

The IAMBlueCECAM Program



Ariel C. Blanco

UP Department of Geodetic Engineering

UP Training Center for Applied Geodesy and Photogrammetry





Comprehensive Assessment and Conservation of <u>Blue Car</u>bon <u>E</u>cosystems and their <u>S</u>ervices in the Coral Triangle



<u>Integrated Assessment and</u> <u>Modelling of Blue Carbon</u> <u>Ecosystem for Conservation and</u> <u>Adaptive Management</u>

What policies Value of BC would likely be ecosystems? effective? Which Coastal species protection by and mangroves? where? DOC, POC DOC, POC Ecosystem components How will Mangrove forests conditions affect SOC mangroves and Seagrass beds Management practices seagrass? Reduce nutrient runoff Coral reefs Reduce sediment runoff Coral recruitment Reduce pathogens Climate change impacts Enforce catch limits Sea level rise Create no-take zones Ocean acidification Ocean warming

Conceptual diagram illustrating climate change impacts on ecosystem components and management practices.

Diagram courtesy of the Integration and Application Network (ian.umces.edu), University of Maryland Center for Environmental Science. Source: Kaufman L and Tschirky J 2010. Living with the Sea. Science and Knowledge Division, Conservation International, Arlington, VA, USA.

P1: Mangrove Remote Sensing Using LiDAR, Multispectral, and Hyperspectral Data (MaRS) (*Dr. Ariel C. Blanco, UP TCAGP*)

P2: LiDAR, Hyperspectral, and Sonar Remote Sensing of Seagrass Meadows (SeaRS) (Asst. Prof. Ayin Tamondong, UP TCAGP)

P3: Geosimulation of Mangroves and Seagrass Vegetation Dynamics (GeoSiMAS) (Asst. Prof. Edgardo Macatulad, UP TCAGP)

P4: Hydrodynamic Modelling for the Assessment of Protective Services of Mangroves and Seagrass (HMAPS-MS) (Dr. Eugene Herrera, UP ICE)

P5: Modelling, Analysis and Simulation of Blue Carbon Cycle and Budgets (BlueCyMAS) (Dr. Ma. Lourdes McGlone, UP MSI)

P6: Suitability Models for Guiding Mangrove RePlanting Efforts (SuitMaPs) (Dr. Rene Rollon, UP IESM)

P7: Economic Valuation of Generated Blue Carbon Ecosystem Services (EconValBlue) (*Dr. Agustin Arcenas, UP SE*)

P8: Multi-agent Systems for **Simulating Policy Scenarios** on Blue Carbon Ecosystems (**BlueMASSPoliS**) (*Dr. Rizal Cruz, UP NCPAG*)

P9: WebGIS for Mapping, Supporting Decision-making, and Promoting Ecological Services of Blue Carbon Ecosystems (BlueWebMapS) (Asst. Prof. Mark Edwin A. Tupas, UP TCAGP)

P10: Geospatial Decision Support Systems and Capacity Building on Geomatics for Mangrove Seagrass Conservation (CapGeoDSS) (Dr. Ariel C. Blanco, UP TCAGP)

IAMBlueCECAM Program Framework

IAMBLUECECAM



Integrated Assessment and Modelling of Blue Carbon Ecosystems for Conservation and Adaptive Management Program



Remote sensing, Geosimulation, Mapping & Modeling





KEY PROJECT QUESTIONS

How do we precisely & accurately assess blue carbon?

Are the blue carbon ecosystems well preserved or degraded? Why? How?

What will happen if no action will be taken?

How do we properly conserve blue carbon?

How do we link blue carbon with coastal ecosystem conservation efforts?



Citizen Science & Capacity Building



Behavioral Economics & Ecoservices Valuation



Data Management

Governance





Mangrove cover
 Estimated fractional cover

over Mangroves and Seagrasses

 Mangrove cover, density, classes/genus, health, 3D structure

While limited to above-ground biomass in terms of blue carbon estimation, RS provides valuable information about mangroves and seagrass over space and time. This is important in the assessment of blue carbon ecosystem services.

➔ Detailed mangrove cover, density, health, mangrove classes/genus/species, and 3D structure from dense point clouds and multispectral data

Extent, density, health of seagrass species distribution if possible

Remote Sensing of



Mangrove RS Research Topics

- Species mapping
- Identification of abandoned fishponds
- Assessment of rates of recovery from damages (e.g., from typhoon)
- Monitoring of mangrove reforestation areas
- Mangrove expansion/colonization
- Mangrove health mapping
- Biomass estimation
 - Above ground and below ground (using geophysical methods).
- Other topics



2012.02.23

© Planet Labs, Inc.

Activities of Projects (Project 1: MaRS)

Mangrove RS (MaRS)

- Field surveys in mangrove forests in 7 pilots sites:
 - (1) Katunggan-It Ibajay Ecopark (KII), Ibajay, Aklan, (2) Bakhawan Ecopark, Kalibo Aklan, (3)
 Banate Bay Ecopark, Banate, Iloilo, (4) Batan Bay, Batan, Aklan, (5) Puerto Princesa, Palawan, (6)
 Busuanga, Palawan and (7) Coron, Palawan
- Development of methodologies and workflows for:
 - Mangrove aboveground biomass estimation
 - Mangrove zonation and structure mapping
 - Species mapping
 - Fishpond status mapping (initial)
 - Others



CORON-BUSUANGA MANGROVES ZONATION MAP



Satellite Images Used: Sentinel 28: Feb 22; 2A: Feb 27, 2018 Scene ID: T50PRU Downloaded from USGS WGS 1984 UTM Zone 51N Projection: Transverse Mercator
 Legend

 Zone 1
 Mail

 Zone 2
 But

 Zone 3
 Cor

 Zone 4
 But

 Zone 5
 Zone 6





MANGROVES ZONATION MAP: BUSUANGA

KII Ecopark (Portion only)





Aboveground Biomass

Aboveground Biomass Maps



The pixel-level maps were generated using the native resolution of the input data.

One 20m x 20m plot = 4 Sentinel pixels = 16 RapidEye pixels = 44.44 PlanetScope pixels

Detecting Abandoned Fishponds using Remote Sensing





Detecting Abandoned Fishponds using Remote Sensing



Fieldwork Activities

- □ Species
- □ Shoot density
- Canopy cover
- Canopy height
- Leaf area
- Biomass











Figure 4.23 Biomass sampling/coring in seagrass meadows in Ceara, Brazil (© Cristina Rooha Barreira, UFC)

ACTIVITIES

Bathymetric Surveys



Survey Route



INITIAL MAPS







Activities of Projects (Project 2: SeaRS)

Seagrass RS (SeaRS)

- Field surveys in selected project sites:
 - (1) Bolinao, Pangasinan, (2) Busuanga, Palawan, and (3) Batan Bay, Aklan
- Development of methodologies and workflows for:
 - Seagrass and coral extents mapping,
 - Characterizing seagrass beds in terms of the parameters needed for carbon stock modelling,
 - Bio-optical modelling (on-going)

Hydrodynamic Modelling for the Assessment of Protective Services of Mangroves and Seagrass (HMAPS-MS)

Project Leader:Eugene C. Herrera, D. EngProject Members:Bryan Clark Hernandez (SSRS)
Julius Giron (SRS), Joaquin Ferrer (URA),
Dayanara Gabay (PA),
Dominic Bautista (PS), Marjorie Turiano (PS)

National Hydraulics Research Center

Shot by: Bryan Hernandez Location: Near river mouth in KII, Iba

HMAPS-MS PRIMARY OBJECTIVE

To investigate on the protective services of soft engineering interventions like natural vegetation (mangroves and sea-grass beds) in dissipating wave and current energy, and reducing storm surge levels at the coasts, and to evaluate their effects on coastal dynamic processes



BlueCARES/IAMBlueCECAM

Project Specific Objectives

- 1. To investigate the **morphodynamic evolution** of the coastal zone incorporating the inter-relationship between coastal hydrodynamics, sediment transport and vegetation.
- 2. To investigate the <u>material transport</u> <u>characteristics</u> of the coastal zone incorporating the inter-relationship between coastal hydrodynamics, sediment transport and vegetation.
- 3. To quantify mangrove <u>litter production</u> (per type), <u>sediment deposition</u> and investigate the effects on vertical variation in flow resistance in <u>dissipating wave and current energy</u>, and to evaluate their effects on coastal dynamic processes.

Sensor Deployment at KII subwatershed

Configuration/ Setup/ Methodology











Activities of Projects (Project 4: HMAP-MS)



- Development of methodologies and workflows for
 - (1) regional and site-specific hydrodynamics
 - (2) watershed hydrology
 - **(3) coastal morphology and vegetation dynamics**

Project Name: Project 5: Modelling, Analysis and Simulation of Blue Carbon Cycle and Budgets (BlueCyMAS)

Project Leader: Maria Lourdes San Diego-McGlone Caroline Marie B. Jaraula Fernando P. Siringan

"Blue Carbon: Sequestration, Storage, Export"



<u>Project Name</u>: IAMBlueCECAM Project 3: GeoSiMAS Geosimulation of Mangroves and Seagrass vegetation dynamics

<u>Project Leader</u>: Edgardo G. Macatulad



"Overview of GeoSiMAS Project"



BlueCARES/IAMBlueCECAM

Activities of Projects (Project 3: GeoSiMAS)

- General prototype geosimulation model
- Site-specific geosimulation models for Mangroves and for Seagrasses
- Calibration parameters and validated geosimulation models
- Identified case scenarios
- Geosimulation scenario outputs

IAMBlueCECAM Project 3: GeoSiMAS

Geosimulation of Mangroves and Seagrass Vegetation Dynamics



Activities of Projects (Project 6: SuitMaPs)

- Meta analysis and spatial analysis of past mangrove replanting areas in 3 Aklan sites
- Analysis of recent and historical images of 7 sites in Panay (KII, Kalibo Bakhawan Ecopark, Batan Bay, Banate Bay, Bancal Bay) and Palawan (Calauit, Busuanga)
- Gathering field data (community structure and relevant biophysical parameters) in 6 sites (KII, Kalibo Bakhawan Ecopark, Batan Bay, Banate Bay, Calapan and Busuanga)

Activities of Projects (Project 6: SuitMaPs)

- Develop initial framework of workflows (identifying filter levels) of 1 site, focusing on Pinamuc-an in Batan Bay
- Initial mangrove replanting suitability map generation based on the initial workflow and model framework, focusing on Pinamucan in Batan Bay
- Shortlisting of parameters for validation and conduct field survey to evaluate outputs of initial workflow and model frameworks of selected site (Pinamuc-an)
- Develop initial framework of protocol and procedures of mangrove reforestation efforts based on initial workflows and model frameworks

Activities of Projects (Project 7: EconValBlue)

- Develop **survey questionnaire**, and prepare other strategies and documents for conducting the survey
- Conduct household survey of about 900 respondents from various barangays in the municipalities of Kalibo and Ibajay, Aklan
- Conduct interviews with ecopark management, fisherfolk associations, BFAR, and MAO and MENRO offices of the Ibajay LGU
- Conduct household survey of about 800 respondents from various
 barangays in Puerto Princesa, Palawan
- Develop tools, applications, and/or materials for the experimental survey
- Conduct **experimental survey** along with FGDs and KIIs
- Analyze and document findings from surveys.

Activities of Projects (Project 8: BlueMASSPolis)



- Conduct **policy consultative workshops** in four (4) municipalities
- Coordinate with local authorities and community leaders (barangay level: New Buswang, Kalibo; Pinamuk-an, New Washington; Cabugao, Batan; and Bugtongbato, Ibajay)
- Conduct interviews, FGDs, and workshops with 232 participants in total
- Analyze and document results from fieldwork activities
- Translate findings into UML diagrams

Project Name: Project 9. BlueWebMaps

Project Leader: Mark Edwin A. Tupas



"WebGIS (and 3D Visualization) for Mapping, Supporting Decision-making, and Promoting Ecological Services of Blue Carbon Ecosystems"



BlueCARES/IAMBlueCECAM

PROJECT HIGHLIGHTS

Objectives:

1. Develop **geodatabase** of mangrove and seagrass data and information, including images, maps, and field data;

 Develop a WebGIS to facilitate data and information sharing and Support decision-making using various models concerning mangroves and seagrasses;

3. Develop various **geovisualization products** to help communities understand and appreciate blue carbon ecosystems.



IAMBlueCECAM



BlueCARES/IAMBIueCECAM



Activities of Projects (Project 10: CapGeoDSS)

- Development, deployment, evaluation and refinement of community mapping protocol
- Questionnaire and interview surveys to determine need for additional knowledge and skills
- FGDs and Klls to identify gaps and support needs in decision-making
 process concerning coastal environments
- Trainings and workshops on mapping and use of images, maps, GIS, and GeoDSS
- Evaluation, assessment, and final report/output generation
- Development and deployment of **IEC materials**



Community Mapping (Concepcion, Busuanga)



Geospatial Needs Assessment Matrix Summary Aklan

| Municipality | People | Hardware | Software | Data / Information | System / Connectivity | Ave | Training Ready? |
|-------------------|--------|----------|----------|-----------------------|--------------------------|-----|--------------------|
| Kalibo | 2.5 | 2.5 | 2 | 2 | 3 | 2.4 | |
| New Washington | 1.5 | 2 | 1 | 1 | 1 | 1.3 | |
| Ibajay | 1 | 1 | 1 | 1 | 1 | 1 | |
| Ave | 1.67 | 1.83 | 1.33 | 1.33 | 1.67 | | |

GIS Capacity Profiling

Google Earth Engine services





Existing IEC on Blue Carbon ecosystems

- Translated to
 Tagalog and other
 local
 languages/dialects
- Layout for different materials and platforms



Information, education and communication (IEC) Materials





Capacity Building and Enhancement

- Blue Carbon Geomatics
- Mangrove Blue Carbon Remote Sensing Training
- Other training implemented by IAMBlueCECAM projects
- More CBE activities to come for...
 - LGUs and NGAs
 - SUCs and HEIs
 - People's organization (as suggested)

Blue Carbon Ecosystems-Related Policy

- Blue Carbon TWG and National Steering Committee
 - Convened by the Climate Change Commission
 - Working on Blue Carbon Roadmap
- Push for national policy on blue carbon
- Engage LGUs
 - November 29: Presentation and meeting with the Sanguniang Panlalawigan ng Aklan

Monitoring to Support Implementation and Accountability

 Continuous and automated processing of satellite images (optical and radar) as early detection of disturbances, damage and recovery assessment, and even fishpond status.

Citizen Science

- Volunteered geographic information (VGI) facilitated using mobile app
- Community mapping activities
- Regular FGDs

MARAMING SALAMAT PO!