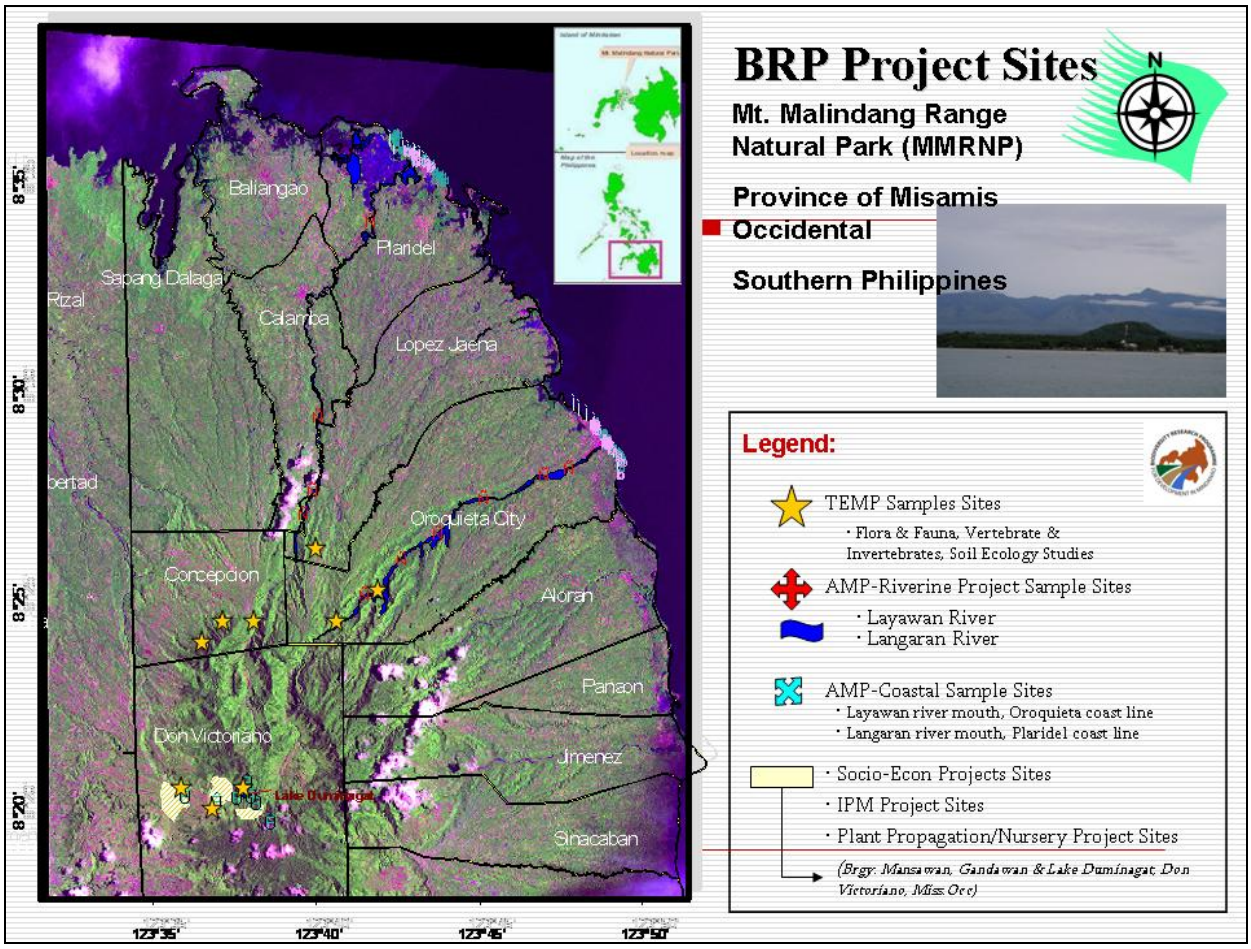
- A Biodiversity Hotspot - Rich biodiversity that is threatened with destruction
- Mindanao as one of the least served
- *Provides an opportunity to prevent reaching the point of no return (total depletion) if changes are made as a result of the research*
- A possible springboard from which similar biodiversity conservation initiatives throughout the country could be launched.
- Declared as national park in 1971 (RA 6266); under the NIPAS in 1992 (RA 7586); and as protected area with the passage of RA 9304 on 30 July 2004,otherwise known as the Mt Malindang Act.

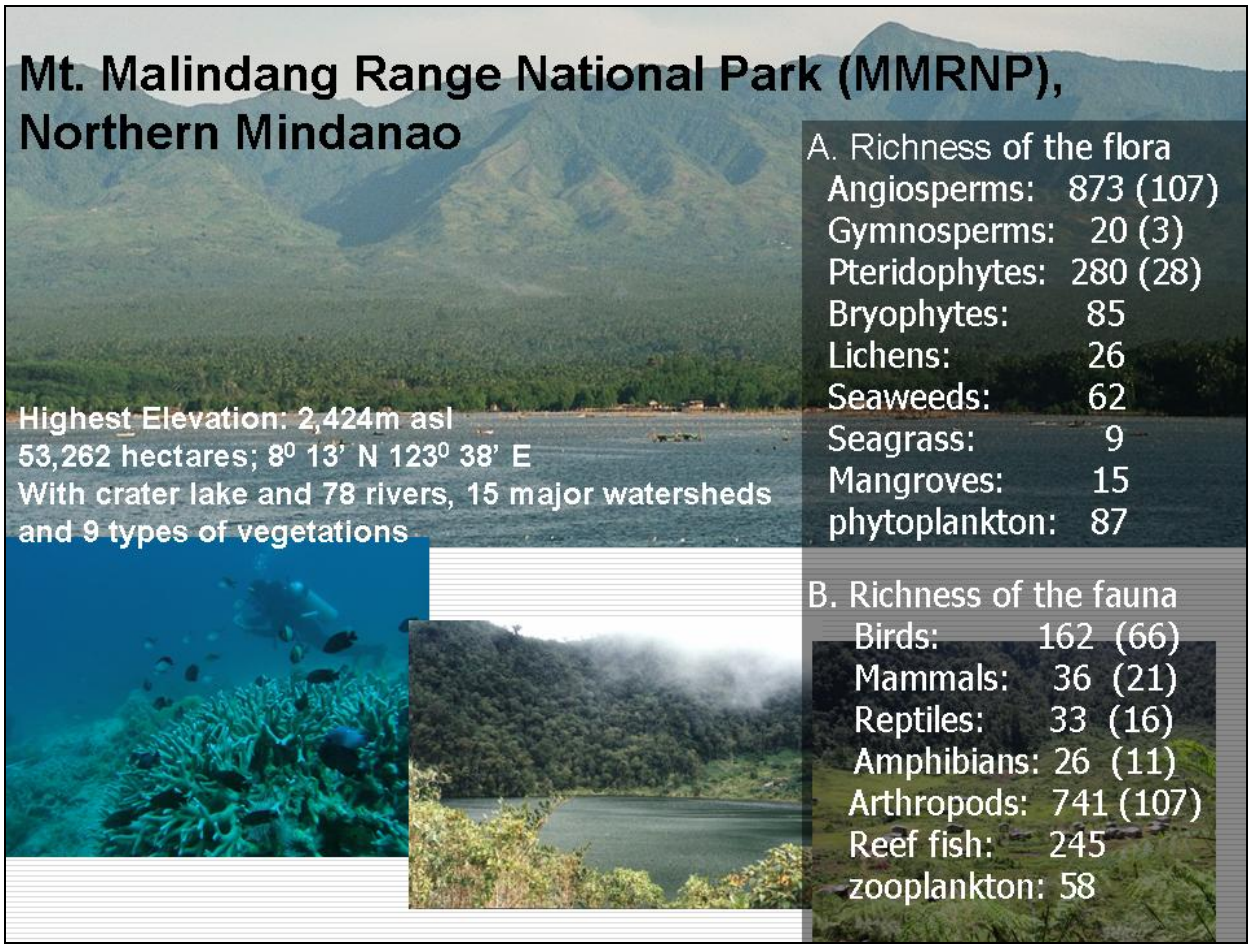
Project implementation phases

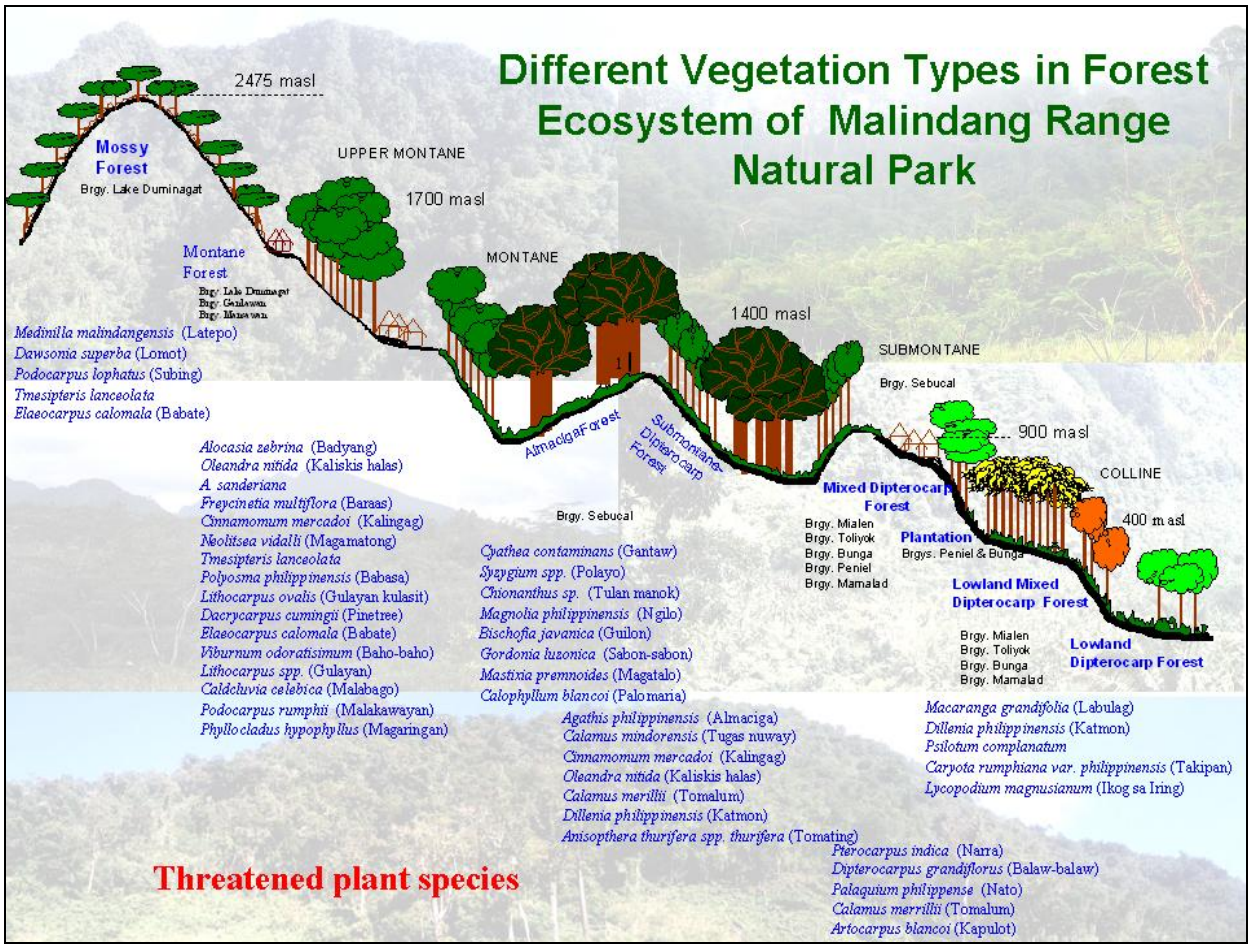
- **Implementation phase I (2000-2003)**: (First generation studies)
  - Development of participatory methods for inventory and assessment of flora and fauna resources in the montane forest; lake duminagat; arthropods in cabbage growing areas; and riverine, riparian and coastal ecosystems
- **Implementation phase II (2003-2005)**: Second generation studies
  - Terrestrial Ecosystem Master Project (TEMP)
    - floral, faunal, and soil ecological diversity
  - Aquatic Ecosystem Master Project (AMP)
    - Riverine, riparian, and coastal studies
  - Socio-economic and Cultural Studies Master Project (SEC)
    - Resource utilization studies, Indigenous Knowledge Systems (IKS) studies, and policy studies
  - Open research projects
    - Community Economic Garden, Integrated pest mgmt, database and information system
  - Student thesis

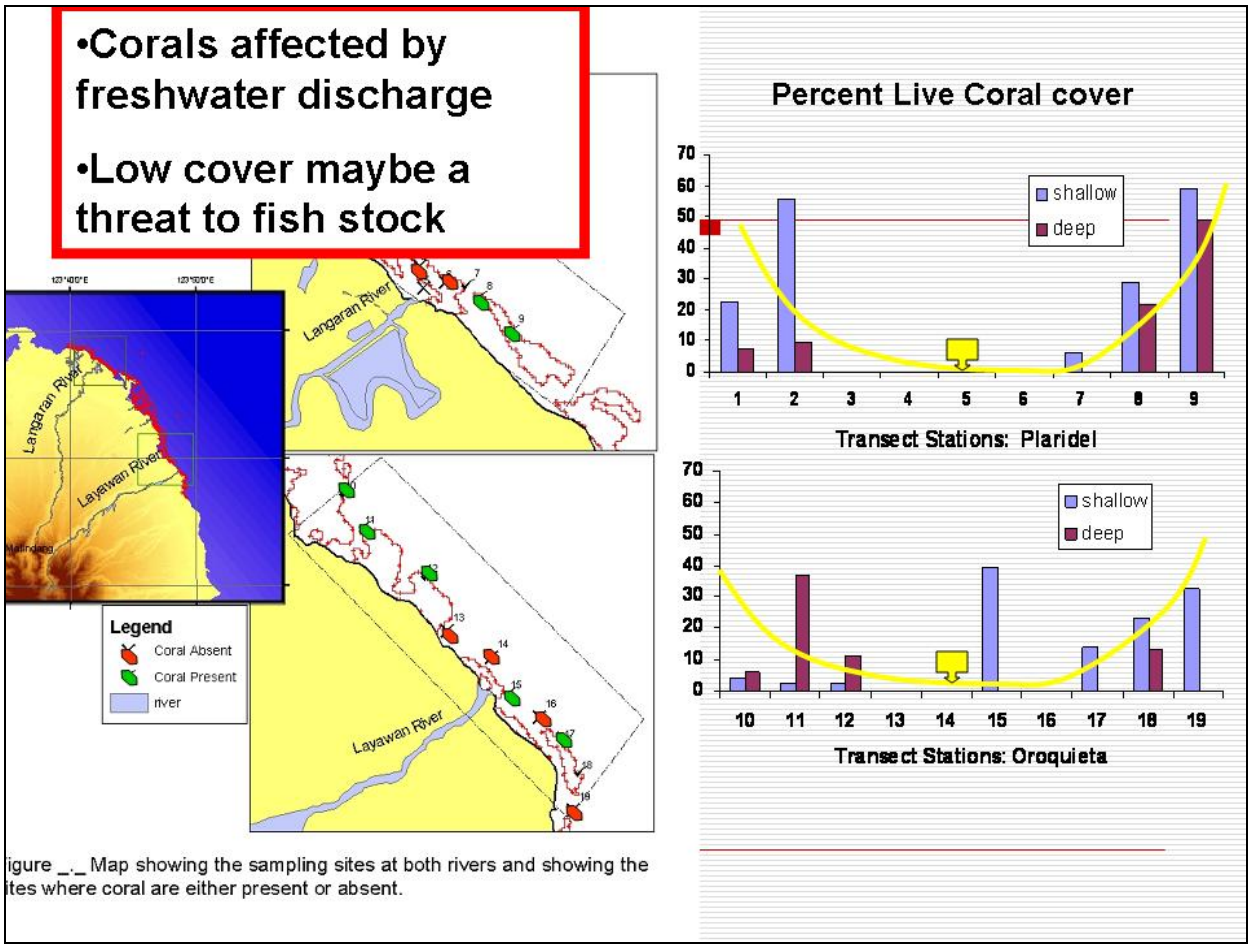
Participants to the BRP

- 128 researchers (14 Dutch, 14 national)
- 21 academic institutions (6 Dutch institutions)
- 4 government agencies (DENR, DA, NAMRIA, NCIP)
- 8 municipalities + 1 city
- SEARCA, a Regional Development Organization
- Subanon Indigenous peoples

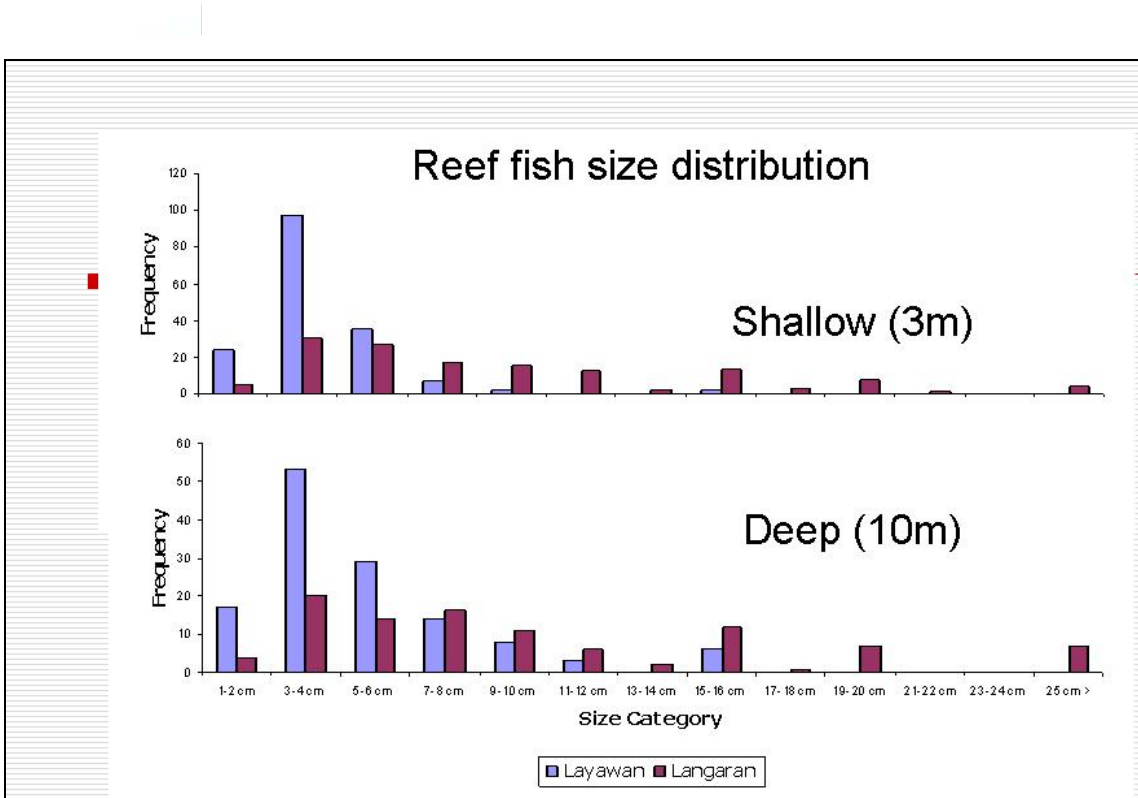

BRP Project Sites
Mt. Malindang Range
Natural Park (MMRNP)
Province of Misamis
Occidental
Southern Philippines
N
Baliangao
Plaridel
Sapang Dalaga
Rizal
Calamba
Lopez Jaena
Oroquieta City
Concepcion
Alorah
Panaon
Don Victoriano
Jimenez
Sinacaban
Lake Duminagat
8°35'
8°30'
8°25'
8°20'
123°35'
123°40'
123°45'
123°50'
Legend:
TEMP Samples Sites
· Flora & Fauna, Vertebrate & Invertebrates, Soil Ecology Studies
AMP-Riverine Project Sample Sites
· Layawan River
· Langaran River
AMP-Coastal Sample Sites
· Layawan river mouth, Oroquieta coast line
· Langaran river mouth, Plaridel coast line
· Socio-Econ Projects Sites
· IPM Project Sites
· Plant Propagation/Nursery Project Sites
(Brgy: Mansawan, Gandawan & Lake Duminagat, Don Victoriano, Miss Occ)


Mt. Malindang Range National Park (MMRNP), Northern Mindanao
A. Richness of the flora
Angiosperms: 873 (107)
Gymnosperms: 20 (3)
Pteridophytes: 280 (28)
Bryophytes: 85
Lichens: 26
Seaweeds: 62
Seagrass: 9
Mangroves: 15
phytoplankton: 87
Highest Elevation: 2,424m asl
53,262 hectares; 8⁰ 13' N 123⁰ 38' E
With crater lake and 78 rivers, 15 major watersheds and 9 types of vegetations
B. Richness of the fauna
Birds: 162 (66)
Mammals: 36 (21)
Reptiles: 33 (16)
Amphibians: 26 (11)
Arthropods: 741 (107)
Reef fish: 245
zooplankton: 58


Different Vegetation Types in Forest Ecosystem of Malindang Range Natural Park
2475 masl
Mossy Forest
Brgy. Lake Duminagat
UPPER MONTANE
1700 masl
Montane Forest
Brgy. Lake Duminagat
Brgy. Gaulawan
Brgy. Manawan
MONTANE
1400 masl
SUBMONTANE
Brgy. Sebucal
900 masl
COLLINE
400 m asl
Medinilla malindangensis (Latepo)
Dawsonia superba (Lomot)
Podocarpus lophatus (Subing)
Tmesipteris lanceolata
Elaeocarpus calomala (Babate)
Alocasia zebrina (Badyang)
Oleandra nitida (Kaliskis halas)
A. sanderiana
Freycinetia multiflora (Baraas)
Cinnamomum mercadoi (Kalingag)
Neolitsea vidalii (Magamatong)
Tmesipteris lanceolata
Polyosma philippinensis (Babasa)
Lithocarpus ovalis (Gulayan kulasit)
Dacrycarpus cumingii (Pinetree)
Elaeocarpus calomala (Babate)
Viburnum odoratisimum (Baho-baho)
Lithocarpus spp. (Gulayan)
Calacluvia celebica (Malabago)
Podocarpus rumphii (Malakawayan)
Phyllocladus hypophyllus (Magaringan)
Almaciga Forest
Submontane-Dipterocarp Forest
Brgy. Sebucal
Cyathea contaminans (Gantaw)
Syzygium spp. (Polayo)
Chionanthus sp. (Tulan manok)
Magnolia philippinensis (Ngilo)
Bischofia javanica (Guilon)
Gordonia luzonica (Sabon-sabon)
Mastixia premnoides (Magatalo)
Calophyllum blancoi (Palomaria)
Agathis philippinensis (Almaciga)
Calamus mindorensis (Tugas nuway)
Cinnamomum mercadoi (Kalingag)
Oleandra nitida (Kaliskis halas)
Calamus merillii (Tomalum)
Dillenia philippinensis (Katmon)
Anisopthera thurifera spp. thurifera (Tomating)
Mixed Dipterocarp Forest
Brgy. Mialen
Brgy. Toliyok
Brgy. Bunga
Brgy. Peniel
Brgy. Mamalad
Plantation
Brgys. Peniel & Bunga
Lowland Mixed Dipterocarp Forest
Brgy. Mialen
Brgy. Toliyok
Brgy. Bunga
Brgy. Mamalad
Lowland Dipterocarp Forest
Macaranga grandifolia (Labulag)
Dillenia philippinensis (Katmon)
Psilotum complanatum
Caryota rumphiana var. philippinensis (Takipan)
Lycopodium magnusianum (Ikog sa Iring)
Threatened plant species
Pterocarpus indica (Narra)
Dipterocarpus grandiflorus (Balaw-balaw)
Palaquium philippense (Nato)
Calamus merrillii (Tomalum)
Artocarpus blancoi (Kapulot)



igure _._ Map showing the sampling sites at both rivers and showing the ites where coral are either present or absent.



Generally small fish <7cm , indication of stress, overfishing;

Plaridel may reach up to 25cm, while Oroquieta no fish bigger than 15cm.

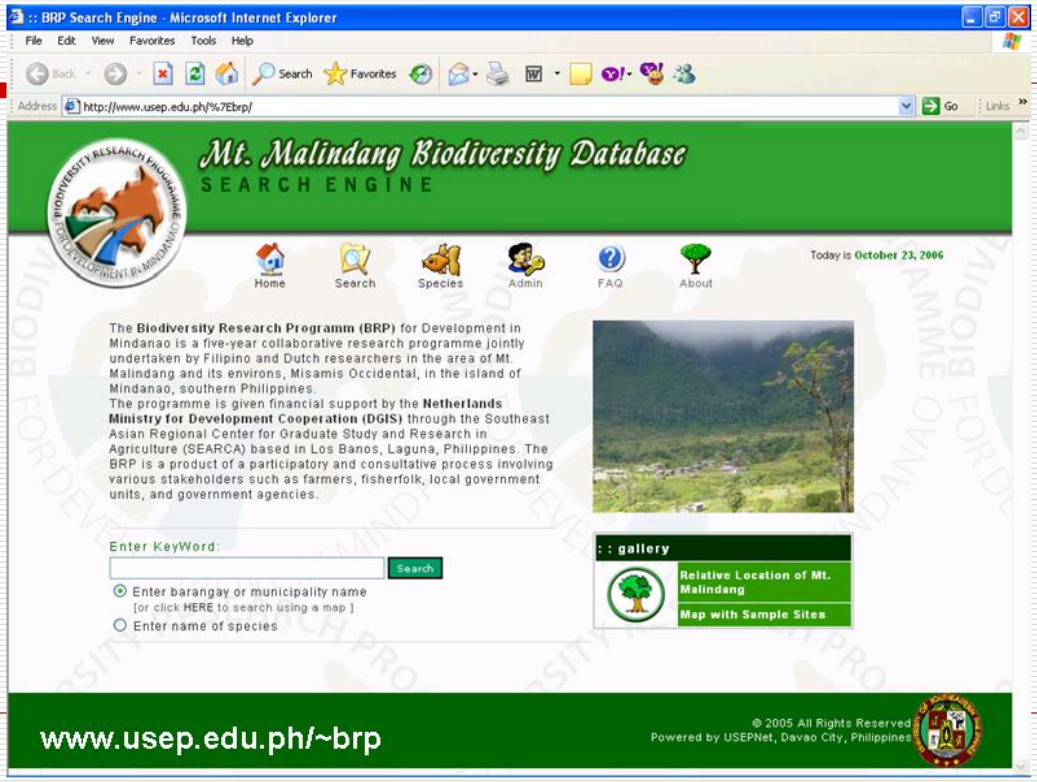
Major conclusions

- Forest resources: high species richness but continues to be threatened
- Agricultural resources: major land use in Mt Malindang
- Freshwater resources: provides water needs for drinking and household needs, irrigation and quarrying for sand and gravel. Sedimentation and coliform contamination increasing
- Marine and Coastal resources: poor state of fish stock due to over fishing; environmental pollution contributes to low water quality.

BRP outputs

- 16 monograph series
- Online BRP database
- More than 20 papers presented in various forum
- Several trainings conducted: Methodology refinement, parataxonomy, desktop mapping, integration workshops, etc
- Brochures, field guides and other IEC materials
- Local research institutions expanded research to other areas using the BRP approach
- MinCBio (Mindanao Consortium for Biodiversity)

Biodiversity Research Program for Mt Malindang & the environ




IEC materials
Common hard corals along coastal waters of Mt. Malindang, Northern Mindanao, Philippines
Common seaweeds along coastal waters of Mt.Malindang, Northern Mindanao, Philippines
Red algae (Rhodophyta)
Green algae (Chlorophyta)
Brown algae (Phaeophyta)

Vulnerability of coastal ecosystems

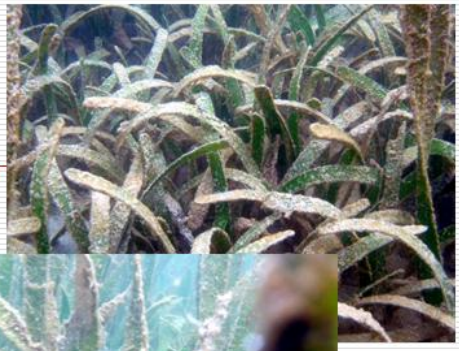
- Understanding the vulnerability of such a large and intricate system to climate change is a challenge
- Connectivity within the marine ecosystems – the linkages and interdependence between and among organisms and processes…
- Hoegh-Guldberg et al (2007) did extensive review and listed the following
  - Increasing air and sea temperatures
  - Rising sea levels
  - Ocean acidification
  - Nutrient enrichment (via changes in rainfall patterns)
  - Altered light levels
  - More extreme weather events
  - Changes to ocean circulation

Coral reefs

- Major component – the corals are considered to be the most vulnerable of all species
- Sensitive to increasing temperature and ocean acidification
- Result to coral bleaching leading to death – decline in coral cover and increase in algal dominance and shift in community composition
- Increase rates of bioerosion resulting to losses on the reef framework

Seagrass

- Important 1° producers, nursery, nutrient storage and cycling, stabilizes sediments.
- At risk with changes in UV light for photosynthesis & growth, increased turbidity from floods, rise in sea level, stronger storms…
- Considered to have low vulnerability except for shallow rooted and fast growing species

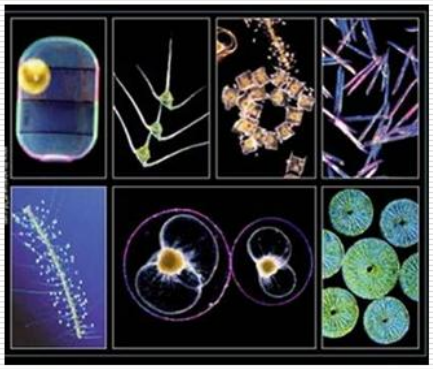


Mangroves

- Important 1° producers, nursery, nutrients storage & cycling, coastal stabilization, biofiltration, etc
- Generally considered to have moderate to high vulnerability depending on the rate of sea level rise.
- Loss of mangroves will have implications on higher trophic levels due to loss of functional role.

Plankton

- Key primary producers, minute and drifters
- Have short generation times and functional redundancy thus have rapid response to climate change…
- but changes in plankton community will have cascading effects on higher trophic levels.
- Most vulnerable to changes in ocean circulation that could affect dispersal and distribution of other organisms.



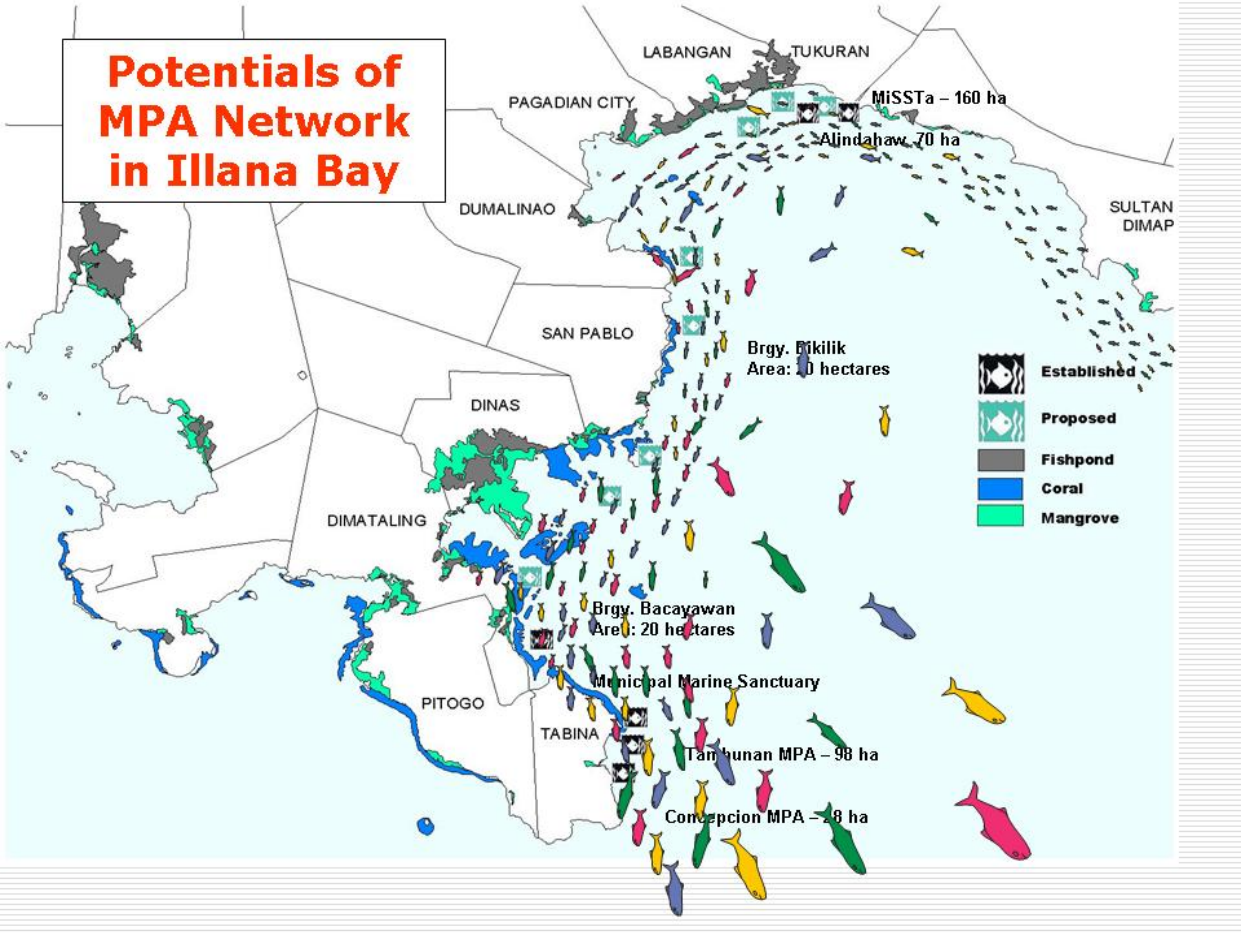
Some Interventions to mitigate Climate change in Mindanao

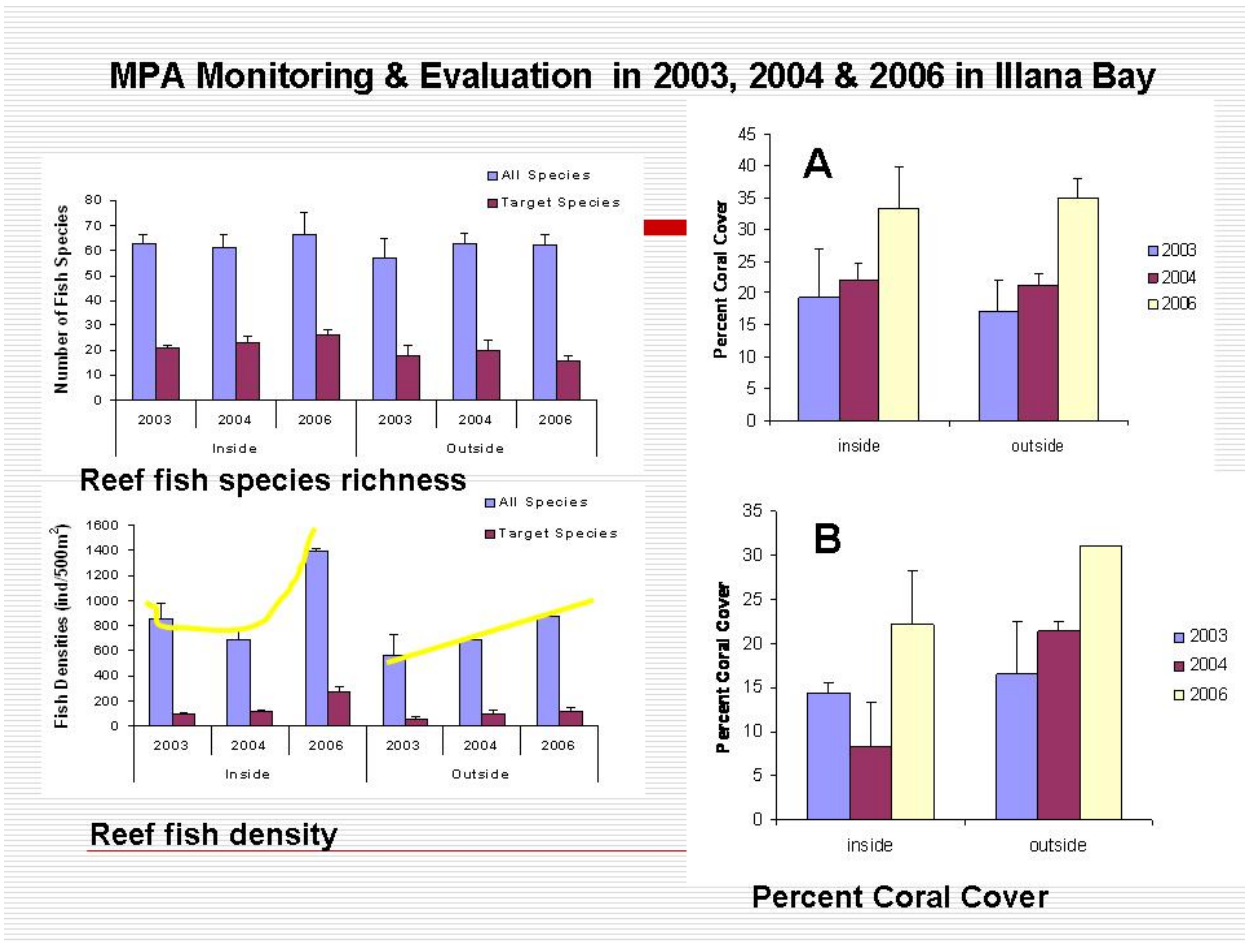
- Climate change is now a national concern…
- Several consultative workshops done – national, regional and local
- Long-term ecological studies of coastal ecosystems in some parts of the country…e.g. Panguil Bay, Illana Bay in Northern Mindanao
- MPA M&E and networking– USAID project thru EcoGov in southwestern Mindanao

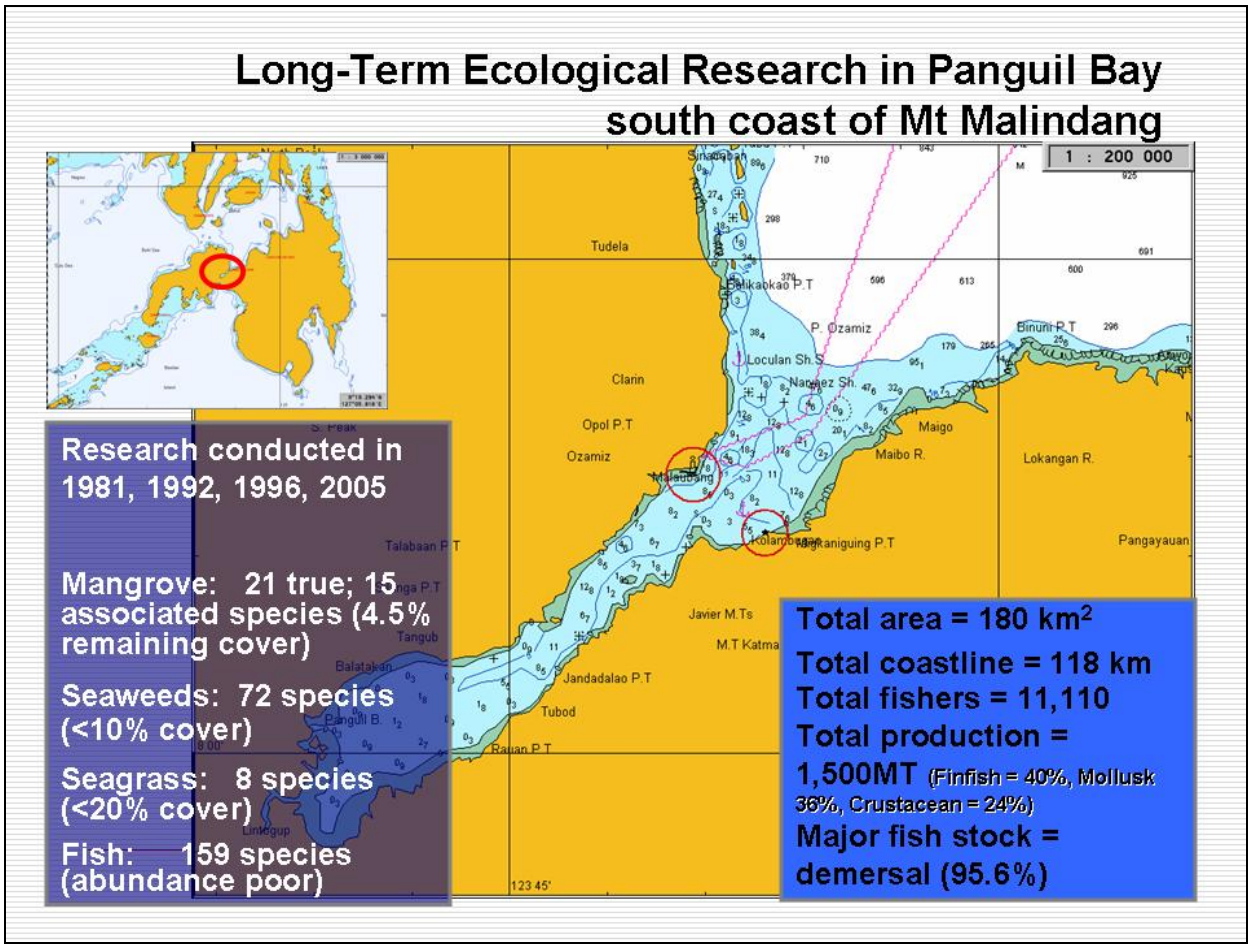

Present scenario, river water quality is good...
BUT further deterioration of water quality (e.g. high TSS load due to increase flooding, etc)...
may widen impacts on the coastal biodiversity..

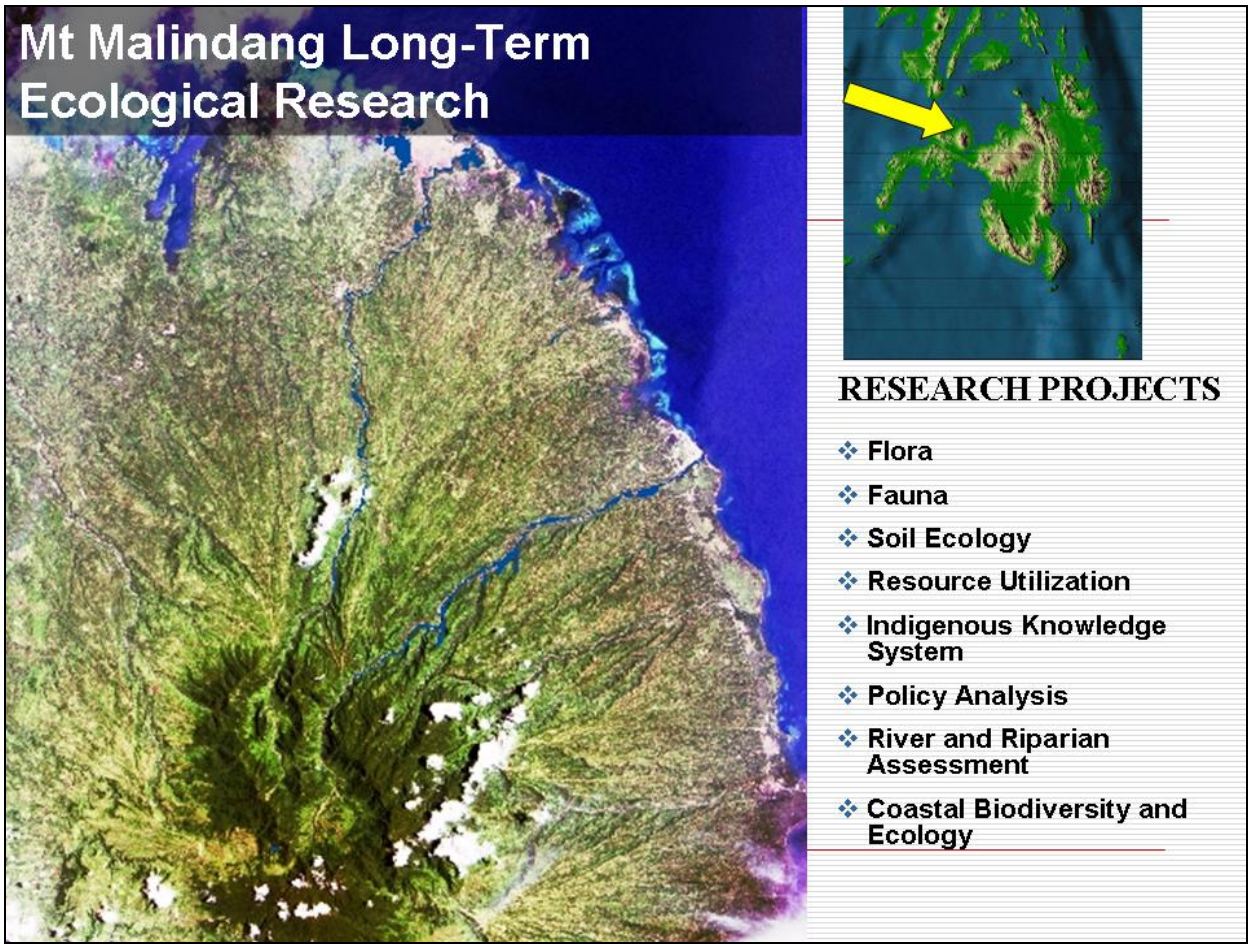
How can we mitigate climate change impact?

- Large-scale ocean nourishment project in the Sulu sea to sequester excess CO_2 ???
  - Inject urea to promote growth of phytoplankton – a simple solution… but…
  - uncertainties related to predicting the effects of artificial enrichment seem to outweigh its potential benefits
    - Plankton response may be species-specific, Ecological bottom-up effect, limited documentation…
- Rehabilitate mangroves and seagrass beds to stabilize coastal areas and reduce erosion – with the expected increase in storms and floods.
- Seaweed farming
- Promote MPA networking


Potentials of MPA Network in Illana Bay
LABANGAN
TUKURAN
PAGADIAN CITY
MiSSTa – 160 ha
Alindahaw 70 ha
DUMALINAO
SULTAN DIMAP
SAN PABLO
Brgy. Bikilik
Area: 10 hectares
DINAS
DIMATALING
Established
Proposed
Fishpond
Coral
Mangrove
Brgy. Bacayawan
Area: 20 hectares
Municipal Marine Sanctuary
PITOGO
TABINA
Tambunan MPA – 98 ha
Concepcion MPA – 18 ha


MPA Monitoring & Evaluation in 2003, 2004 & 2006 in Illana Bay
All Species
Target Species
Number of Fish Species
2003
2004
2006
Inside
Outside
Reef fish species richness
Fish Densities (ind/500m²)
Reef fish density
A
B
Percent Coral Cover
inside
outside
Percent Coral Cover


Long-Term Ecological Research in Panguil Bay
south coast of Mt Malindang
1 : 200 000
Tudela
Clarin
Opol P.T
Ozamiz
Maloubong
Talabaan P.T
Tangub
Balatakan
Panguil B.
Jandadalao P.T
Tubod
Rajan P.T
Javier M.Ts
M.T Katma
Kolambugan
Magkaniguing P.T
Maigo
Maibo R.
Lokangan R.
Pangayauan
Binuni P.T
P. Ozamiz
Loculan Sh.S
Nanamez Sh.
Research conducted in 1981, 1992, 1996, 2005
Mangrove: 21 true; 15 associated species (4.5% remaining cover)
Seaweeds: 72 species (<10% cover)
Seagrass: 8 species (<20% cover)
Fish: 159 species (abundance poor)
Total area = 180 km2
Total coastline = 118 km
Total fishers = 11,110
Total production = 1,500MT (Finfish = 40%, Mollusk 36%, Crustacean = 24%)
Major fish stock = demersal (95.6%)


Mt Malindang Long-Term Ecological Research
RESEARCH PROJECTS
Flora
Fauna
Soil Ecology
Resource Utilization
Indigenous Knowledge System
Policy Analysis
River and Riparian Assessment
Coastal Biodiversity and Ecology

How shall BRP..?

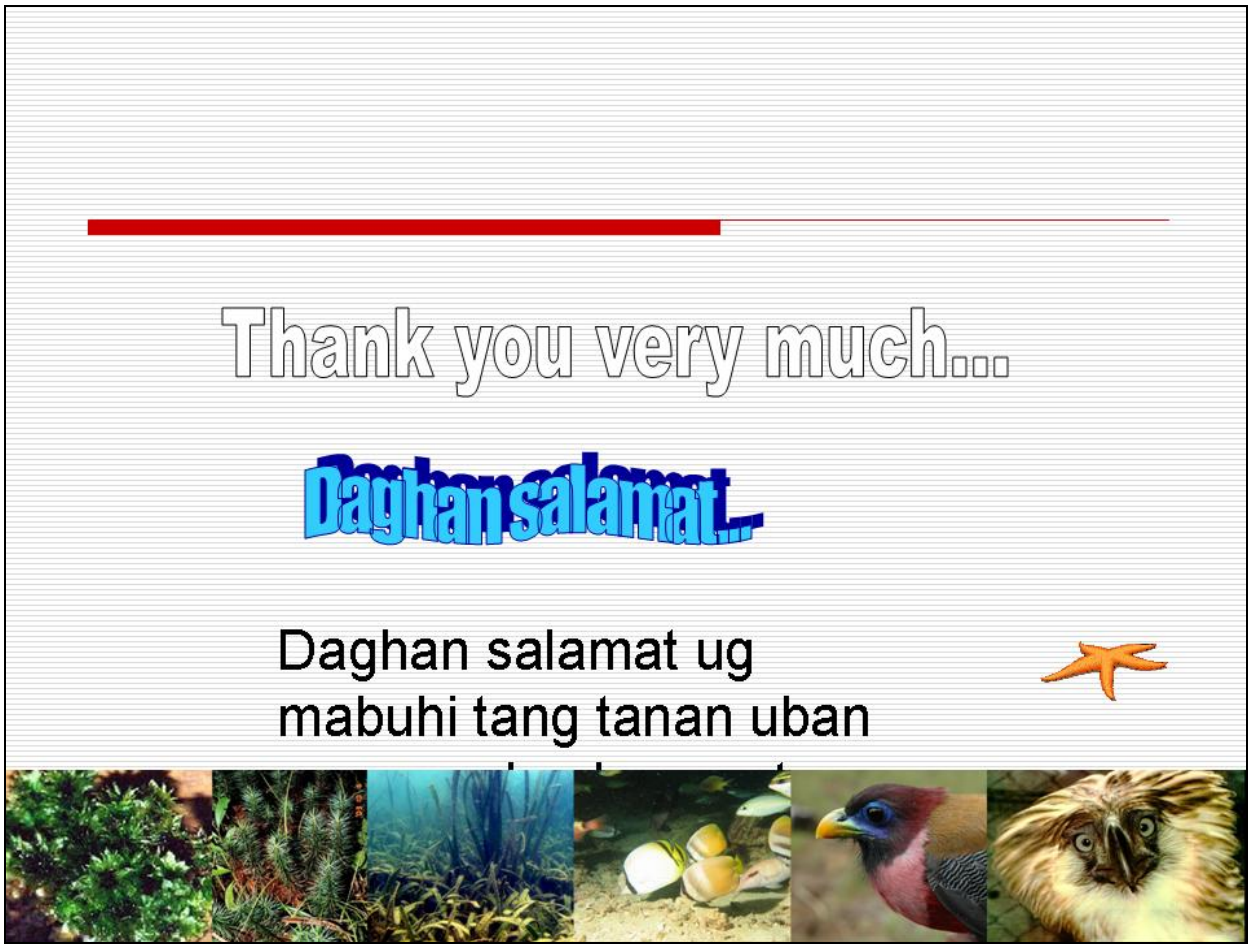
- Institutionalize a community-based monitoring protocol for the coral reef, seagrass beds, mangrove areas.
- Partnership with research institutions and with the local government units
- Coordinated efforts needed to protect coastal biodiversity, improve water quality and ensure sustainable fishing.

What's next for BRP?

- Coral bleaching watch
- Permanent plots for long-term ecological research (e.g. Biomes, LTER,
- Public awareness program
- Continue species inventory – collaborative and participatory…

Mt Malindang and its environ…

- a national park that harbors at least 2880 species…
- An area we need to protect…
- an area which we could use as a basis for predicting future events such as global climate change….
- Window for biodiversity watch…
- Availability of local partners and local research institutions
- … we need R&D funds to make things going.


Thank you very much...
Daghan salamat...
Daghan salamat ug
mabuhi tang tanan uban