Integrated coastal landscape management: An adaptation related to climate change impact

The following collaborators worked on this project:

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3. Prof. Peter Tian-Yuan Shih, National Yang Ming Chiao Tung University, China Taipei
4. Prof. Dr. Zhang Li, Aerospace Information Research Institute, CAS, China
5. Dr. Muhammad Helmi, Diponegoro University, Indonesia
6. Dr. Ati Rahadiati, Badan Informasi Geospasial, Indonesia
7. Armaiki Yusmur, Seameo Biotrop – Indonesia
The Asia-Pacific Network for Global Change Research (APN) is an intergovernmental network of 22 countries working towards pursuing an Asia-Pacific region that is successfully addressing the challenges of global change and sustainability.
CBA2019-11SY-Sutrisno:
“Integrated coastal landscape management: An adaptation related to climate change impact”

Final Report submitted to APN

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OVERVIEW OF PROJECT WORK AND OUTCOMES

1. Project Information

<table>
<thead>
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<td>Project Duration</td>
<td>1.5 year</td>
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<td>Funding Awarded</td>
<td>US$ 40,000</td>
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Key organizations involved:
1. Indonesian Society for Remote Sensing
2. Badan Informasi Geospasial (BIG)
3. Universiti Teknologi Malaysia (UTM)
4. The Ohio State University (OSU)
5. National Yang Ming Chiao Tung University
6. University Diponegoro
7. Seameo Biotrop

2. Project Summary

The impact of sea-level rise (SLR) in different coastal regions is influenced by a variety of factors that interact with one another (De Dominic et al., 2018; Sutrisno et al., 2021; Sutrisno, 2014). The risks necessitate the immediate implementation of adaptation measures, specifically integrated spatial planning-based ecosystem management (Roebeling et al., 2018; Sutrisno et al., 2017). The spatial planning aims to manage the various coastal landscape utilization to achieve a sustainable coastal region for the benefit of the people whose life depends on the coastal ecosystem. In this issue, a spatial planning-based ecosystem adaptation (SPBEA) should be considered to be developed. Therefore, the key objective of this project is to initiate regional and local capacity development in the sustainable use of the coastal ecosystem while combating the SLR trend and considering ecosystem-based adaptation. The project will be obtained through a multi-analysis approach that includes the development of an integrated coastal SPBEA concept and method, capacity development of training for young scientists, and a participatory workshop for the local community. The SPBEA method will become the material for training and participatory workshops. The Sayung Subdistrict, Demak, Indonesia, is the study area for this method, which is located on the northern coast of Central Java Province, Indonesia.

This project contributes to the APN agenda of resource utilization and pathways for sustainable development (RUSD), as well as risk reduction and resilience (RRR). So, the project will contribute significantly to the APN action agenda by addressing the links between science, policy, and scientific capacity development. Indeed, the project also supports the SDGs to build strong institutions and boost skills to formulate and implement sustainable growth among Asia Pacific states.

Keywords: SPBEA, Sea level rise, Capacity building

3. Activities Undertaken

1. Project planning meeting as the preparation for the implementation of the project
2. Two Focus discussion groups (FGDs) to discuss the SPBEA method, design, and development of the prototype. The method will be used in the capacity-building step.
3. Kick-off meeting to launch the project and collecting valuable information for the implementation of the project and the development of the SPBEA.
4. Compiling the concept, method, and development of the prototype
5. Training for young scientists on the practical ways of integrated coastal SPBEA
6. Local community participatory workshop.
7. FGDs of project evaluation
8. Publication and dissemination

4. Key facts/figures
- The development of integrated coastal SPBEA method
- 40 young scientists have been trained in the training on practical ways of integrated coastal SPBEA
- 10 local farmers have been involved in the local community workshop for the preliminary SPBEA implementation

5. Potential for further work
This project can be expanded in the future, with the local government using the SPBEA model's results for future detailed spatial planning. Young scientists who have been trained may become experts in providing data for coastal SPBEA in their own countries. This young scientist can also teach locals about rapid mapping and help to build a participatory mapping community in their respective countries. Aside from that, the locals may be involved in the implementation of their spatial plan for a sustainable rural fishing village. If these plans are consistently implemented, more people will be saved in the future, and the changing global environment will be reduced even further.

6. Publications
1. The fifth International Conference of Indonesian society for remote sensing (ICOIRS) held at Bandung on September 17 – 20, 2019
2. The 4th Digital and belt conference held in Shenzhen-China, December 17th to 19th 2019
3. Asia–Europe Scientists on Sustainable Development for Coast Environment conference, China, December 14th – 15th 2020
4. Pre-conference proceedings vol 1, PORSEC 2020
6. Submitted to APN Science bulletin
7. APN Report

7. Awards and honors
1. The best participants awards have been given to:
   a. Si thu min, Myanmar
   b. Lusita meilana, China Taipei
   c. Htet htet, Myanmar
   d. Miguel Garcia, Philippines
   e. Cindy Claudia, Indonesia
   f. Ayi priana, Indonesia
g. Feri Nugroho, Indonesia
h. Lency muna, Trinidad Tobago
i. Luca nguyen, Malta
j. Amalina abdul hamid, Malaysia

8. Pull quote

Collaborators:
Rongjun Qin, The Ohio State University, USA. It was a wonderful experience to lecture and interact with regional scientists and governors in this training on the practical way of SPBEA. I am glad that everyone in the training has learned essential geospatial techniques that could be directly used, and advanced further in their professional career, which will bring new aspects of using geospatial techniques for sustainable spatial planning.

Trainees:
Ali M. Muslih – Syiah Kuala University, Aceh
Many things can be learned from this training. I've gained new knowledge here, and I hope that events like this will be held regularly.

Vo Trong Hoang - Institute of Geography, VAST, Viet Nam
This training course provided us with many informative topics that will be beneficial to my studies. I'm hoping that the video of the lectures can be shared with us.

Si Thu Min – University of Mandalay, Myanmar
Excellent and colorful training for me, as I learned a lot about Spatial Planning methods and knowledge. Thank you for considering me! I'd like to see you again. I'm looking forward to hearing from you again. Have a great time!

Lency Muna – The University of Fiji, Fiji
All the topics presented in the training are very interesting. I however find the topic on the Theory and concept of integration coastal and land spatial planning to be most relevant to my country’s situation. SPBEA is needed for certain locations in the Solomon Islands because current adaptation projects are ineffective due to poor planning and understanding of the local geography and ecosystems. Thus the inclusive SPBEA method can be more effective for adaptation projects.

Augusto Almeida da Silva – Timor Leste
I am very interested in this training. where I can learn new things. Hopefully, this kind of training will be continued.

Joren Mundane A. Pacaldo, Mindanao State University, Philippines
The most interesting topic I learn is about Big Scale Mapping because it involves data acquisition using UAV(drones) and different kinds of cameras such as Thermal Infrared Camera and Short-wave Infrared, it also involves a different kind of sensors like geodetic, sonar, radar. It also involves different kinds of factors in taking photos that must be achieved, like the foreword and side overlapping, shutter speed, ISO, aperture. The drawback of this kind
of mapping is the cost because it requires expensive equipment which is not student budget-friendly. However, this topic has more to learn in the future

9. References


Acknowledgments

We would like to express our gratitude to the Asia-Pacific Network for Global Change Research for supporting us with the funding to carry out this activity. Our gratitude is also conveyed to the collaborators of the project from Badan Informasi Geospasial, especially the geospatial center of excellent; the Indonesian Society for Remote sensing; the academic community of the Diponegoro University; the Aerospace Information Research Institute, CAS; Prof Dr. Mazlan bin Hashim from University Teknologi Malaysia; Prof. Dr. Peter Tian-yuan Shih from National Yang-Ming Chiao Tung University; Prof. Dr. Peter Tian-yuan Shih from National Yang-Ming Chiao Tung University; Prof Rongjun Qin from the University of Ohio for all of their in-kind support. We also thank the local committees and partners involved in the project's implementation, for their assistance and participation in ensuring that this activity can take place successfully and produce fruitful results for all of us.
1. Introduction

1.1. Background

Human activities in coastal areas have an impact on the vulnerability of coastal areas to natural phenomena due to climate change. Conversely, those climate change impacts, such as storm surges, tidal waves, and rising sea levels may affect the livelihood of the coastal community. In some coastal areas, the impact of environmental degradation is caused by the interaction of various factors either by human activities, such as land conversion and unsustainable exploitation of coastal resources, or the climate change impact such as land subsidence, tidal flooding, or shoreline retreat (Sutrisno et al, 2021). (Sutrisno et al, 2014) said that the land subsidence is a part of relative sea-level rise caused by the groundwater discharge or seabed compaction. Indeed, storm surge and tidal waves can be exacerbated by climate change. (De Dominic et al., 2018) states combination of both, relative sea-level rise, the tidal wave may cause tidal flooding, abrasion and shoreline retreat, especially in the unprotected coastal area. The problems of the coastal environment have not only an impact on environmental degradation but also a negative impact on the quality of human life.

Recent debates in sustainability science have supported the need for a long-term spatial planning-based structure for ecosystem management that accounts for a range of ecological and social benefits. To reduce the effects of SLR and the risk of hydrological disasters in the coastal climate, it is essential to understand ecosystem services, their mechanisms, and their relevance to adaptation. Strengthening science-based environmental factors, human well-being and sustainable development can be achieved through the development of spatial planning-based ecosystem adaptation (SPBEA) and capacity development. Because it is distinguished by the principles of sustainability, ecological health, and human participation in the ecosystem, ecosystem-based spatial planning has been promoted globally as the best way
to ensure the sustainability of coastal ecosystems (Santos et al., 2014). Human beings will instinctively adapt to environmental changes to survive. For example, since 1980, the shoreline along the northern coast of central Java has been shifting inland (Kusuma et al. 2015). This permanent flood is caused by a hydrological catastrophe in this region, as well as sea-level rise, mangrove conversion to ponds, and tidal flood, local call as rob (Miladan, 2009). Several local communities adapt to protect settlements and fishpond areas with dikes have been introduced, but they have not yet successfully proven due to a lack of comprehensive planning. Therefore, further study is needed on the extent to which this adaptation can be carried out. For this reason, an SPBEA method needs to be developed prior as the source of knowledge, then, it is shared with the stakeholders, either young scientists or local society. Through this, the capacity of the stakeholders hopefully will be improved, for maintaining and restoring habitats, as well as growing understanding of the ecological services and economic value of the coastal ecosystem, and effectively applied the SPBEA concept on coastal areas. The design, method and prototype development of an integrated coastal SPBEA, as well as its implementation for the capacity building, including training for the young scientists and a workshop for the local community, will be the project's main success indicators.

1.2. The objective of the project

The key issue of this project is to increase regional and local capacity in the sustainable use of the coastal environment by improving understanding of the integrated SPBEA while combating shoreline retreat as an impact of sea-level rise. The detailed objective of this project is

1. to promote the concept and method of an integrated coastal landscape spatial planning-based ecosystem adaptation
2. to train the young scientists in practical ways of sustainable integrated spatial planning of the coastal area and to increase the awareness and science-based knowledge of the young scientists about the ecosystem functions and ecosystem adaptation concept and method
3. to increase the awareness of the local communities of the impact of SLR, high tide, mangrove ecosystem function, and the aquaculture ecosystem-based approach as part of an adaptation

The young scientists were chosen from Southeast Asia, the Asia Pacific, archipelagic and island states, UNDP member countries. The local community of a small village on the northern coast of central Java province has become involved in participatory capacity development.

The technique's spatial planning was required for better management of the coastal environment, particularly for disaster prevention and human quality of life. The SPBEA model can be applied to other disasters and global change management issues that many Asia Pacific countries have been dealing with for years. As a result, this activity is relevant to the APN agenda's risk reduction and resilience because it will fill the gap in providing a spatial planning method for maintaining a sustainable environment, emergency responses, and humanitarian aspects that continue to be issued for Asia Pacific countries.
2. Methodology

The basic method used in this project is face-to-face knowledge sharing and discussion, supplemented by in-class practice and fieldwork. However, due to the outbreak of COVID-19, the method that was planned to be in a class lecture and practice was changed to a combination of online and offline face-to-face methods, and the fieldwork was changed to be virtual.

The activity was divided into three steps, there is:

Activity-1: Compiling the concept and the method of integrated coastal SPBEA. Before promoting the role of integrated coastal SPBEA in dealing with sea-level rise and high tide, a concept and method must be developed. This concept evolved into science-based knowledge for the training of young scientists and a participatory workshop with the local community. Meetings, focus groups discussions (FGDs), and kick-off meetings have also been held to gather information about the best concept and method based on experts’ experiences and previous research. The SPBEA method, design, and model can then be developed in the training module.

Activity-2: The training for the young scientists on the practical ways of integrated coastal SPBEA. Training has been implemented for selected Southeast Asia Pacific young scientists on how to carry out practical methods of integrated spatial planning-based ecosystem adaptation to mitigate the issue of sea-level rise and high tide. This training program’s method was in-class discussion, in-class practice, and field visits that at this moment have been done virtually.

Activity-3: the local community participatory workshop. Promoting the sustainable use of coastal ecosystems through on-site ecosystem planning workshops has been participatory implemented with the local coastal community in Surodadi village, Sayung sub-district. The subject is how to maintain their coastal fish farming through an ecosystem-based approach that will be learned and practiced by the locals. This activity had been done face to face with a limited number of participants and health protocol.

Therefore, the steps of the project include:

1. Preparation
2. SPBEA method and prototype development
3. Capacity development through the training on the practical ways on integrated SPBEA
4. Local community participatory workshop for SPBEA and introduce Associated mangrove aquaculture.
5. Dissemination and publication

2.1. Preparation

The meetings and FGDs method were used for preparation in this stage. Components prepared in this stage, i.e.

A. Preliminary meetings:
Consist of several meetings with the research team and partners. Kinds of preparation that have been discussed include the management of the work plan, the preparation of data, methods, questionnaire, software, and hardware, criteria of participants and local
coastal community, brochures, and the method of announcements. The criteria of the participants have been specified, there is the age is not be older than 40 years; young scientists in earth science and has a bachelor degree in earth science, master or Ph.D. students in earth sciences; understand and able to operate RS and GIS software and fluent in English. Meanwhile, the local community of the study area has been chosen as the participants.

B. FGDs:
The method of integrated coastal SPBEA was discussed, as well as the coordination of project implementation among international and national collaborators/research partners, the determination of data, software, and other needs for the training and workshop, and the agenda for the training and workshop. The FGDs were held twice in National Technology Institute Bandung, Indonesia on September, 17th 2019, and in University Teknologi Malaysia, Kuala Lumpur on October 31st, 2019.

C. Kick-off meetings
The project should be promoted and discussed with the larger group. In this step, policymakers from the relevant authority and experts from relevant institutions have been invited to participate as discussants to improve the method and the project's implementation. The Kick-off meetings were held on November 20th, 2019 at the Diponegoro University, Semarang - Indonesia.

2.2. Development of the integrated coastal SPBEA method and prototype.
The figure below depicts the root of the problem and the reason why we need to develop the SPBEA method.

![Figure 1](https://example.com/figure1.png)

**Figure 1.** Illustration of the root of the problems in the coastal area (Sutrisno, 2019)

Referring to existing issues, the design of the prototype, method, and data requirements for the SPBEA model can be evaluated using multi-criteria analysis (MCA), which employs geographic information system (GIS) techniques, expert judgment such as the AHP.
method for algorithm development, remote sensing (RS) analysis, and field data acquisition for generating input data. The procedures are as follows:

**Figure 2.** Flowchart of the SPBEA steps development

a. **SPBEA design:**
   The design follows the hierarchical method of spatial planning for the coastal ecosystem, with the determination of potential zone, available zone, allocation zone, and allocation site as (Manjarrez et al., 2017) modification.

b. **SPBE analysis:**
   Following the design, MCA-based analysis was used. Expert judgment was used to create the algorithm.

c. **Data:**
   The data used was collected following the design model. The data may include environmental field data, a UAV-derived map, RS-derived data, and ancillary data from institutions or organizations.

d. **SPBEA Prototype:** A prototype was developed from analysis.

e. **SPBEA site development example:** SPBEA will be further developed and discussed at a participatory workshop in the study area. At this stage, a visual interpretation method is used with a high-resolution RS image map, a UAV-derived map.

The development of the model was carried out in the proponent laboratory, supported by the discussion in the meetings with collaborators and local partners.

### 2.3. Training on the practical ways of Integrated SPBEA

Due to the covid-19 outbreak, the SPBEA training is carried out by a combination of the offline and online format. The offline event is limited to a small number of local participants, while the online event is available to everyone from around the world. The 5-day training involves virtual lecture and practice for online participants, in-class lecture and practice for offline participants, and a virtual field visit for both. The supporting theory of climate change-based SLR and hydrological hazards, coastal ecosystem functions and services, mapping, spatial planning, modeling, and the method for deriving the prototype of integrated SPBEA are being discussed in this training.
Meanwhile, in-class practice concentrated on mapping and deriving the SPBEA model. Related to the participatory workshop, a small site area of interest for the ecosystem adaptation model and method as the class and field practice has been chosen, there is Sayung subdistrict.

2.3. Local community participatory workshop.

Within three days, a participatory workshop for pond farmers is held in Surodadi village, Sayung subdistrict. The workshop took the form of a face-to-face sharing session and a demonstration for SPBEA practice, with the issues being silvo-fisheries and coastal area conservation. The demonstration plot belongs to the farmer’s community leaders. Previously, the booklet, image map of Surodadi village, mangrove, and fish seeds were being prepared and distributed to participants. Because of the pandemic, the number of participants was reduced to ten, and the discussion was divided into two small groups of five people.

2.4. Evaluation

An evaluation of capacity building was also conducted in the form of FGDs, both offline after the training and online after the training and workshop. The method used was a face-to-face discussion about the training and workshop implementation, success, and barriers.

2.5. Dissemination and publication

Prior to the implementation of capacity building, the promotion was held at international conferences. Publication of project implementation and results must be done through some international conference, international journal, report, and bulletin. Besides, the SPBEA participatory mapping booklet is distributed to the farmer community of Surodadi village, Sayung sub-district. Indeed, training materials and videos had to be distributed to participants.

3. Results & Discussion

Because of the Covid-19 pandemic, the project has been granted a Special Circumstances No-Cost Extension (Appendix-1). So, while part of the project has been completed as planned before the pandemic, the other, especially the main activities of capacity building, which is the training on the practical ways of integrated SPBEA and the participatory workshop, has been adjusted.

For the sake of the participant's health and safety, as well as to comply with the travel ban policies of many collaborators and participant countries, the prohibition on gathering and restrictions on domestic travel, the committee decided, with collaborator approval, to conduct the main of activities of the project online for foreign participants and restricted offline for national participants. For the offline participants, it has been done with strict health guidelines. There shall only be a maximum of 20 people, including participants, committee members, and lecturers, occupying an offline execution room.

The adjustment of the implementation of the project due to the pandemic can be seen in table 1.

Table 1. Changed of the activities

<table>
<thead>
<tr>
<th>Activities</th>
<th>Date Before</th>
<th>Date New</th>
<th>The method Before</th>
<th>The method New</th>
<th>Numbers Before</th>
<th>Numbers New</th>
<th>Explanation</th>
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<td>September 17th, 2019</td>
<td>September 17th, 2019</td>
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<td>The method</td>
<td>Numbers</td>
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<td>Meeting on November 15th-16th, 2019 in Diponegoro University and FGD in Diponegoro University on November, 21st, 2019</td>
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<td>6 Training on spatial planning-based ecosystem adaptation: a tool to support climate change adaptation in Semarang</td>
<td>May 4th - 8th, 2020, Changed to April, 13th - 20th 2019</td>
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<td>The implementation of the hybrid training, combine offline and online</td>
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<td>Activities</td>
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<td>online</td>
<td>10</td>
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**Note:** The explanation for the scheduling change is due to pandemic lockdown, travel restrictions, and a request from a local partner due to the local situation (flooding, local outbreak, local cultural event).

The report for implementation of the project is as follow:

### 3.1. Preparation

#### 3.1.1. Meetings

Meetings for the implementation of the project and SPBEA model development as the source of training and workshop has been held in Bogor and Semarang, Indonesia (see Figure 3). The meetings from September 2019 to February 2020 were following the original schedule. The first meeting for project preparation was done on September 1\(^{st}\) and 5\(^{th}\) in Bogor, following by the meeting with a local partner for discussing the SPBEA method development and the preparation of Kick-off meetings on November 15\(^{th}\), 2019.

The next meeting was on February 3\(^{rd}\), 2020, with local stakeholders and the local government to organize the training and participatory workshop, as well as schedule meetings with the heads of the pond farmers group to plan the demonstration plot and field visits. The majority of the meetings were in-kind activities from the proponent and collaborator from Diponegoro University.

Following the acceptance of the Special Circumstances No-Cost Extension, the following meetings were rescheduled and held either offline or online. The offline meeting was conducted in compliance with the health policy, with all participants being subjected to a negative covid test. Committee meetings, coordination meetings with the committee, collaborators, local partners, or the ponds farmer community, and preparation for the training and workshop were all held. During the pandemic and work from home conditions, besides virtual meetings, communication and discussion were still carried out via the social media WhatsApp group and mailing list.
Preparation meeting, Bogor, September 1st, 2019

Diponegoro University-Semarang, November 15th 2019

Coordination meeting, Diponegoro University-Semarang February 3rd, 2020

Committee meeting, April 2020

Coordination meeting with collaborators, October, 30th 2020

Meeting with the pounds farmer community leader in Surodadi village-Sayung sub district, December 17th, 2020

Training and workshop preparation meetings, January 2021

Figure 3. Meetings for preparation from September 2019 to February 2020
3.1.2. FGDs

Two FGDs were held in Semarang on September 17th, 2019 at the National Technology Institute (ITN) Bandung-Indonesia, and on October 31st, 2019 at the Universiti Teknologi Malaysia, Kuala Lumpur. The meetings focused on the SPBEA's development, sharing knowledge about past experiences, spatial planning development, and program implementation (Appendix-2). The FGDs were in-kind activities provided by the proponent and collaborator from Universiti Teknologi Malaysia and travel to Kuala Lumpur was provided by APN and in-kind of BIG.
Following the kick-off meetings on November 21st, 2020, another FGD was held to evaluate the input from the kick-off meetings for the integrated SPBEA method and model development, as well as to manage the project's implementation with local partners.

### 3.1.3. Kick-off meetings

The kick-off meeting was held on November 20th, 2019 at Diponegoro University in Semarang, Indonesia, and was followed by an FGD to evaluate the kick-off meeting and finalize the SPBEA method. In general, the results of the resume demonstrate the importance of implementing SPBEA in areas prone to tidal flooding and what parameters should be considered in the method's development.

The APN funded the kick-off meeting, and the implementation is detailed in Appendix-3.

![Kick-off meetings in Diponegoro University on November 20th, 2019](image)

**Figure 5.** Kick-off meetings and FGDs

### 3.1.4. Field Data

Following the input for the SPBEA method and development, as well as for implementing the participatory workshop, the field surveys for field data acquisition and drone mapping have been carried out three times in Sayung subdistrict, on February 28th, 2020, and December 17th – 21st, 2020 for the environment and social-economic data acquisition, and January 22nd to 26th, 2021 for drone mapping for deriving the detail scale base map. Field data collection was postponed after February 2020 due to the covid-19 outbreak and travel restrictions. Figure 6 depicts the implementation of the field data collection.

![Water quality survey and ecosystem observation](image)

**Figure 6-a.** Fieldworks in Sayung Sub-district
3.2. SPBEA Method and prototype development.

Research on the development of the SPBEA model results in the hierarchical analysis process and the data required for the model as described in Figure 7 and Table 2 below. The steps of SPBEA model development taught in training were derived from (Sutrisno et.al., 2021) SPBEA hierarchical method. The development of the SPBEA model itself has been published online on the ISPRS international journal of Geo-information (see: https://doi.org/10.3390/ijgi10030176).

Prior to the implementation of the SPBEA model, an understanding of the concept of ecological functions, products, and services of coastal ecosystems; mapping concepts; how to obtain data from remote sensing; how to obtain large-scale maps using drones for participatory mapping; and how Associated Mangrove Aquaculture based-business is implemented to support SPBEA is required.

Table 2. Data for SPBEA model development

<table>
<thead>
<tr>
<th>Data</th>
<th>Type</th>
<th>data output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land system</td>
<td>ancillary data</td>
<td></td>
</tr>
<tr>
<td>The land-use/land cove</td>
<td>ancillary data/RS-Derived map</td>
<td></td>
</tr>
<tr>
<td>Base map</td>
<td>ancillary data</td>
<td></td>
</tr>
<tr>
<td>Spatial plan</td>
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<td></td>
</tr>
<tr>
<td>Soil map</td>
<td>ancillary data</td>
<td></td>
</tr>
<tr>
<td>Geomorphology map</td>
<td>ancillary data</td>
<td></td>
</tr>
<tr>
<td>Geology map</td>
<td>ancillary data</td>
<td></td>
</tr>
<tr>
<td>slope</td>
<td>ancillary data</td>
<td></td>
</tr>
<tr>
<td>Data</td>
<td>Type</td>
<td>data output</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>-----------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Flooding prone area</td>
<td>RS Derived-map</td>
<td></td>
</tr>
<tr>
<td>Green belt</td>
<td>GIS-derive map</td>
<td></td>
</tr>
<tr>
<td>Protection zone</td>
<td>GIS- derive map</td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td>field data</td>
<td></td>
</tr>
<tr>
<td>Salinity</td>
<td>field data</td>
<td></td>
</tr>
<tr>
<td>Social, culture and economy</td>
<td>field data</td>
<td></td>
</tr>
<tr>
<td>High-resolution orthorectified image</td>
<td></td>
<td>- Land-used map</td>
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<tr>
<td></td>
<td></td>
<td>- green belt</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- protection zone</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- coastal change</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- sedimentation map</td>
</tr>
<tr>
<td>Landsat 8 Oli</td>
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<td>- Flooding prone</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- protection zone</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- coastal change</td>
</tr>
<tr>
<td>Drone -Based map</td>
<td>field data</td>
<td>- Detailed Land-used map</td>
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<td></td>
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<td>- green belt</td>
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<tr>
<td></td>
<td></td>
<td>- protection zone</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- coastal change</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- slope and elevation map</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- planning map</td>
</tr>
</tbody>
</table>

**Figure 7.** Steps of SPBEA model development (Rahadiati et al., 2021)

GIS analysis techniques are used in the analysis process, such as the weight scoring method, buffers, and simple and advanced overlays.
Besides that, several Geographic Information System (GIS) and Remote sensing (RS) techniques of analysis are used to generate input data that will be used in the development of the SPBEA model, for example

a. Coastal vulnerability index:

![Coastal vulnerability index diagram]

**Figure 8.** steps of coastal vulnerability index (Armaiki et al., 2021)

b. Drone large scale-map

![Drone large scale-map diagram]

**Figure 9.** The process for deriving drone large scale-map (Qin, 2021)

Other techniques, such as digital and visual remote sensing analysis, have been implemented for deriving land use data, protection zones, flooding, and event detail spatial plans. The method and prototype SPBEA development can be acknowledged further at [https://doi.org/10.3390/ijgi10030176](https://doi.org/10.3390/ijgi10030176).

For supporting the SPBEA model knowledge of the ecological and economic function of the mangrove ecosystem, how the polyculture and associated mangrove aquaculture can protect the ponds and the process of SLR in shoreline retreat and coastal inundation has also been acknowledged.

### 3.3. Training on the practical ways of Integrated SPBEA

#### 3.3.1. Training of SPBEA

Training on the practical ways of integrated SPBEA was successfully implemented from February 15th, 2021 to February 19th, 2021, venue at Harris Hotel Sentral Land – Semarang,
Indonesia. This training was originally intended only for participants from Southeast Asia, with the first stage selecting 20 participants. However, given the pandemic condition, and the fact that training will be conducted both offline and online, there was plenty of room to invite more participants. The committee then decided to invite 10 to 20 additional participants (target 40), which resulted in an unexpected turnout of 75 participants. Participants come from countries in Southeast Asia (Malaysia, Myanmar, Vietnam, Philippines, Cambodia, and Indonesia), the Pacific countries (Japan, China, China Taipei, Fiji, Solomon island, Timor Leste), and other Asia, South America, Africa to Southern Europe countries, such as Madagascar, Guyana, Trinidad Tobago, Gambia, and Malta.

However, many online participants dropped out or did not complete the 5-day full training target. The time difference between the western and eastern hemispheres, as well as network issues, make completing the entire training difficult. However, more than half of the participants had completed the entire 5-day training and were adhering to the agenda. Appendix-4 contains a list of participants.
Pandemics restrict human mobility not only between countries but also across regions. In fact, each local government and the institutions that fall under it establish their own rules in response to the pandemic. As a result, Papuan participants will be unable to attend offline. Participants from other eastern parts of Indonesia, namely Southeast Sulawesi, and other western regions, such as Bengkulu, served as substitutes.

The training material given adheres to the original agreement, beginning with a basic understanding of coastal disasters in relation to climate change and practicing how to develop the disaster model. The second day began with an understanding of the services, products, and ecological functions of coastal ecosystems, followed by social sensing practice and the development of a spatial model for disaster mitigation. On the third day, it was demonstrated how to create a detailed scale map using UAVs. This map helps to develop the detailed scale of SPBEA. Finally, on the last day, the idea of spatial planning and SPBEA, as well as the importance of associated mangrove aquaculture for SPBEA, were discussed, followed by practice on the SPBEA model. See Figure 14 and Appendix-5 and Appendix-6.
The significant impact of climate change-based and hydrological disasters to the coastal area: A case of Semarang, Demak, and Pekalongan, Central Java, Indonesia

The use of social sensing data to track human behavior and public concerns

Practice: RS data analysis using R for disaster mitigation

GCPs and photogrammetry for big-scale mapping

Spatial data acquisition using UAVs and their processing

Practicing: Big Scale Mapping

Figure 14-a. Illustration of the training implementation
Sustainable Coastal Aquaculture: Mangrove Aquaculture (AMA), Low External Input for Sustainable Aquaculture (LEISA), Integrated Multi Trophic Aquaculture (IMTA).

Figure 14-b. Illustration of the training implementation

3.3.2. Virtual Field visit

Because of the restrictions on mobility and the number of crowds, offline participants are not permitted to leave the venue. Field visits were instead performed virtually for both offline and online participants. Figure 15 shows an example of a simulated field tour.

Figure 15-a. Illustration of virtual field-visit
3.3.3. Participant presentation on the result of the training

To determine the extent to which training is effective in increasing participants' knowledge of SPBEA, selected participants were invited to present the training results. The following is a list of the presenters and the subjects they have been discussing:

1. Miguel Garcia, Trinidad and Tobago
2. Seila Nhiep, Cambodia
3. Roseanne Ramos, Philippines
4. Vandana Devi, Fiji
5. Lency Muna, Fiji
6. Hoang vo, Vietnam
7. Delio da costa, Timor Leste
8. Amalina Abdul Hamid, Malaysia
9. Munawaroh, Indonesia
10. Shi Thu min, Myanmar
11. Htet htet, Myanmar
12. Yin Yin Aye, Myanmar
13. Ayi Priana, Indonesia
14. La ode Khairum Mastu, Indonesia
15. Lusita Meilana, China Taipei

Figure 15-b. Illustration of virtual field-visit

Figure 16-a. Presentation from the participants
Figure 16-b. Presentation from the participants
3.3.4. Closing ceremony and awards

The closing ceremony took place exactly as planned. The announcement for the best participants was made before the training was officially closed. Certificates are given to those who actively communicate with the lecture the most and provide the best practice performance. The following are the names of the best participants:

1. Si Thu Min, Myanmar
2. Lusita Meilana, China Taipei
3. Htet Htet, Myanmar
4. Miguel Garcia, Phillipines
5. Cindy Claudia, Indonesia
6. Ayi Priana, Indonesia
7. Feri Nugroho, Indonesia
8. Lency Muna, Fiji
9. Luca Nguyen, Malta
10. Amalina Abdul Hamid, Malaysia

Announcement of the award and the closing ceremony

Example of the best participants certificate

Some of the farewell chats from some participants

**Figure 17. Closing ceremony and awards announcement**

The appreciation has also been awarded to the lectures and committee for their effort to make this training fruitful.
3.3.5. Evaluation of the training

According to our observations, the majority of the participants can better follow the training material. For online participants, time and communication for practicing seem to be a concern, but not for offline participants. We make the problems easier to solve by sharing the video of the training materials as well as the lecturers’ e-mail addresses for future communications. Figure 19 below depicts the participants' performance in this training.
3.4 Local community participatory workshop

From February 20th to 22nd, 2021, an offline participatory workshop was held in Surodadi village, Sayung sub-district. This village was chosen because it has not fully implemented SPBEA. Due to the pandemic, the workshop only invited ten participants, all of whom were representatives from the aquaculture farming community. The participants were divided into two groups, with each group holding discussions and exercises.

This workshop is a follow-up to the training, in which the spatial zoning and the UAVs-derived map developed during the training will be implemented to a more comprehensive participatory spatial planning with the villagers.

The agenda of this training is to raise public awareness of the importance of ecosystem adaptation-based village spatial planning, to discuss how village spatial planning should be compiled, and to put it into practice both in the village SPBEA map sketch and in small examples in the field, in how SPBEA should be implemented. Agenda of the workshop can be seen in Appendix-5.

![Workshop at Surodadi village](image)

![distribution of seeds for the demonstration site](image)

![Group-1 discussion for rural SPBEA](image)

**Figure 20-a.** Local community participatory mapping
Figure 20-b. Local community participatory mapping

Figure 21 depicts workshop materials, including a subset of zonation maps derived from training and a large scaled – drone map used as the exercise tools. The villagers were also given a theory and guidance booklet for rural SPBEA, which is attached separately to this report.

Figure 21-a. Training-map derived for the participatory workshop
Following a discussion and exercise at a specific SPBEA workshop, we attempted to implement our rural spatial planning concept on a demonstration site. The concept of suitability planning was used in the implementation of Associated Mangrove Aquaculture (AMA) or silvo-fishery, as well as coastal and river green belt development. In the sample ponds belonging to the pond farming communities, mangroves were planted and fish seedlings were spread using the polyculture concept. Mangroves were planted along the river’s banks.

However, it is unlikely that we can assess the success of this program due to the project’s time frame and the fact that the demonstration requires time for growth. The solution
is the committee partners from Diponegoro University will continue to monitor the program, either through reports from the farmer community or by visiting the site (subject to pandemic regulation), even after the project has ended.

4. Evaluation

The evaluation instrument for training and workshop implementation is based on a small focus group discussion (FGD), which is conducted either offline or online. The first FGD was held offline following the training on February 19th, 2021 in Harris Sentraland Hotel, Semarang, and the second online on February 23rd, 2021.

Figure 23. The evaluation FGDs

The following are the conclusions of the evaluation:

1. The findings and feedback from the participants indicate that the training is successful in raising participants' knowledge and understanding of SPBEA and its supporting sciences, as evidenced by the results and comments from participants.

2. Training implementation will be more effective in the Asia-Pacific zone, where time differences are less of a factor. In comparison to online training, offline training appears to be more effective and efficient. Contact and trial and error are more efficient and beneficial in the offline world because on-site lecturer and guidance will explicitly guide the practice process.

3. Communication impediment Issues in online training can be addressed by allowing participants to communicate with lecturers via e-mail or other social media, as well as providing video of training materials to share with participants who may have a network constrained. More evaluation and communication to participants about the effectiveness of this method are required.

4. The implementation of the participatory workshop related to the detailed planning of the SPBEA in Surodadi has piqued the participants' interest. However, in order to be implemented, it must be supported by local government policies. With the help of regional universities, this project can be expanded.

5. Due to the short time frame for completing this project, the committee and University of Diponegoro partners will continue to evaluate the sample area (demonstration site) either through the farmer report or by visiting the demonstration site.

While the assessment of project output achievement is explained in Table 3 below.
Table 3. Achievement of the project

<table>
<thead>
<tr>
<th>Activities</th>
<th>Objective</th>
<th>Indicator</th>
<th>Achievement</th>
</tr>
</thead>
<tbody>
<tr>
<td>The SPBEA Method</td>
<td>model of Spatial planning-based ecosystem Adaptation model and site planning-based ecosystem</td>
<td>1. Data 2. model</td>
<td>1. Data for analysis (report) 2. SPBEA model (report in a journal)</td>
</tr>
<tr>
<td>Training on integrated coastal SPBEA</td>
<td>Improved the science-based knowledge of the young scientist in spatial planning ecosystem based adaptation model</td>
<td>1.20 participants 2. Training documents</td>
<td>3. 71 participants 4. Documents: report, material of training, video of training</td>
</tr>
<tr>
<td>Participatory workshop on-site planning of ecosystem adaptation</td>
<td>Improved knowledge and awareness of local community in ecosystem-based approach activities</td>
<td>1. 20 participants 2. Document</td>
<td>1. 10 participants (due to the pandemic) 2. Document: Booklet, Report</td>
</tr>
</tbody>
</table>

Based on the evaluation of project implementation achievements, the project's target has been met the achievement of the activity indicators. Obstacles arise during workshop activities, which were held in an offline format. As previously stated, because of the existence of health protocols during a pandemic, we should adhere to the regulation that limits the number of people participating in one activity to a small group. Meanwhile, as more opportunities became available to participants around the world, the number of training participants increased significantly.
5. Dissemination and publication

The SPBEA method and model were disseminated in Surodadi village, Sayung sub-district, Indonesia, where we delivered and detailed the material obtained from the creation of the SPBEA method and model via this participatory workshop. This SPBEA miniature demonstration site, for example, has been implemented. The villagers have also been given booklets. Furthermore, the SPBEA concept was presented online at the 2nd coastal research conference of Asia-Europe Scientists on Sustainable Development for Coast Environment, which will be held in China on December 14th and 15th, 2020. Due to the pandemic, other publications at PORSEC 2020 in Johor Baru have been postponed until an undetermined date. The extended abstract for the first volume of proceedings, on the other hand, has been submitted and is awaiting publication.

The result of SPBEA method and prototype has been published in the ISPRS International Journal of Geo-information (https://doi.org/10.3390/ijgi10030176). Indeed, the article for APN Science bulletin has also been drafted.

Figure 24. Dissemination and publication

6. Conclusions

According to the assessment, the training on the practical ways of integrated SPBEA has increased the participants' science-based knowledge in spatial planning based on ecosystem adaptation, as a method to mitigate the impact of coastal change caused by climate change. Indeed, the implementation of the participatory workshop has raised local citizens' awareness and fundamental knowledge about managing their environment to mitigate climate change impacts on their environment and livelihoods. However, the assessment concluded that practicing online training has certain challenges, particularly in communication, network, and time differences, which the committee attempted to mitigate by providing direct contact with lecturers via e-mail and sharing training videos. Furthermore, policy support and assistance from the regional government are required for the implementation of rural SPBEA. The regional university will most likely be able to mediate this effort.
Because of the project's time constraints, proper monitoring of the SPBEA demonstration site is impossible. In this case, the regional university has the potential to continue the program and provide assistance to make this effort a success.

7. Future Directions

This project is considering the capacities and limits of the coastal ecosystem and its interaction with human social life and thereby will reduce climate-associated risks (SLR) for a sustainable future. As a result, this initiative is in line with the SDGs, which have been ratified by a significant number of countries around the world, and is based on the idea of leaving no one behind. Indeed, this project is a means to combat climate change (SLR) and its impact on the future of sustainable ecosystems and the lives of coastal inhabitants through capacity development or a method of sustainable planning that is relevant to SDGs-13. Therefore, the knowledge gained from this training was extremely beneficial to the participants in convincing their government to implement ecosystem-based spatial planning. Furthermore, the implementation of training is supported by Archipelagic and Island States - UNDP, which has several students under its supervision to learn more about this concept and pave the way for its implementation. For the local case, the regional authority can utilize the awareness of the local community to manage their idea to support sustainable spatial planning and the goal of SDGs-13

References


**Acknowledgment**
This material is based on work supported by the Asia-Pacific Network for Global Change Research (APN) under Grant No. CBA2019-11SY-Sutrisno

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APPENDICES
Appendix.1. Special No Cost extension

Dr Dewayany Sutrisno  
Institution: Indonesian Society for Remote Sensing and Geospatial Information Agency  
dewayany@email.com  
Indonesia

Project: CBA2019-11SY-Sutrisno  
Project Leader: Dr Dewayany Sutrisno  
Reference: CovEx1-CBA09-1 (first extension)

Subject: 6-month Special No-Cost Extension for COVID-19 Pandemic

Dear Dr Dewayany Sutrisno,

Based on your email dated 13 April 2020 requesting a special extension, and adhering to the APN Project Management Strategy in Response to COVID-19 Pandemic Version 1, I am writing on behalf of the APN Secretariat Director to confirm that a Special No-Cost Extension has been approved for the APN-funded activity outlined below:

<table>
<thead>
<tr>
<th>Special Extension Reference:</th>
<th>CovEx1-CBA09-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>APN Project Reference:</td>
<td>CBA2019-11SY-Sutrisno</td>
</tr>
<tr>
<td>Project Title:</td>
<td>Integrated Coastal Landscape Management: An Adaptation Related to Climate Change Impact</td>
</tr>
<tr>
<td>Contract Period:</td>
<td>1 September 2019 - 31 August 2021 (2 years)</td>
</tr>
<tr>
<td>New Contract Period:</td>
<td>1 September 2021 - 28 February 2022</td>
</tr>
<tr>
<td>Submission Deadlines:</td>
<td>Final Technical Report is to be submitted by 31 March 2022. Final Financial Report is to be submitted by 30 April 2022</td>
</tr>
</tbody>
</table>

If you require any additional information or assistance, please do not hesitate to contact the APN Secretariat at COVID-19@apn-gcr.org quoting the Special Extension Reference number in the box above.

Sincerely,

Dr Linda Anne Stevenson  
Head, Communications and Scientific Affairs Division  
APN Secretariat
Appendix 2. Material of FGDs

2.1. 1st FGD Bandung, Indonesia

Integrated coastal landscape management: An adaptation related to climate change impact

Title: Integrated coastal landscape management: An adaptation related to climate change impact

1. BACKGROUND

1.1. The impact of SLR in coastal regions and interacting with other factors such as land dike, wind direction, and wave height.

1.2. Climate change impacts lead to changes in sea level rise, storm surges, and changes in the coastal environment.

1.3. The need for integrated coastal landscape management to address these challenges.

1.4. The role of stakeholders in developing adaptation strategies.

1.5. The need for public participation in planning and implementing adaptation measures.

2. Objectives of the Proposed Project

2.1. To promote the concept and methods of integrated coastal management to reduce the vulnerability of coastal communities.

2.2. To train the local community in practical ways of sustainable integrated coastal planning.

2.3. To enhance the awareness and scientific knowledge of the young scientists about the ecosystem functions and adaptation concepts and methods.

3. OUR TEAM

- **Collaborators:**
  - M. Raden Fauzi, UII, Universiti Teknologi Malaysia
  - Peter Tjan Yean Biin, National Cheng Kung University, Taiwan
  - Rongxing Qie, Tsinghua University, United States
  - Zhang Li, Institute of Remote Sensing and Digital Earth, China
  - Muhammad Riaq, Darmajaya University, Yogyakarta, Indonesia
  - F. Alif Arifin, Badan Pusat Statistik, Indonesia

- **Supporting:**
  - Institut Teknologi, Indonesia
  - Jakarta
  - Bogor, Indonesia

4. OUR TEAM

- **Collaborators:**
  - M. Raden Fauzi, UII, Universiti Teknologi Malaysia
  - Peter Tjan Yean Biin, National Cheng Kung University, Taiwan
  - Rongxing Qie, Tsinghua University, United States
  - Zhang Li, Institute of Remote Sensing and Digital Earth, China
  - Muhammad Riaq, Darmajaya University, Yogyakarta, Indonesia
  - F. Alif Arifin, Badan Pusat Statistik, Indonesia

- **Supporting:**
  - Institut Teknologi, Indonesia
  - Jakarta
  - Bogor, Indonesia

5. SEE THE IMPACT OF CLIMATE CHANGE

6. Mitigation

- Changes in coastal areas by integrating tourism and agriculture activities.
  - Use of traditional and modern techniques.
  - Development of coastal erosion control structures.
  - Use of coastal vegetation and mangrove forests.

7. Adaptation

- Changes in coastal areas by integrating tourism and agriculture activities.
  - Use of traditional and modern techniques.
  - Development of coastal erosion control structures.
Expected Deliverables/Outputs

1. One report and at least one publication of the concept and method of integrated coastal SPICEA and the example of SPICEA prototype.
2. Implementation of training for integrated coastal SPICEA for 20 (twenty) young scientists funded by AIP and others. The integrated SPICEA systems are field points, monitoring and outreach-infrastructure such as marine.
3. Implementation of the participatory workshops for 20 (twenty) local-northern coastal stakeholders and write report, and a demonstration site of all-fisheries/eco-tourism.

Methodology and Work Plan

Activity 1: Conceptual framework and methodology/techniques to develop SPICEA

The conceptual framework, methods, and techniques to develop SPICEA will be explained systematically, including SPICEA. Visualization, simulation, and participatory process training and several demonstration sites

Activity 2: Establishing the participatory SPICEA

- Conceptual framework and methodology/techniques to develop SPICEA
- Demonstration site of all-fisheries/eco-tourism

Methodology and Work Plan

Development of the integrated coastal SPICEA prototype.

Institute and methodology for the participatory bi-monthly (i.e., through workshops, seminars, and discussions with participants.

Report and evaluation.

Thank You
2.2. 2nd FGD Kuala Lumpur, Malaysia

RESULT OF THE PRELIMINARY MEETINGS

Siti Amirah Sehat

Integrating Coastal Landscape Management: An adaptation related to climate change impact

Preliminary result

1. Previous Research

2. HOW PEOPLE PERCEIVE AND ADAPT?

Minute of meetings:

1. INTRODUCTION:
   - Disagreement between: the accuracy of the socioeconomic and the urban land use changes over time.
   - The time period studied: the period of 2015-2025.
   - The data used: data from the 2015-2025 period.

2. STUDY AREA:
   - The study area is located in the Coastal Zone of the Malacca Strait.
   - The study area is characterized by its coastal morphology, including estuaries, mangroves, and sandy beaches.

3. METHODOLOGY:
   - The methodology involved the use of GIS and remote sensing data.
   - The data used included satellite images and aerial photographs.

4. RESULTS:
   - The results showed a significant increase in the area of urbanization over the study period.
   - The results also indicated a decrease in the area of natural vegetation.

Mitigation

- Urban development and land conservation for coastal protection and tourism.
- Coastal protection and erosion control structures.
- Environmental education and awareness campaigns.
- Sustainable management of coastal resources.
- Public participation in coastal management activities.
Final Report: CBA2019-11SY-SUTRISNO
Benefit of silvo-fisheries

C. Change of the land cover

How the issue impact on coastal infrastructure?

F. Resilience study

g. Coastal infrastructure spatial planning

b. Land subsidence

d. Wave impact, storm surge and mitigation

1. Coastal erosion that occurred especially between 2007 and 2009 was caused by hydrometeorological factors, such as the wave variability.
2. The highest sediment flux for coastal infrastructure in the Breakwater and coastal green belt while typical has the lowest.
3. The strategic of coastal protection as a part of coastal erosion mitigation relates to consider the economics of maintenance and breakwater infrastructure.

The condition of interviews:

a. Realistic appraisal of livelihood adaptation to the community in Matisa locality which is economically lower than the lower middle category.

b. The strategy to mitigate the effects of climate change due to heavy rain because of the high terrain.

c. Positive adaptation related to climate change.

\[ \text{Resilience} = \text{Adaptation} - \text{Erosion} \]

The final report is on CBA2019-11SY-SUTRISNO.
The problems from the air

Thank you very much for your attention
## Appendix 3. Kick-off Meeting

### 3.1. Kick-off Agenda

Kick off Meeting Integrated Coastal Landscape Management: an Adaptation to Climate Change Impact  
Semarang, 20 November 2019

<table>
<thead>
<tr>
<th>No.</th>
<th>Waktu</th>
<th>Kegiatan</th>
<th>Pelaksana</th>
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<td>1</td>
<td>08.00 – 08.30</td>
<td>Registrasi Peserta</td>
<td>Panitia</td>
</tr>
<tr>
<td>2</td>
<td>08.30 – 09.00</td>
<td>Pembukaan dan Sambutan</td>
<td>1. Dekan Fakultas Perikanan dan Ilmu Kelautan, Universitas Diponegoro</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. Badan Informasi Geospasial</td>
</tr>
<tr>
<td>3</td>
<td>09.00 – 09.20</td>
<td>Spatial Planning Based-Ecosystem Adaptation: Concept and Planning</td>
<td>Prof. Dr. Dewayany Sutrisno, M.Appsc</td>
</tr>
<tr>
<td>4</td>
<td>09.20 – 09.40</td>
<td>Rencana Pembangunan Tol Tanggul Laut Semarang-Demak Provinsi Jawa Tengah</td>
<td>Dr. Prasetyo Aribowo, SH, MSoc, SC Kepala BAPPEDA Provinsi Jawa Tengah</td>
</tr>
<tr>
<td>5</td>
<td>09.40 – 10.00</td>
<td>Coffee break</td>
<td>Panitia</td>
</tr>
<tr>
<td>6</td>
<td>10.00 – 10.20</td>
<td>Integrated Coastal Zone Management (ICZM) di Pantura Propinsi Jawa Tengan</td>
<td>Prof. Dr. Ir. Muhammad Zainuri, DEA</td>
</tr>
<tr>
<td>7</td>
<td>10.20 – 10.40</td>
<td>Integrated Coastal Zone Management: An Adaptation to Related Climate Change Impact. Case Study: Sayung District, Demak, Central Java</td>
<td>Dr. Muhammad Helmi S.Si. M.Si. (Pusat Kajian Mitigasi Bencana dan Rehabilitasi Pesisir)</td>
</tr>
<tr>
<td>8</td>
<td>10.40 – 11.00</td>
<td>Analisis Parameter Oseanografi dan Mitigasi Bencana Kerusakan Pantai di Wilayah Pesisir</td>
<td>Prof. Dr. Denny Nugroho Sugianto, S.T., M.Si. Departemen Oseanografi, FPIK UNDIP</td>
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<tr>
<td>9</td>
<td>11.00 – 11.20</td>
<td>Rehabilitasi Berbasis Ekosistem Pesisir: Pembelajaran dari Lapangan</td>
<td>Eko Budi Priyanto (Wetland International)</td>
</tr>
<tr>
<td>10</td>
<td>11.20 – 11.40</td>
<td>Pendekatan Spasial Kawasan Raja Ampat: Trade-off antara fungsi budidaya dan lindung</td>
<td>Dr.rer.nat., Ir. Wisnu Pradoto, M.Sc. (Perencanaan Wilayah dan Kota undip)</td>
</tr>
<tr>
<td>11</td>
<td>11.40 – 12.30</td>
<td>Resume dan Diskusi</td>
<td>Moderator: Dr. Ir. Kunarso, M.Si. Prof. Dr. Dewayany Sutrisno, M.Appsc</td>
</tr>
<tr>
<td>12</td>
<td>12.30 – 12.40</td>
<td>Penutupan</td>
<td>Prof. Dr. Denny Nugroho Sugianto, S.T., M.Si. Departemen Oseanografi, FPIK UNDIP</td>
</tr>
</tbody>
</table>
3.2. Presentation 1

**Spatial Planning Based-Ecosystem Adaptation: Concept and Planning**

**Indonesian Case**

In some part of Indonesia, the impact of sea level rise, and climate change associated impact such as storm surge, high wave, and varied among coastal areas.

The model to develop the study in the coastal environment and social economy, and the people adaptation may vary among coastal areas.

- On Yelo Reau Island, the SLR effect or baseline may cause high wave, storm surge, and coastal change.

In the north coast of Java Island, the impact of SLR will create a complex combination of land subsidence, land conversion, high tide and storm surge.

**Mitigation**

- Storm surge
- High wave
- Erosion

**Adaptation**

- Resilience
- Migration

**What has been occurred in this area?**

- Climate change
- Sea level rise
- Extreme weather and local effect
- Land subsidence
- Coastal inundation
- Flooding

**Questions**

- How about the local spatial planning?
- How about the best mitigation and adaptation?
- How about the experience and research has been done to overcome the problems?

...especially in a spatial planning based ecosystem adaptation, and its related method and concept

**Methodology and Work Plan**

- Activity 1. Compiling the concept and the method of integrated coastal management (ICMCA)
- Activity 2. Field surveys and observations
- Activity 3. Data analysis and interpretation
- Activity 4. Report writing and dissemination

**Managing the environment**

1. The impact of this land clearing may vary severe erosion. Flooding either caused by storm, tide, or heavy rain.
2. Some actions have been carried out to protect the degraded environment such as:
   - Built the transect on the sea wall,
   - The combination of semi-hard structure and soft structure in seawall realisation.
**What we have learnt**

1. Protection of the coastal development is important.
2. All coastal development needs to be protected against sea level rise, as coastal protection actions are not allowed by the government, and the area is still under industrial development.
3. The government has adopted “City-wide” strategies, with the government and industry working together to protect the area.
4. The government and industry have adopted the policy as a strategy for coastal protection.
5. The government and industry have adopted the policy as a strategy for coastal protection.

**Benefit of silvo-fisheries**

The benefit of silvo-fisheries is that it provides a sustainable way of managing fish and shrimp stocks. The model shows that it can be done in a sustainable way, and that it can be done in a way that is beneficial to the environment and the economy.

**SEA LEVEL RISE, satellite altimetry Based model**

The model shows that sea level rise is a problem that needs to be addressed. The model also shows that it can be done in a sustainable way, and that it can be done in a way that is beneficial to the environment and the economy.

**Methodology and Work Plan**

Activity 1: Development of the integrated coastal SPBEA prototype.

Activity 2: Evaluation and monitoring of the project will be held through PMSCs, field checks and communication with partners.

Activity 3: Report will be published.

**Expected outcome**

1. Increasing the cooperation, understanding and friendship in activities regarding the mitigation and adaptation on sea level and climate changes impact.
2. Understanding in collaboration to maintain the sustainability of coastal areas.
3. Finding the best fit model of SPBEA as the adaptation strategies.
Future and direction

- Sharing knowledge by joint study to the coastal area affected by sea level rise from various zones and various regions in the South China Sea area is important.
- This working group should start with collaboration to solve the problem of the climate change phenomenon and assist each other to sustainable manage the coastal and communities within.
- Each country can do the priority analysis and adaptation like we have done and share within the working group for finding the best fit model of the impact, mitigation and adaptation of sea level.
- The project can be adapted through the capacity building, to the people living along the coast of South China Sea countries.
3.3. Presentation 2
Terima Kasih
3.4. Presentation 3

Presentation 3

Focus Group Discussions
Integrated Coastal Zone Management (ICZM) di Pantura Propinsi Jawa Tengah Tahun 2019

- Permasalahan:
  1. Degradasi kondisi alam: abrasi, alreasi, sedimentasi > Rob, Land Subsidence, Sea Level Rise
  2. Penurunan Daya Tampung yang tingkat sesuai dengan Tata Ruang
  3. Kelalaian Masyarakat dan Penurunan Daya Dukung
  4. Peningkatan dan pengembangan Daerah Industri > Investasi > Tekanan Lingkungan

- Tantangan:
  1. Pertanian
  2. Industri
  3. Pariwisata

TATA RUANG?
Nilai Tambah dan Kesejahteraan

- Wilayah Peselisir:
  1. Garis Pantai > 12 Mil > Keuangan
  2. Ketetapan Peraturan dan Peruntukannya
  3. Perubahan Peruntukan pada Suatu Wilayah
  4. Prioritas - prioritas peruntukan tidak menimbulkan Tumpang Tindih Kebijakan / Peraturan

- Tantangan:
  1. Koordinat
  2. Ruang
  3. Kebutuhan

- Wilayah Pantai:
  1. Pantura Barat, Coastal Cell 5
  2. Batas Wilayah > Pertimbangan Ekosistem
  3. Pertimbangan Keterpaduan Coastal Cell dan Watershed Cell
  4. Pendekatan Aspek Biologis, Ekologis, Biofisik dan Anthroposentris (SDM, Pengguna, Perusahaan)

- Tantangan:
  1. Wilayah Pantai > Dampak
  2. Pembangunan / Pengembangan / Bangunan Panas
  3. Perubahan Gender Pantai

PERUMUSAN
Focus Group Discussions
Integrated Coastal Zone Management (ICZM) di Pantura Propinsi Jawa Tengah Tahun 2019

Pencapaian
1. Analisis Lusian dan Daya Dukung Lingkungan
2. Analisis Patensi dan Nilai Tambah
3. Analisis Sosial dan Keberpihakan Partisipasi Masyarakat (Anthroposentris)
4. Sinergitas Kelambagaan
5. Proporsionalitas Peraturan dan Kebijakan Lembaga Pengelola

Implementasi
1. Kebijakan Penetapan Zonasi dan Tata Ruang untuk Lusian dan Daya Dukung Lingkungan serta Peruntukannya
2. Coverage / Kompetensi Penutupan Buku dan Keuangan dalam Pengelola Jaringan Panas
3. Kebijakan Kepemilikan dan Paritipatif SDM
4. Penetapan Kesepakatan Antar Lembaga agar tidak terjadi Tumpang Tindih Kebijakan

Final Report: CBA2019-11SY-SUTRISNO 45
PERUMUSAN
FOCUS GROUP DISCUSSIONS
INTEGRATED COASTAL ZONE MANAGEMENT (ICZM) DI PANTURA PROPINSI JAWA TENGAH TAHUN 2019

MONITORING
1. BAPUPT dan Pemda melakukan Pengawasan terhadap
   Kepatuhan Zonasi dan Tata Ruang untuk Lusinan dan Daya
   Dukung Lingkungan serta Peruntukannya
2. Analisis Tahunan terhadap Pendapatan dalam Pengelolaan
   Jangka Panjang
3. Tingkat Partisipasi Masyarakat terhadap Pengembangan
   Usaha (Pariwisata, Industri, Pertanian)
4. Tingkat Sinergitas Antar Lembaga, terkait dengan
   Kebijakan Prioritas

EVALUASI
1. Evaluasi Kebijakan Penetapan Zonasi berdasarkan
   Ekosistem
2. Evaluasi Cost Benefit dalam Perencanaan Neraca Keuangan
   Jangka Panjang
3. Evaluasi Tingkat Kesejahteraan Masyarakat (Wellfare)
4. Evaluasi terhadap Satgas Bersama untuk Pengelolaan
   Wilayah Terpadu

Tak Ada Pelaut Ulung Yang Dilahirkan dari
Samudra Yang Tenang,
Tapi 1a akan Dilahirkan dari Samudra Yang Penuh
Terpaan Badai, Gelombang dan Topan

Jerima Kasih
3.5. Presentation 4

FGD dan Kick Off Meeting
Integrated Coastal Landscape Management: An Adaptation to Related Climate Change Impact
Case Study: Sayung District, Demak, Central Java

Ih. Muharrman Hadi
Dr. Rudi F. Kurniawan

Center for Coastal Revisualization and Disaster Mitigation Studies (CoREM)
Oceanographic Department, Faculty of Fisheries and Marine Sciences
Universitas Diponegoro
Semarang - 2018

Studi Area Erosi dan Sedimentasi

Penentuan area erosi dan sedimentasi:
1. Wilayah yang terjadi penetrasi garis pesisir
2. Garis pantai awal proyek PTBW Provinsi, PTBW Kab/Kota serta Pemko/PMK (Skala 1:25,000, 1:50,000, yang berfungsi sebagai data peningkatan 4D, efektif garis pantai 2013)
3. Gradien pantai terpasang dari data satelit resolusi tinggi 2018
4. Erosi (area yang hilang) dan sedimentasi (area yang bertambah) dipaparkan berdasarkan analisis spasial kedalaman garis pantai terpasang

Karakteristik spasial erosi dan sedimentasi
Peta Kecamatan Sayung, Demak, 2018

Karakteristik spasial erosi dan sedimentasi
Peta Kecamatan Sayung, Demak, 2018

Laju Penurunan Muka Tanah dan SLB, Erosi Sedimen, Demak 2003

Laju Penurunan Muka Tanah dan SLB, Erosi Sedimen, Demak 2009
Siapa Status Pemilik Tanah Timbul Di Pesisir?

Status Tanah Timbul

Peraturan Pemerintah No. 16 tahun 2004 tentang Penataan Tanah, Pasal 12:

"Tanah yang berasal dari tanah timbul atau hasil rekonstruksi di ujungnya pemukaan pantai, pasir, raba, danau dan bekas sungai difokuskan langsung oleh negara.

Surat Menteri Agraria/Kepala BPN No. 410-1253, tanggal 9 Mei 1998:

"Tanah-tanah timbul sealeran akan dianggap sebagai kawasan penanam, seluas 200 hektar, termasuk 50 hektar, yang timbul dari tanah timbul secara alami ketika dinyatakan sebagai tanah yang langsung dikawal oleh negara."

Teknik Pemetaan Tanah Timbul pada Kecamatan Sayang, Kab. Demak

Area Tanah Timbul Potensi Rehabilitasi

Kriteria penetuan area tanah timbul potensi rehabilitasi “mangrove”:

1. Daerah erosi/erosi
2. Terbentuk aneh timbul
3. Enclave pada area mangrove
4. Wksesah di sekiling mangrove
5. Jenis substrat dasar lumber berpasir
6. Terlindung dari cara laju sungai

Gambaran Tanah Timbul Potensi Rehabilitasi di Kecamatan Sayang, Kab. Demak
Terimakasih
3.6. Presentation 5
Hasil analisis model erosi dan akresi pada setiap musim

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<td>16.431 m³</td>
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Pembangunan Pelindung Pantai yang dilakukan dengan
Rehabilitasi Pasir Penanaman Mangrove

TERIMA KASIH

cerneyangdong@gmail.com
081576403223
2019
3.7. Presentation 6

**Rehabilitasi Berbasis Ekosistem Pesisir**
Pembelajaran Dari Lapangan

**Mekanisme BioRights**
Mekanisme berbasis ekosistem yang mengajarkan bahwa intervensi pertanian harus mempertimbangkan keberlanjutan lingkungan.

**Tahapan BioRights**
Menggambarkan tahapan dalam implementasi BioRights, mulai dari pendekatan, pelaksanaan, hingga pengukuran hasilnya.

**Bantul : 2000–sekarang**
Gambaran perubahan lingkungan dari tahun 2000 hingga sekarang, menunjukkan perbaikan kondisi ekosistem pesisir.

**Rehabilitasi Mangrove**
Gambaran proyek rehabilitasi mangrove, menunjukkan perbaikan kondisi ekosistem mangrove.
Mix Mangrove Aquaculture (MMA)

February 2018
March 2018
October 2018

TERIMA KASIH

For more information, contact wetlands@uni.com.
3.8. Presentation 7

Outline

Kriteria deliniasi kawasan

sustainable eco-tourism industry

blue economy

- Penerimaan masyarakat lokal terhadap hiburan
- Fasilitas fasilitas yang ada dalam perencanaan

- Pembangunan infrastruktur
- Pembangunan kawasan

- Pembangunan pariwisata
- Pembangunan ekonomi

- Pembangunan infrastruktur
- Pembangunan kawasan

- Pembangunan pariwisata
- Pembangunan ekonomi

Kata kunci

- Pemanfaatan lahan
- Pengembangan pariwisata
- Pembangunan infrastruktur
- Pembangunan kawasan

- Pembangunan pariwisata
- Pembangunan ekonomi

- Pembangunan infrastruktur
- Pembangunan kawasan

- Pembangunan pariwisata
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- Pembangunan infrastruktur
- Pembangunan kawasan

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### Appendix 4. List of Participants

#### 4.1 List of Online participants

<table>
<thead>
<tr>
<th>No</th>
<th>Name</th>
<th>E-Mail</th>
<th>Affiliation</th>
<th>Country</th>
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<tr>
<td>1</td>
<td>NHIEP Seila</td>
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<td>Indonesia</td>
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<td>14</td>
<td>Arief Reza Fahlevi</td>
<td><a href="mailto:Reza.fahlevi_33@yahoo.co.id">Reza.fahlevi_33@yahoo.co.id</a></td>
<td>LPSPL Sorong</td>
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<tr>
<td>17</td>
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<td>BIG</td>
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<tr>
<td>18</td>
<td>Feri Nugroho</td>
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</tr>
<tr>
<td>19</td>
<td>A Sediyo Adi Nugraha</td>
<td><a href="mailto:Adi.Nugraha@Undiksha.Ac.Id">Adi.Nugraha@Undiksha.Ac.Id</a></td>
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<tr>
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<td>Ali M. Muslih</td>
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<td>Indonesia</td>
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<td>Jaka Suryanta</td>
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<td>BIG</td>
<td>Indonesia</td>
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<td>25</td>
<td>Zilda Dona Okta Permata</td>
<td><a href="mailto:Zilda.Dona@Bppt.Go.Id">Zilda.Dona@Bppt.Go.Id</a></td>
<td>Pusat Teknologi Pengembangan Sumberdaya Wilayah - BPPT</td>
<td>Indonesia</td>
</tr>
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<td>26</td>
<td>Maslahatun Nasihia</td>
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<td>Sri Lestari Munajati</td>
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<td>Geospatial Information Authority Of Republic Of Indonesia (BIG)</td>
<td>Indonesia</td>
</tr>
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<td>28</td>
<td>Mohammad Rohmane Darminto</td>
<td><a href="mailto:Rohmaneo@Its.Ac.Id">Rohmaneo@Its.Ac.Id</a></td>
<td>Institut Teknologi Sepuluh Nopember</td>
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<tr>
<td>29</td>
<td>Amandangi Wahyuning Hastuti</td>
<td><a href="mailto:Amandangi.Wahyuning@Gmail.Com">Amandangi.Wahyuning@Gmail.Com</a></td>
<td>Institute for Marine Research and Observation</td>
<td>Indonesia</td>
</tr>
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<td>30</td>
<td>Risa Krisadhi</td>
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<td>Badan Informasi Geospasial</td>
<td>Indonesia</td>
</tr>
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<td>31</td>
<td>Muhammad Pramulya</td>
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<td>Tanjungpura University</td>
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<td>32</td>
<td>Ayi Priana</td>
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<td>Universitas Gadjah Mada</td>
<td>Indonesia</td>
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<tr>
<td>33</td>
<td>Munawaroh</td>
<td><a href="mailto:Munawaroh@Big.Go.Id">Munawaroh@Big.Go.Id</a></td>
<td>Badan Informasi Geospasial</td>
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<td>34</td>
<td>Lestari Lakhsni Widowati</td>
<td><a href="mailto:Rnwidowati@Yahoo.Com">Rnwidowati@Yahoo.Com</a></td>
<td>Diponegoro University</td>
<td>Indonesia</td>
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<tr>
<td>35</td>
<td>Restiana Wisnu Ariyati</td>
<td>Resti_Wisné<a href="mailto:e@yahoo.com">e@yahoo.com</a></td>
<td>Diponegoro University</td>
<td>Indonesia</td>
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<tr>
<td>36</td>
<td>Sri Rejeki</td>
<td><a href="mailto:Sri_Rejeki7356@yahoo.co.uk">Sri_Rejeki7356@yahoo.co.uk</a></td>
<td>Diponegoro University</td>
<td>Indonesia</td>
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<tr>
<td>37</td>
<td>Samuel Leivy Opa, S.Kel., M.Si.</td>
<td><a href="mailto:Samueloppa@Gmail.com">Samueloppa@Gmail.com</a></td>
<td>IST Esa Trinita</td>
<td>Indonesia</td>
</tr>
<tr>
<td>38</td>
<td>Kennedi Sembiring</td>
<td><a href="mailto:Kennedi.Sg@Gmail.Com">Kennedi.Sg@Gmail.Com</a></td>
<td>Lecturer</td>
<td>Indonesia</td>
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<tr>
<td>39</td>
<td>Afdal Ziqri</td>
<td><a href="mailto:Afdalziqri98@Gmail.com">Afdalziqri98@Gmail.com</a></td>
<td>IPB University</td>
<td>Indonesia</td>
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<tr>
<td>40</td>
<td>Cindy Claudea Hanami</td>
<td><a href="mailto:Cindyc.ami@Gmail.com">Cindyc.ami@Gmail.com</a></td>
<td>Bengkulu University</td>
<td>Indonesia</td>
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<td>41</td>
<td>Tri Atmaja</td>
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<td>Japan</td>
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<tr>
<td>42</td>
<td>Ayin Tamondong</td>
<td><a href="mailto:aytamondong@gmail.com">aytamondong@gmail.com</a></td>
<td>Tokyo Institute of Technology</td>
<td>Japan</td>
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<tr>
<td>43</td>
<td>Andriamamapionona Lalaina Tienh</td>
<td><a href="mailto:Tienhlaire@gmail.com">Tienhlaire@gmail.com</a></td>
<td>Doktor Ilmu Sosial Undip</td>
<td>Madagascar</td>
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<td>Rasolonjatovo Faniry Fanilo Fanantenana Valisoa Fihobiana</td>
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<td>Student</td>
<td>Madagascar</td>
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<td>45</td>
<td>Muhammad Luqman Bin Ahmad Affandi</td>
<td><a href="mailto:Luqmanaffandi97@gmail.com">Luqmanaffandi97@gmail.com</a></td>
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<td>46</td>
<td>Amalina Izzati Abdul Hamid</td>
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<td>Mazlan Hashim</td>
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<td>Julio Da Silva And Domingas Pereira</td>
<td>Timor Leste</td>
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<td>Vietnam</td>
</tr>
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</table>
## Appendix 5. Training and Workshop Agenda

### 5.1. Training Agenda

*At West Indonesian Time (WIB)**   Venue Harris Sentraland, Semarang – Indonesia

<table>
<thead>
<tr>
<th>Time</th>
<th>Topics</th>
<th>Facilitators</th>
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<tr>
<td><strong>Sunday 14/02/2021</strong></td>
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<tr>
<td>16.00 - 20.00 pm</td>
<td>Registration &amp; health security checked documents for offline trainees</td>
<td>Committee</td>
</tr>
<tr>
<td><strong>Monday 15/02/2021</strong></td>
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<tr>
<td>10.00 – 12.00 pm</td>
<td>Medical checked for the committee and offline trainees</td>
<td>Committee</td>
</tr>
<tr>
<td>12.00 – 13.00 pm</td>
<td>- Registration for offline and online Virtual meeting room is opened</td>
<td>Committee</td>
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<td></td>
<td>- Lunch</td>
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<tr>
<td>13.00 - 13.30 pm</td>
<td>Opening ceremony</td>
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<tr>
<td>13.00 - 13.05 pm</td>
<td>Training report</td>
<td>Training Proponent</td>
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<tr>
<td>13.05 – 13.15 pm</td>
<td>Welcome address</td>
<td>Dr. Agustan - The president of ISRS</td>
</tr>
<tr>
<td>13.15 – 13.20 pm</td>
<td>Forewords</td>
<td>Dr. Suprajaka - Director of Research, Promotion &amp; Cooperation, BIG</td>
</tr>
<tr>
<td>13.20 – 13.30 pm</td>
<td>Opening remark &amp; Opening of the training</td>
<td>Prof. Dr. Tri Winarni Agustini, M.Sc. Dean of Faculty of Fisheries and Marine Sciences, Diponegoro University.</td>
</tr>
<tr>
<td>13.30 – 14.30 pm</td>
<td>The significant impact of climate change-based and hydrological disasters to the coastal area: A case of Semarang, Demak, and Pekalongan, Central Java, Indonesia</td>
<td>Dr. Muhammad Helmi - Diponegoro University</td>
</tr>
<tr>
<td>14.30 – 15.30 pm</td>
<td>Practicing the impact of climate change on the coastal area</td>
<td>Dr. Aslan - SEAMEO Biotrop</td>
</tr>
<tr>
<td>15.30 – 16.00</td>
<td>Coffee break</td>
<td></td>
</tr>
<tr>
<td>16.00 - 18.00 pm</td>
<td>Climate Change Impact Assessment for Sayung Sub District coastal using Coastal Vulnerability Index (CVI)</td>
<td>Armaiki Yusmur – SEAMEO Biotrop</td>
</tr>
<tr>
<td><strong>Tuesday 16/02/2021</strong></td>
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<tr>
<td>08.00 - 08.30 am</td>
<td>- Fill in the Attendees’ list for both online and offline trainees</td>
<td>Committee</td>
</tr>
<tr>
<td></td>
<td>- The virtual meeting room is opened</td>
<td></td>
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<tr>
<td>08.30 - 10.00 am</td>
<td>- Theory and concept of coastal ecosystem functions and services</td>
<td>Prof. Dr. Mazlan Hashim - Universiti Teknologi Malaysia</td>
</tr>
<tr>
<td></td>
<td>- The concept for RS and geospatial application for disaster mitigation</td>
<td></td>
</tr>
<tr>
<td>10.00 - 11.00 am</td>
<td>The use of social sensing data to track human behaviour and public concerns</td>
<td>Prof. Dr. Zhang Li &amp; Dr. Bowei Chen – China Academy of Science</td>
</tr>
<tr>
<td>11.00 - 13.00 pm</td>
<td>Practice: RS data analysis using R for disaster mitigation</td>
<td>Dr. Bowei Chen - China Academy of Science</td>
</tr>
<tr>
<td>13.00 - 14.00 pm</td>
<td>Lunch for online and offline participants</td>
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<tr>
<td>Time</td>
<td>Activity</td>
<td>Presenter(s)</td>
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<tr>
<td>14.00 - 16.00 pm</td>
<td>Practice: RS data analysis using R for disaster mitigation</td>
<td>Dr. Bowei Chen</td>
</tr>
<tr>
<td>Wednesday, 17/02/2021</td>
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<tr>
<td>08.00 - 08.30 am</td>
<td>- Fill in the Attendees' list for both online and offline trainees</td>
<td>Committee</td>
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<tr>
<td>08.30 - 09.00 am</td>
<td>Virtual field trip to the study area &amp; QA</td>
<td>Committee</td>
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<tr>
<td>09.00 - 10.00 am</td>
<td>Spatial data acquisition using UAVs and its processing</td>
<td>Prof. Dr. Rongjun Qin - Ohio State University</td>
</tr>
<tr>
<td>10.00 - 11.00 am</td>
<td>GCPs and photogrammetry for big-scale mapping</td>
<td>Prof. Peter Tian-Yuan Shih - National Chiao Tung University, Taiwan</td>
</tr>
<tr>
<td>11.00 - 13.00 pm</td>
<td>Practicing: Big Scale Mapping</td>
<td>Dr. Xiao Ling, Mr. Mostafa Elhashash - Ohio State University</td>
</tr>
<tr>
<td>13.00 - 14.00 pm</td>
<td>Lunch for online and offline participants</td>
<td></td>
</tr>
<tr>
<td>14.00 - 16.00 pm</td>
<td>Practicing: Big Scale Mapping</td>
<td>Dr. Xiao Ling, Mr. Mostafa Elhashash - Ohio State University</td>
</tr>
<tr>
<td>Thursday, 18/02/2021</td>
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<tr>
<td>08.00 - 08.30 am</td>
<td>- Fill in the Attendees' list for both online and offline trainees</td>
<td>Committee</td>
</tr>
<tr>
<td>08.30 - 09.30 am</td>
<td>Theory and concept of integration coastal and land spatial planning</td>
<td>Dr. Mulyanto Darmawan – Geospatial center of excellent, BIG</td>
</tr>
<tr>
<td>09.30 - 10.30 am</td>
<td>Spatial planning-based ecosystem adaptation</td>
<td>Prof. Dr. Dewayany Sutrisno, M.AppSc - ISRS/ Geospatial center of excellent BIG</td>
</tr>
<tr>
<td>10.30 - 11.30 am</td>
<td>Sustainable Coastal Aquaculture: Mangrove Aquaculture (AMA), Low External Input for Sustainable Aquaculture (LEISA), Integrated Multi Trophic Aquaculture (IMTA).</td>
<td>Prof.Dr. Sri Rejeki - Diponegoro University</td>
</tr>
<tr>
<td>11.30 - 13.00 pm</td>
<td>Practising SPBEA</td>
<td>Dr. Ati Rahadiati Lalitya Narieswari - Geospatial center of excellent BIG</td>
</tr>
<tr>
<td>13.30 - 14.00 pm</td>
<td>Lunch for online and offline participants</td>
<td></td>
</tr>
<tr>
<td>14.00 - 16.00 pm</td>
<td>Practising SPBEA</td>
<td>Dr. Ati Rahadiati Lalitya Narieswari - Geospatial center of excellent BIG</td>
</tr>
<tr>
<td>16.00 - 19.00 pm</td>
<td>Preparation for presentation</td>
<td>All trainees (work will be done offline)</td>
</tr>
<tr>
<td>Friday, 19/02/2021</td>
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Final Report: CBA2019-11SY-SUTRISNO
08.00 - 08.30 am  - Fill in the Attendees' list for both online and offline trainees  - The virtual meeting room is opened  - Medical checked for offline trainees and committees  - submission of the trainees' presentation  Committee

08.30 - 10.30 am  Presentation from the trainees  Committee will prepare the list

10.30 – 11.30 Closing ceremony  Committee

11.30 - 13.30 pm  Lunch for online and offline participants

5.2. Workshop Agenda
*At West Indonesian Time (WIB)*  
**Venue Surodadi Village, Sayung Subdistrict, Demak - Indonesia**

<table>
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<tr>
<th>Time</th>
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<th>Facilitators</th>
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<tr>
<td><strong>Saturday 20/02/2021</strong></td>
<td></td>
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</tr>
<tr>
<td>07.00 - 09.00 am</td>
<td>Travel to Surodadi Village</td>
<td>Committee</td>
</tr>
<tr>
<td>09.00 – 10.00 Am</td>
<td>- opening and delivery of seeds  - spread fish seeds by each group member</td>
<td>Committee</td>
</tr>
<tr>
<td>10.00 – 12.00</td>
<td>SPBEA workshop group -1</td>
<td>Dr. Mulyanto Darmawan – Geospatial center of excellent, BiG</td>
</tr>
<tr>
<td>12.00 – 13.00 pm</td>
<td>Lunch</td>
<td>Committee</td>
</tr>
<tr>
<td>13.00 – 15.00 pm</td>
<td>SPBEA workshop group -2</td>
<td>Dr. Yosef Prihanto – Geospatial center of excellent, BiG</td>
</tr>
<tr>
<td></td>
<td>Back to Semarang</td>
<td>Committee</td>
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<tr>
<td><strong>Sunday 21/02/2021</strong></td>
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<tr>
<td>08.00 - 10.00 am</td>
<td>Travel to Surodadi Village</td>
<td>Committee</td>
</tr>
<tr>
<td>10.00 – 13.00 am</td>
<td>Field work in demonstration site group 1  - planting mangrove and reviewing the fish stocking demonstrations (AMA concept)</td>
<td>Restiana W. Ariyati Lestari L. Widowati Diponegoro University</td>
</tr>
<tr>
<td>13.00 – 14.00 pm</td>
<td>Lunch</td>
<td>Committee</td>
</tr>
<tr>
<td></td>
<td>Back to Semarang</td>
<td>Committee</td>
</tr>
<tr>
<td><strong>Monday 22/02/2021</strong></td>
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<tr>
<td>08.00 - 10.00 am</td>
<td>Travel to Surodadi Village</td>
<td>Committee</td>
</tr>
<tr>
<td>10.00 – 13.00 am</td>
<td>Field work in demonstration site group 2  - planting mangrove and reviewing the fish stocking demonstrations (AMA concept)</td>
<td>Restiana W. Ariyati Lestari L. Widowati Diponegoro University</td>
</tr>
<tr>
<td>13.00 – 14.00 pm</td>
<td>Lunch</td>
<td>Committee</td>
</tr>
<tr>
<td></td>
<td>Back to the home-based</td>
<td>Committee</td>
</tr>
</tbody>
</table>
Appendix 6. Training material

6.1. Day 1, Lecture 1: Dr. Muhammad Helmi

Content
1. Condition of coastal alluvial plains at the north of Java island and its impact to hydrological disaster (tidal flood)
2. Urban growth spatial modeling
3. Land subsidence and SLR increase the hydrological disaster impact (tidal flood and coastal erosion) at coastal areas.
4. Spatial modeling for SLR inundation analysis
5. Tidal flood translation (tidal hydrological disaster) modeling and its impact to the coastal land at Makassar on 2040, 2055
6.2. Day 1, Lecture 2: Dr. Aslan

What is Climate Change?

Climate Change Impact to Coastal Areas

Coastal Vulnerability Analysis vs. Climate Change Impact

Coastal Vulnerability Index - CVI

CVI is one of the most commonly accepted metrics to assess coastal vulnerability to sea-level rise, in particular for the coastal zone and other ecosystems. Coasts are affected by a wide range of forcing mechanisms, such as changes in temperature, sea level, and ocean currents, which can lead to alterations in coastal processes and ecosystems. CVI helps in understanding the potential impacts of these changes on coastal areas and in developing strategies to mitigate and adapt to climate change.
6.3. Day 1, lecture 3: Armaiki Yusmur
Step by Step Process

1. Define the problem
2. Gather data
3. Analyze data
4. Interpret results
5. Draw conclusions

Final Result

Thank You
6.4. Day 2, lecture 1: Prof. Dr. Mazlan Hashim

**Theory and concept of coastal ecosystem functions and services**

**Concept and related theory**

1. Ecosystem goods and services - Millennium Assessment
   - Relations to value ecosystem goods and services

2. ESV (Ecosystem Services Valuation) matters
   - Case study

3. Implementation examples

**Why value?**

- Understanding how much an ecosystem contributes to economic activity and well-being.
- Indirect value (such as biodiversity protection) and direct use values.
- Understanding the costs and benefits of an intervention that alters the ecosystem (e.g., economic productivity and environmental quality).
- How not to value conservation and sustainability.

**Relationship between ecosystem functions and monetary valuation techniques**

<table>
<thead>
<tr>
<th>Ecosystem Function (Source: De Groot et al., 2002)</th>
<th>Monetary Valuation Techniques</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ecosystem goods and services</td>
<td>Market-Based Methods</td>
</tr>
<tr>
<td>Ecosystem services</td>
<td>Cost-Based Methods</td>
</tr>
<tr>
<td>Ecosystem benefits</td>
<td>Risk-Based Methods</td>
</tr>
</tbody>
</table>

**Introduction**

- Ecosystem function is the capacity of natural processes and components to provide goods and services that satisfy human needs, either directly or indirectly (De Groot et al., 2002).
- Ecosystem functions are conceptualized as a subset of ecological processes and ecosystem structures.

**How it started?**

- The concept of ecosystem services has emerged from the need to value the benefits ecosystem services provide to society.
- De Groot et al. (2002).
- De Groot et al. (2007).
Summary

- Demonstrated the concept of Ecosystem Service Values - from natural capital: The ecosystem function is the capacity of natural processes and components to provide goods and services that satisfy human needs, either directly or indirectly.
- ESV mapping due to changes of landscape (ecosystem service changes): real-time from changes in the provisioning, regulating, habitat and cultural services.

TESV due to landscape change

1. Loss due to changes, total soil loss (t/ha/yr) @ 8% rate
2. TESV year 1 (before change) = 5 A
3. TESV year 2 (after change) = 3 B
4. Net TESV = 8 - (A + B)

Applicable to all landscape changes including coastal Ecosystem Service (MCES) mapping, due to specific "river of change".
Final Report: CBA2019-11SY-SUTRISNO
References
6.5. Day 2, Lecture 2: Dr. Bowei Chen and Dr. Li Zhang

RS DATA ANALYSING USING R FOR DISASTER MITIGATION
THE TRAINING ON THE PRACTICAL WAYS OF INTEGRATED COASTAL SPATIAL PLANNING-BASED ECOSYSTEM ADAPTATION (ICSP-SEA)

Dr. Bowei CHEN and Prof. Dr. Li ZHANG
The Argonne Informatics Research Institute, Chinese Academy of Sciences
February 10, 2021

Practise Session

Practise Session Part-I 11:00 - 13:00 am | Tuesday, February 16, 2021
Practise Session Part-II 14:00 - 16:00 pm | Tuesday, February 16, 2021

About R

R is a language and environment for statistical computing and graphics. It is a GNU project which is similar to the S language and environment which was developed at Bell Laboratories (formerly AT&T, now Lucent Technologies) by John Chambers and colleagues. R can be considered as a different implementation of S. There are some important differences, but much code written for S runs unaltered under R.

R provides an effective environment for statistical analysis, graphical techniques, and for writing report. The S language is often the choice of choice for research in statistical methodology, and R provides an Open Source route to participation in that activity.

Advantages of R Programming

Various benefits of R language are mentioned below, which will help you to grasp the concept:

- Open Source
- Exemplary Support for Data Wrangling
- The Army of Packages
- Quality Plotting and Graphing
- Highly Customizable
- Platform Independent
- Eye-Catching Reports
- Machine Learning Operations
- Statistics
- Continuously Growing

https://www.r-project.org/about.html
How to Install R

Installing R on Windows 10

Installing R on Windows 10 is very straightforward. The easiest way to
install R is through CRAN, which stands for The Comprehensive R
Archive Network. Just visit the CRAN downloads page and follow the links as
shown in the picture below:

Installing Packages in R

Now you have base R installed on your system and a nice IDE to begin
your R programming journey. However, base R is rather limited in the
things it can do, which is why we have R packages such as ggplot for
data manipulation capabilities or ggplot2 for improved data
visualizations. There are many tools to install R packages using
RStudio, the best is to execute the following lines of code in the console:

```
if (!require('master')) install.packages('master')
```

## loading required package: master

## loading required package: ggplot2

Tabulate Data in R - The Basics

- Raster to tabulate data
- Use 'raster' package
- Use 'ggplot' package

flexdashboard: Easy interactive dashboards for R

Please refer to the "SPBEA_2nd_half" folder, and open
"SPBEA_2nd_half.Rmd" file.

Installing RStudio

Once R is installed, you can proceed to install the RStudio IDE to have a
more improved environment to work in your R scripts. It includes a
console that supports direct code execution and tools for plotting and
keeping track of your variables in the workspace, among other features.
The installation process is very straightforward, as well. Simply go to the
RStudio downloads page.

Raster Data in R - The Basics

- Read single band raster image
- Read data range in the image
- Plot single band raster image
- Read multiple bands raster image
- Plot multiple bands raster image
- Read shapefiles
- Plot the shapefiles
- Clip raster via shapefiles
- Write your first R function

Practice Sessions

- Practice Session Part I
  - Intro into R
  - Raster Data in R - The Basics
  - Tabulate Data in R - The Basics

- Practice Session Part II
  - flexdashboard: Easy interactive dashboards for R
6.5. Day 3, Lecture 1: Prof. Dr. Rongjun Qin

**Topics to be discussed today**

1. **UAV platform and image sensors**
2. **UAV Flight Design**
3. **Photogrammetric Processing**

*We primarily deal with images captured by different sensors, carried by different platforms.*

**Recent developments:**

- **Optical sensors:**
  - Digital cameras
  - Hyperspectral sensors
- **Active sensors:**
  - LiDAR, Radar
  - Infrared and thermal imaging
- **Platforms:**
  - Satellites, airships, UAS, balloons, and mobile vehicles.

*Images from [https://www.nndc.org/nps](https://www.nndc.org/nps)*

**Thermal Infrared Cameras**

- **5000 nm – 40,000 nm**

*An artist using an 18th-century camera to take an image.*

*The first commercially available camera: Cirrus Daguerreotyp*. 

---
Finding the Fire Centers

Rapid Mapping for Coastal spatial planning
- Identify coastal lines
- Accuracy measuring coastal lines with precise registration among different temporal collections to estimate coastal line changes
- Generate coastal line models for flood monitoring
- Ecosystem monitoring and biomass computation

Types of aerial photos
- Vertical photos - camera axis vertical
- Tilted photos - 1-3° off nadir vertically all aerial photos are unintentionally tilted
- High oblique - intentional inclination including horizon
- Low oblique - does not include horizon

Short-wave Infrared
500-1700 nm
Low responses to water

Photogrammetric Mapping
Photogrammetry is defined as the technique of obtaining reliable measurements of objects from photographs.
To make accurate measurements it is important to determine photographic scale that is suitable for different applications.

Overlapping Stereo-photography
To determine parallax and stereo3D viewing:
Forward overlap ~60%
Side overlap ~20-30%
For UAV mission we always expect higher overlaps for flexibility concern:
80-90% forward
60-80% side

Mapping Scale
Scale defines the relationship between a linear distance on a vertical photograph and the corresponding actual distance on the ground.
Photographic scale indicates proportional distance

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Mapping Scale

Linear distance on the photo graph

Actual distance on the ground

Example: 1:25,000 or 1/25,000 means that a length of 1 unit of measurement on the photo graph represents 25,000 units of measurement on the ground.

Photograph Scale

Scale = \( \frac{f \cdot H'}{H} \)
where
\( f \) = focal length
\( H' \) = flying height above terrain
\( d \) = image distance
\( D \) = ground distance
\( h \) = terrain elevation
\( H \) = flying height (\( h + H' \))

Scale Determination

Scale = \( \frac{f \cdot H'}{H} \)

\( H' \) = flying height above terrain

E.g. : \( f = 20 \) mm
\( H = 400 \) m MSL, ground elevation = 200 m

Scale = \( \frac{20 \text{ mm} \times \frac{1}{1000}}{400 \text{ m} - 200 \text{ m}} \) = \( \frac{20}{200000} \) 1:10,000

Scale = 1:20,000

Ground Sampling Distance (GSD)

\[ \text{GSD} = \frac{d \text{ (pixel size)}}{f \text{ (focal length)}} \]

Example: Pixel size = 0.005 mm
\( f = 20 \) mm
\( H = 200 \) m

GSD(m) = \( \frac{0.005 \text{ mm} \times 200 \text{ m}}{20 \text{ mm}} \) = 0.005 m

Motion Blur

Peak Blur = \( \frac{\text{Ground Speed} \times \text{Exposure Time}}{8} \)

E.g.: Ground Speed = 10 km/h, GSD = 5 cm

Exposure time = 1/200 s

Pixel size = \( \frac{0.05}{2} = 0.025 \text{ pixel} \)

This should be kept within 1 pixel H

Depth of Field - Aperture

The larger the aperture, the smaller depth of field. But you will get image with good exposure. (Note: you need to have shorter shutter time to avoid motion blur)

B/H ratio

\[ \frac{\text{B}}{\text{H}} \text{ ratio determines the vertical accuracy of any ray emanation relative to the horizontal baseline,} \]

\[ \frac{\text{V_H accuracy (pixel)}}{\text{H accuracy (pixel)}} = \frac{\text{B}}{\text{H}} \]

Example: \( \text{H accuracy} = 1 \) pixel, \( \text{B}/\text{H} = 3/1 \)

\[ \text{V_H accuracy} = 1 \times \frac{3}{3} = 1 \text{ pixel} \]

The B/H ratio is directly correlated to the intersection angle

The intersection angle should not be too large to create large parallel, while not too small for

Photogrammetric Flight

Given regular basics, the BH ratio can be computed through average

Field of view (FOV) determined by:

\[ \frac{90 \times (60)}{2 \times 40} = \frac{2700}{80} = 33.75 \]
**Flight Design**

Summary of Mission Parameters:
1. Map scale, GSD
2. Accuracy

Flight Design:
1. Camera exposure time, Aperture, ISO – Image quality
2. Focal length, Pixel size, flying height – map scale, GSD
3. Flying speed – Image quality, ensure not to cause motion blur
4. Overlap, B/H ratio – Ensure good intersection, good quality for photogrammetric processing and vertical accuracy

---

**GCP distribution**

- Planimetric GCPs
- Side overlap: 20%
- Side overlap: 100%

---

**Lens distortion - Examples**

- Distorted image
- Undistorted image

---

**UAV image processing**

Input project parameters

- Flight planning
- Image Acquisition (automatic)
- Measurement of tie points (automatic)
- Measurement of control points (manual)
- Hue adjustment / creation of image (automatic)
- Generation of DSM (automatic post-processing)
- Ortho-image generation (automatic)
- Generation of derivatives (hybrid 3D models, object extraction, etc.)

---

**Camera Calibration**

- Camera calibration parameters
  - K1, K2, K3: radial distortion
  - p1, p2: decentering distortion
  - b1, b2: affinity parameters

---

**Geo-referencing**

Determine the orientation of images and referencing them to world coordinate system.

Observations:
1. Tie points / identical points – for solving relative positions of the images
2. GCP (ground control points) – for referencing the orientations of the camera to a world coordinate system. At the same time refine camera parameters.
Tie points
Used to connect image coordinate systems

Minimum of 5 points per model, but usually > 6

Nowadays we extract thousands of points automatically

GCP Measurement

Colinearity Equation

\[ x_r - x_p = \frac{1}{2} (x_p - x_r) \]
\[ y_r - y_p = \frac{1}{2} (y_p - y_r) \]
\[ z_r - z_p = \alpha_3 \beta_3 (x_p - y_r) \]

\( \alpha_3, \beta_3 \) = orthogonal rotation matrix (D4G)°

Bundle Adjustment
Mathematical chain of data frame sensor Central Projection

- Smallest error determination of orientation parameters and object coordinates
- No separation into relative and absolute orientation
- Interior orientation can be included in the unknown parameters of the adjustment
- Situation: Combination of forward orientation and restoration
- Basis: Colinearity equations

GCP (Ground Control Points) are critical for the recovering interior and exterior orientations, which nowadays are mainly from GPS measurement!

3D point determination – Spatial Resection

Determination of Camera Orientation

- Observations: Image coordinates \((x_p, y_p)\)
- Unknowns: \(X, Y, Z, X_p, Y_p, Z_p, \phi, \theta, \psi\)

Fundamental Model is non-linear:

- Linearization with Taylor

\[ x_n = x_n + \frac{\partial f_n}{\partial x} \Delta x + \frac{\partial f_n}{\partial y} \Delta y + \frac{\partial f_n}{\partial z} \Delta z + \frac{\partial f_n}{\partial \theta} \Delta \theta + \frac{\partial f_n}{\partial \phi} \Delta \phi + \frac{\partial f_n}{\partial \psi} \Delta \psi \]

Approximations for the linear parameters
Precision and reliability of the bundle solution

- Covariance matrix
- Theoretical precision
- Empirical precision

Precision of the solution vector:

\[ \begin{align*}
\sigma_x &= \sigma_0 \sqrt{Q_{xx}} \\
\sigma_y &= \sigma_0 \sqrt{Q_{yy}} \\
\sigma_{xy} &= \sigma_0 \sqrt{Q_{xy}} \\
\end{align*} \]

Least squares estimation:

\[ \begin{align*}
1 &= f(\mathbf{x}) \\
\mathbf{e} &= \mathbf{A} \mathbf{x} - \mathbf{b} \\
\mathbf{x} &= (\mathbf{A}^T \mathbf{A})^{-1} \mathbf{A}^T \mathbf{b} \\
\end{align*} \]

At least 12 observations for this DATUM ORIENTATION necessary:

1. 7 Parameters of the ECC
2. 7 accelerations of object points (GCPs)
3. free network solution (linear equations)

Lens distortion modelling:

- \( a, b, c \) to 3D from left to right
- Parameters \( k \) - radial
- Parameters \( p, q \) - tangential
- Parameters \( u, v \) - shear
- Parameters \( s \) - affine

General Bundle Solution:

\[ \begin{align*}
\mathbf{e} &= \mathbf{A} \mathbf{x} + \mathbf{b} \\
\mathbf{A} &= \mathbf{A} \mathbf{P} \\
\end{align*} \]

Image dense matching

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Triangulate the disparity (sense identical points) to point clouds

Ortho Rectification

Applications – 3D City Modeling

Resulting Physical Model 3D NUS

Traffic trajectory mapping
GCPs and photogrammetry for big scale mapping

Peter T.Y. Shih
Department of Civil Engineering
National Yang Ming Chiao Tung University, Taiwan

Outline
- Big scale mapping: UAV photogrammetry
- GNSS, a short introduction
- GNSS in the field
- GNSS data and processing
- Coordinate system conversion

What is Big Scale Map?

<table>
<thead>
<tr>
<th>Classification</th>
<th>Range</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>large scale</td>
<td>1:0 – 1600,000</td>
<td>1:0,000,000 for map of virus; 1:5,000 for walking map of town</td>
</tr>
<tr>
<td>medium scale</td>
<td>1:500,000 – 12,000,000</td>
<td>Map of a country</td>
</tr>
<tr>
<td>small scale</td>
<td>1:2,000,000 – 1:000,000</td>
<td>1:50,000,000 for world map; 1:10^9 for map of galaxy</td>
</tr>
</tbody>
</table>

What is Big Scale Map?
- Typically, “big scale map” means scale equal or larger than 1:2500
- Regarding the features included, in addition to roads and other communications, tourist paths, hiking trails, and cycling trails, they present also characteristics of the landscape (http://www.mapdesign.si/en/maps.html).

Big Scale Mapping
- High spatial resolution satellite images
- Aerial photographs
- UAV collected photographs

Photogrammetry
- is the science and technology of obtaining reliable information about physical objects and the environment through the process of recording, measuring and interpreting photographic images and patterns of electromagnetic radiant imagery and other phenomena.
### Photogrammetry and GNSS

- Relative orientation; absolute orientation
- Absolute orientation: geo-referencing → GCPs (Ground Control Points), and geo-tagged photos
- GCPs: could be surveyed with GNSS
- Geo-tag: commonly obtained with GNSS
- Further extension: rotation angles from INS (Gyro and accelerometer)

### GNSS: A short introduction

**Intersection error (Mohan, 2017)**

![Intersection Error Diagram]

### GNSS uncertainty

- The fundamental uncertainty is limited by the strength of geometric configuration. The uncertainty from the “distance determination” also affects, including the uncertainty of the satellite position, the atmospheric delay, etc.

### Why GNSS?

- Collecting ground control points for aerial triangulation;
- Determining the trajectory of the flight, obtaining the direct observation of the exterior orientation.

### GNSS positioning principle

- Are Intersection, that is, intersection with distances.
- For two dimensional, two arcs intersect and one point is determined.
- The distance measured is from the phase center of satellite antenna to the phase center of receiver antenna.

### Strength of Figure

**DOP (Dilution of Positioning)**

- HDOP-horizontal dilution of precision
- VDOP-vertical dilution of precision
- PDOP-position (3D) dilution of precision
- TDOP-time dilution of precision
- GDOP-geometric dilution of precision

### GNSS uncertainty

- The relative positioning with differencing technique is a major way for reducing uncertainty.
- Absolute positioning: single receiver, including SPS (Standard Positioning Service) and PPP (Precise Point Positioning).
- Relative positioning: using differencing.
GNSS Data Processing
- Static: PPP, Baseline, Network
- Real time kinematic: RT-PPP, Network-RTK, RTK, PPP-RTK
- Post processing kinematic: PPP, Baseline, Network

GNSS receiver
- Single frequency, dual frequency
- Output coordinates, observed code, both the code and phase observations
- Native file formats
- RINEX: the standard exchange file format

GNSS Data processing modes
- Real Time
  - SPS and RT-PPP
  - Real Time Kinematic (RTK), Network RTK
- Post processing
  - With software, e.g., RTKLIB
  - Web service, e.g., CSRS-PPP (Note: be aware of the reference frame used for output)

network RTK
- Established with a network of CORS (Continuously Operating Reference Stations)
- Need both satellite and mobile communication availability
- Services in Taiwan: eGNSS from NLSC, a government agency, and several commercial services

network RTK -2
- There may be different datum, the GNSS (WGS84 for GPS, PZ-90 for Glonass), the nRTK coordinate system, the legal coordinate system ...
- In Taiwan, eGNSS provides online coordinate system transformation.

network RTK -3
- nRTK services are regional, and may need to pay
- A network RTK service provider in Indonesia: [http://nrtk.big.go.id/](http://nrtk.big.go.id/)
InaCORS BIG Satu Referensi Pemetaan Indonesia, Jan. 2019

- A total of 137 InaCORS stations spread from Sabang to Meratupe. This number will increase to 187 stations by the end of 2018. Fifty new InaCORS stations are built in 2018 ready to be used to support maintenance of geospatial reference systems and various activities survey and mapping in 2019. Of the 50 stations, 33 stations have been completed in October 2018 and 17 stations is under construction until the end of the year.

Learning about the sky

With android apps
- GPS Test (Chartcross Limited)
- GPS Status & Toolbox (MobiWIA – EclipSim)

GNSS: In the field
AGPS
- Assisted GPS, or augmented GPS
- AGPS server, services based on the System-On-Chip design
- Qualcomm: gpsOneXTRA Assistance
- Broadcom: A-GPS-WWRI

GNSS data and processing

Outline
- The GNSS data, where to get it?
- The GNSS data processing, with RTKLIB

GNSS related files
- Product
  - GPS Satellite Ephemerides / Satellite & Station Clocks
  - GLONASS Satellite Ephemerides
  - Earth Rotation
  - Atmospheric Parameters
- Data
  - Network observations
The use of product and data

- **Product**
  - Frequently used for deriving precise positions
  - For PPP (Precise Point Positioning)
  - For PPK (Post Processing Kinematic)
  - For PPS (Post Processing Static)

- **Data**
  - For PPK and PPS, as reference

<table>
<thead>
<tr>
<th>Type</th>
<th>Accuracy</th>
<th>Latitude</th>
<th>Update</th>
<th>Sample Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broadcast</td>
<td>-0.05 cm</td>
<td>-87.5 km</td>
<td>Daily</td>
<td>24 h</td>
</tr>
<tr>
<td>Unsynchronized</td>
<td>-0.5 cm</td>
<td>-50 km</td>
<td>Weekly</td>
<td>2 weeks</td>
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<tr>
<td>Unsynchronized</td>
<td>-2.5 cm</td>
<td>-10 km</td>
<td>Monthly</td>
<td>1 month</td>
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<tr>
<td>Data</td>
<td></td>
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IGS ftp sites

- [ftp://garner.ucsd.edu/](ftp://garner.ucsd.edu/)
- [ftp://igs.ensg.ign.fr/pub/igs/data/](ftp://igs.ensg.ign.fr/pub/igs/data/)
- [ftp://gsse.esa.int/gnss/data/](ftp://gsse.esa.int/gnss/data/)
- cddis, using FileZilla

ftp from cddis with FileZilla

- Host: gdc.cddis.eosdis.nasa.gov
- Port: 21 (or leave blank for the default)
- User: Anonymous
- Password: <<Your EMAIL ADDRESS>>
- There is also a https based server which requires self-registered account.
Obtaining GNSS Data
Besides IGS, I also used two others.
1. UNAVACO
   ftp://data-out.unavco.org/pub/rinex/obs/
2. MGM net
   ftp://mgmds01.tksc.jaxa.jp/data/daily/

Product and data to be downloaded
- RINEX file of CORS, usually I download the daily file
- Clock (clk), orbit (sp3), Earth Rotation Parameter (erp)

Cddis – Anonymous@gdc.cddis.gsfc.nasa.gov

Download brdc from cddis with Filezilla

Pro and cons of using public data
- **Pro:** free
- **Cons:** low sampling rate (30 sec); may not be available on that day
  ➞ Alternative: establish own reference station

Daily GPS Broadcast Ephemeris Files
- The daily GPS broadcast ephemeris file is a merge of the individual site navigation files into one, non-redundant file that can be utilized by users instead of the many individual navigation files.
- Station name: brdc, ifag, auto

Download brdc
ftp://gssc.csa.int/gnss/data/daily/2020/021/

20n: for GPS, 20g: for GLONASS
The Final Orbit files generated and uploaded
- igs2088[9-6].sp3: IGS GPS ephemeris files in SP3 format.
- igs2088[9-6].clk: IGS GPS satellite and station clocks in clock RINEX format.
- igs2088[9-6].erp: Earth Rotation Parameters (ERP) and their rates as well as Universal Time (UT1-UTC) and Length Of Day (LOD) associated with IGS ephemerides.
- igs20887.sum: Complete report.

Processing GNSS with RTKLIB
- RTKLIB is an open source software
- The latest version is 2.4.3 b34 released on 2020/12/29.
- The denotation b34 indicates beta version and p13 indicates stable version.

The features of RTKLIB
1. It supports standard and precise positioning algorithms with GPS, GLONASS, Galileo, QZSS, BeiDou and SBAS
2. It supports various positioning modes with GNSS for both real-time and post-processing: Single, DGPS/DGNSS, Kinematic, Static, Moving-Baseline, Fixed, PPP-Kinematic, PPP-Static and PPP-Fixed
- More to read at: http://www.rtklib.com/

Overview of RTKlib
- RTKLIB is an open source program package for standard and precise positioning with GNSS (global navigation satellite system). RTKLIB consists of a portable program library and several APs (application programs) utilizing the library.

Download RTKLIB
- Using “RTKLIB GNSS” as keyword, the correct link usually would be the top one from most search engine, such as www.google.com
- Download could be made at, http://www.rtklib.com/
- The 2.4.2 pXX is the stable version with the newest patches. The 2.4.3 bXX is the development or beta version with experimental implementations.
rtklbexplorer

- The web site hosted by Mr. Tim Everett, https://rtklbexplorer.wordpress.com/, is an important source for rtklib with extensive information.
- A demo5 implementation of rtklib is provided from https://github.com/rtklbexplorer/RTKLIB

Download

- For 2.4.3 source and data: https://github.com/tomejitasaka/RTKLIB/tree/rtklb_2.4.3;
- For 2.4.2: https://github.com/tomejitasaka/RTKLIB

Download and organizing

- Download both the source and the binary.
- The bin directory of source is empty.
- The binary has bin directory only.
- Using the source to establish the file structures and use the binary to fill bin.

File Structure

- app
- bin
- hdr
- data
- doc
- lib
- src
- test
- util
- readme.txt
- UltraEdit Document (.txt)
Functions

<table>
<thead>
<tr>
<th>Functions</th>
<th>Column 2</th>
<th>Column 3</th>
<th>Column 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) All functions</td>
<td>rtklaunch</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>(b) Real-time Positioning</td>
<td>rtklaunch</td>
<td>0.0, 5.0</td>
<td>0.0</td>
</tr>
<tr>
<td>(c) Communication killer</td>
<td>rtklaunch</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(d) Real-Time Fitting</td>
<td>rtklaunch</td>
<td>0.0, 4.0</td>
<td>0.0</td>
</tr>
<tr>
<td>(e) ECEF Conversion</td>
<td>rtklaunch</td>
<td>0.0, 7.0</td>
<td>0.0</td>
</tr>
<tr>
<td>(f) rtklaunch</td>
<td>rtklaunch</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(g) Broadcast ephemeris and orbit data</td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(h) rtklaunch</td>
<td>rtklaunch</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(i) rtklaunch</td>
<td>rtklaunch</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Start RTKLIB

- Please use rtklaunch to start. Some environment variables will be set.

![Figure 3.1-1](image.png)

Obtaining GNSS related files:

rtkget

- Start by click the icon in the launch window
- Related files in the bin directory:
  rtkget.exe, rtkget.ini, rtkget.trace
- The parameters stored in the .ini file will be loaded at the start. And, the .ini file will be updated after quit rtkget.
- An important parameter file usually stored in the data directory: URL_LIST.TXT.

rtkget-options

Keywords in a url address are replaced as follows:

- %Y -> yyyy : year (4 digits) (2018-2099)
- %y -> yy : year (2 digits) (00-99)
- %m -> mm : month (01-12)
- %d -> dd : day of month (01-31)
- %h -> hh : hours (00-23)
- %H -> a : hour code (a-h)
- %M -> mm : minutes (00-59)
- %n -> ddd : day of year (001-366)
The Meaning of igs18783.sp3

- **sp3** is the precise GPS Orbit Data.
- Ultra-rapid (igs36WWWWD.sp3), 6-hour latency constrained (no-net rotation, no-net translation) 24-hour file - sp3
- Rapid (igs36WWWWD.sp3), 13-hour latency constrained (no-net rotation, no-net translation) 24-hour file - sp3
- Final (igs36WWWWD.sp3), 12 to 18 day latency, minimally constrained (no-net rotation) 24-hour file - sp3

“Interval” parameters in the GUI

- Interval: the time interval of each file, 15 min, 30 min, 1 H, 3 H, 6 H, 12 H, 24H, 7 day.
- What will happen if it is specified as 7 day in the previous GUI?
- Answer: only the first (igs18783.sp3) and the last (igs18793.sp3) will be downloaded.
- What will happen if it is specified as 15 min?

Hatanaka-Compression

- The .yrd files are files with Hatanaka-Compression.
- This compression can convert a RINEX observation file into a smaller ASCII format.
- Yuki Hatanaka (hatanaka.go.jp) (GSI) wrote and maintains mx2rnx and rnx2mx, which allows the user to compress/decompress, respectively (https://www.aravco.org/data/gps-gnss/hatanaka/hatanaka.html).

Module 2: RTKPLOT

- Start from the rtklauch GUI, press the most left icon.
- File ➔ Open Obs Data (jog20060.160)
- File ➔ Open Nav Data (brdc0060.16n)

18783

- GPS Week number (1878) and Day of Week (3)
- One online utc to gps date converter is located at, https://spacewea.ucsd.edu/convertDate.shtml
- 18783: 2016-01-06
- 18792: 2016-01-12
- Why igs18793.sp3 is downloaded?
Module 3: RTKPOST

Subjects

- Differential GNSS, Static
- Differential GNSS, Kinematic
The general recommended baseline length, that is, the distance from the rover to the reference station, is less than 20 km.
Coordinate system conversion

Datum Transformation
- ITRF has different definition, ..., 2000, 2005, 2008, 2014, ...
- WGS84 kept high degree synchronization with ITRF with updated definition.
- National datum

Coordinate Conversion
- Geocentric coordinates
  X (m), Y (m), Z (m)
- Geodetic coordinates
  Longitude, Latitude, Height (m)
- Projected coordinates
  Easting, Northing

MSP GEOTRANS
- An application program which allows you to convert geographic coordinates among a wide variety of coordinate systems, map projections, and datums.
- GEOTRANS runs in Microsoft Windows, LINUX, and UNIX environments.

JAVA
- GeoTrans 3.8 requires Java Runtime Environment (JRE) 1.8 or later to execute (JRE 1.8.0.192 or later is recommended).
Start Geotrans

- Z:\Papers\Presentations\20210215APN\Software\master\geotrans3.8\GEOTRANS\win_64
- runGeotrans.bat

An Exercise

- TNML
  - X: -2982779.428
  - Y: 4966662.497
  - Z: 2658805.617

Options/Format

Change Format

Change Precision

Limitation

MSC GEOTRANS 3.8

Warning: Output accuracy is limited to ~1m
Convert → upper to Lower

Result
- Longitude: 120.98734816E
- Latitude: 24.79795367N
- Height: 75.867

Check the consistency

| TNML (Original) | X: 298.2779.428 | Y: 4966662.497 | Z: 2658805.617 |
| TNML (Reversed) | X: 298.2779.428 | Y: 4966662.497 | Z: 2658805.617 |

Height Systems

Thank you all.

- Questions are welcome to be sent to Peter Shih, tyshih@mail.nctu.edu.tw

Height issue
- The height obtained from GNSS is originally ellipsoid height, which is a geometric height.
- For most civil applications, normal or orthometric height is required.
- For the conversion, geoid model is usually applied.
6.5. Day 3, Lecture 3: Prof. Rongjun Qin, Dr. Xiao Ling, Mr. Mostafa Elhashash
Data description
Multiple fields University of Singapore campus.
Image numbers: 23
Image size: 1024x1024
GPS: 5m
Overlap: 80%, forward, 65%, backward.

Metashape
Metashape is a standalone software product that performs photogrammetry processing of digital images and generates 3D models to be used in GIS applications, cultural heritage documentation, and visual effects

Importing photos
Set position and orientation of the images, 3 translation components and 3 Euler rotation angles.

Measuring GCPs
Ground control points (GCPs) are points on the ground with known coordinates.

Contents
1. Importing photos
2. Measuring GCPs
3.Geo-referring
4. Building dense cloud
5. Building mesh
6. Building DSM
7. Building orthophoto
Thank you for your time
Definition

Space means a site that consists of land space, oceanic space, and air space, including space that is on or above the earth as one unified space where humans and other creatures live, carry out activities and maintain sustainable life. (Law no 33/2007 about spatial management)

Sea water (Ocean) is space on earth that connects the mainland to the main island and other natural forms, which is the geographical and ecological unity and all its associated elements, and the limit of the system is determined by the legislation and international law (Law no 32/2014 about the sea).

Spatial is the spatial aspect of an object or event. Spatial use is the form of space structure and space pattern (Law no 36/2007 about spatial management).

Geospatial is a spatial aspect that shows the orientation, location and position of an object or event that is below, on or above the earth's surface which is stated in a certain coordinate system (Law No 4/2011 about Geospatial Information).

Outline

1. Role of IG for Regional Spatial Development
2. Development and Future Application of Geospatial Information Technology in Indonesia
3. Status of Coastal and Land Spatial Planning in Indonesia
4. Integration of Coastal and Land Spatial Planning
5. Conclusion

Coastal area is the transitional area between land and sea ecosystem influenced by a change in the land and sea. (Law no 26/2007 about spatial management)

Spatial planning is a process to determine space structure and space pattern that consists of preparing and determining the spatial plan (Law no 26/2007 about spatial management).

Coastal Spatial Planning is known as Zonation Planning. Zoning Plan is a plan which is determined the direction of resource usage at each unity of plan, along with the structure utilization and room pattern at area of planning which covers the activity which do and do not execute the activity which is only shall be executed after getting the permit. (Law no 27/2007 about RWTP3K)

Land spatial planning is related to the spatial management that defines as a system for the process of spatial planning, space utilization and control over space utilization.

Data Integration is the process of combining data from different sources into a single, unified view. Integration begins with the ingestion process, and includes steps such as cleansing, ETL mapping, and transformation.

Role of IG for Regional Spatial Development

INDONESIA: Home of Natural Heritage

Geospatial Information is very important for supporting the implementation of National Spatial Plan and Regional Spatial Plan.
Development and Future Application of Geospatial Information Technology in Indonesia

1. One Map Policy

2. High resolution satellite for detailed spatial planning (RDTR)

Ongoing & Incoming Geospatial Activities

- Development of NAD-83 (GCS) and the Local Datum
- Establishment of 1:5000 national topographic base maps
- Production of thematic maps and new editions
- Updating from 1:2000 to 1:5000 scales

Integration of Geospatial and Socioeconomic Data

Association of Spatial Planning and other Spatial Planning

Integration of Geospatial and Socioeconomic Data

Association of Spatial Planning and other Spatial Planning
The relationship between land and coastal marine spatial planning has been threatening the sustainable coastal development.

Status of RTRW and RZWP3K

Methodology for Integration

GIS analysis

Geometric correction:
- All data use the same coordinate and projection systems.

Topology check:
- Ensure all data do not have topology problems, such as undercuts, over-cuts.

Check classification and topology:
- Ensure all data have the same classification.

Seamless process:
- Ensure seamless data.

Synchronization and harmonization between RTRW and RZWP3K to understand a connection between them.

Data Integration

The most important task to be integrated the Coastal Spatial Planning program with Land Spatial Planning to be ONE DATA INDONESIA

ONE DATA OF SPATIAL PLANNING

Study area

The submarine area and submarine pipe line intersect with protected area

The marine spatial plan included in the National Concept Plan for Banten is one of the activities, at least one.
Mangrove area close to industrial area and Migration path of biota intersect by area of port

Result

Conclusion

## Base map is difference and affect to the difference on coastline boundary. The differences include in the geometric, attribute, and topological aspects of the dataset. As for geometric aspect, the land spatial planning (RTRW) adopts mean sea level as base map while coastal spatial plan (KZNP3K) uses the highest tidal.

## The integration help identify zonation in an adjacent area to optimize spatial planning.

## Inconsistencies zone found in adjacent zonation between coastal and land, therefore to achieve the Sustainable Coastal Area Development goal, harmonization between these spatial maps should needs to be done before implementing the national development program.

Conclusion

This lecture examined the spatial problems in the process of integrating two spatial planning maps. The purpose is to determine the level of harmonization between these maps.

Results of the integration provide land spatial planning in the aspects of coastal and small islands area management.
6.5. Day 4, Lecture 2: Prof. Dewayany Sutrisno

Spatial Planning-Based Ecosystem Adaptation

Indonesian Case

- Indonesia's coastal area is facing various challenges such as rising sea levels and climate change.
- The island of Java is particularly vulnerable due to its location and geography.

How far the adaptation??

Adaptation

Questions?

- How long does it take for people to compete with the phenomenon of coastal degradation?
- Coastal communities need solutions for their survival.

To know the impact before spatial planning

- Understand the essence of the problem
- Study and simulate the impact
- Analyze the solution
- Implement the solution
Sea Level rise

Types of sea level rise:
- Isostatic adjustment: movement of land due to changes in the volume of water stored in the oceans.
- Glacial isostatic adjustment: movement of land due to changes in the volume of water stored in glaciers.
- Thermal expansion: increase in ocean water volume due to warming.

Reliability of sea level rise:
- Low extent of uncertainty: changes in sea levels are expected to be consistent with previous predictions.

Coastal Recession Projection Model

Remote Sensing Method To Monitor The Coastal Impact

Method

Learning the Accuracy

- The accuracy of the model is ±0.5% and ±1.0% for training and testing, respectively.
- The model is designed to identify areas susceptible to coastal erosion and predict future changes.
- The model uses satellite imagery and historical data to estimate sea level rise and coastal changes.
- The model is validated using historical data and field measurements.

Image of the flooding

Result of the Implementation of the Model

- The accuracy of the model is ±0.5% and ±1.0% for training and testing, respectively.
- The model is designed to identify areas susceptible to coastal erosion and predict future changes.
- The model uses satellite imagery and historical data to estimate sea level rise and coastal changes.
- The model is validated using historical data and field measurements.
Model Development

SPBEA AND CLIMATE CHANGE ADAPTATION

Sea level rise
- Protect coastal features that protect the shoreline, including mangroves, reefs, wetlands, and forests.
- Make new coastal protection and developments with well defined setback distances.
- Develop emergency plans for coastal protection (polders, reserves, and environmental adaptation) and development in light of climate change.
- Plan for inland movement of natural and built communities.

SPBEA AND CLIMATE CHANGE ADAPTATION

Other Issues

Increasing sea temperature
- In marine ecological resilience of coastal ecosystems to the effect of warming by reducing invertebrate stresses, e.g., marine pollution, habitat loss, overfishing, and climate change.
- Increase protection of more resilient coastal ecosystems, e.g., those in regions of high temperature, cooling of other anoxic conditions.

SPBEA SYSTEMATIC PROCESS

Management and decision making plan
- Conduct stakeholder workshops throughout the management processes.
- Implement adaptation to coastal features, including mangroves, reefs, wetlands, and forests.
- Develop emergency plans for coastal protection (polders, reserves, and environmental adaptation) and development in light of climate change.
- Plan for inland movement of natural and built communities.

SPBEA AND CLIMATE CHANGE ADAPTATION

Impacts

Mangrove ecosystems
- Reduce coastal features that protect the shoreline, including mangroves, reefs, wetlands, and forests.
- Develop emergency plans for coastal protection (polders, reserves, and environmental adaptation) and development in light of climate change.
- Plan for inland movement of natural and built communities.

The process

Identification and planning
- Conduct stakeholder workshops throughout the management processes.
- Implement adaptation to coastal features, including mangroves, reefs, wetlands, and forests.
- Develop emergency plans for coastal protection (polders, reserves, and environmental adaptation) and development in light of climate change.
- Plan for inland movement of natural and built communities.
6.5. Day 4, Lecture 3: Prof. Sri Rejeki

**BACKGROUND**

- **COASTAL ABRASION**
  It is a phenomenon of land erosion by hydro-oceanographic activities in the form of tides, waves and ocean currents.

**GENERAL PROBLEMS**

- Physical, Chemical, Biological and Environmental and Economic Degradation

**PROBLEMS SOLVING**

1. Associated Mangrove Aquaculture (AMA)
2. Low External Input Sustainable Aquaculture (LEISA)
3. Integrated Multi Trophic Aquaculture (IMTA)

**IN DEMAK DISTRICT**

- 360 HA PONDS AFFECTED BY ABRASION (2018)

**ASSOCIATED MANGROVE AQUACULTURE (AMA)**

- New concept of SILVO-FISHERY
  - Eco-logically
  - No Coastal Protection

**OLD CONCEPT: SILVO-FISHERY**

**MANGROVE PLANTING ON THE POND’S DYKE OR INSIDE THE POND**

- Limiting Pond Management
- The dykes become narrow
- Management drying of the pond bed is not optimal

**MANGROVE PLANTING ON THE POND’S DYKE OR INSIDE THE POND**

- Reducing Pond Productivity
- Decomposition of fallen mangrove leaves needs oxygen
- Tannin leaching down into NH₃ toxic
MANGROVE PLANTING ON THE POND’S DYKE
OR INSIDE THE POND

Increase shading of the pond

In extensive ponds are shallow (40-80 cm water depth)
• Stimulate natural food growth
• The water temperature drops

WHY DO WE NEED ASSOCIATED MANGROVE AQUACULTURE?

In terms of pond management

Protects pond dyke → reduces operational costs of pond maintenance

Pond management can be done more optimally

Water quality degradation is avoided / reduced

ASSOCIATED MANGROVE AQUACULTURE

Green belt space (Gor No. 61 of 2016)
Regarding coastal ecosystem

Mangroves along the coastline 10-300 m from the lowest tide to the land

Mangrove 15-20 m from shore embankment to land

WHY DO WE NEED ASSOCIATED MANGROVE AQUACULTURE?

From Ecosystem
Point of view... green belt provides

As a nursery and feeding grounds for aquaculture; important marine families

Leaves and fronds can be processed to feed fish (bottom feeders) or shrimp (bottom feeders)

Mangrove forest can be used to make compost for pond fertilizers

LOW EXTERNAL INPUT SUSTAINABLE AQUACULTURE (LEISA)

INTEGRATED MULTI TROPHIC AQUACULTURE (IMTA)

LEISA AND IMTA CONCEPT APPLICATION

LEISA – IMTA APPLICATION ADVANTAGES

Traditional Ponds Affected by Abstraction

LEISA - IMTA

Traditional Ponds

Increase pond productivity

Ensuring Sustainable Aquaculture

THANK YOU
6.5. Day 4, Lecture 4: Dr. Ati Rahadiati
STEP BY STEP PROCESS

Setup and Design (pre-construction stage):
1. Site selection
2. Site preparation
3. Site surveying
4. Site layout design

PRACTICE

- Mix the cement, sand, and water in the correct ratio.
- Smooth the surface after each pour.
6.5. Day 5, Presentation from the trainees

Coastal Vulnerability Index application for analysis of coastal vulnerability levels in Sayung Sub District

Result

Method & sourced data

- Method
- Sourced Data

Knowledge, Training, Experience

- The Assessment Mapping effort to prevent the impact of Climate Change, hydrological disaster to the coastal area

The practical tasks in mapping coastal risk in Peta A

The practical tasks in mapping coastal risk in Peta B

The practical tasks in mapping coastal risk in Peta C

The practical tasks in mapping coastal risk in Peta D

The practical tasks in mapping coastal risk in Peta E

The practical tasks in mapping coastal risk in Peta F

The practical tasks in mapping coastal risk in Peta G

The practical tasks in mapping coastal risk in Peta H

The practical tasks in mapping coastal risk in Peta I

The practical tasks in mapping coastal risk in Peta J

The practical tasks in mapping coastal risk in Peta K

The practical tasks in mapping coastal risk in Peta L

The practical tasks in mapping coastal risk in Peta M

The practical tasks in mapping coastal risk in Peta N

The practical tasks in mapping coastal risk in Peta O

The practical tasks in mapping coastal risk in Peta P

The practical tasks in mapping coastal risk in Peta Q

The practical tasks in mapping coastal risk in Peta R

The practical tasks in mapping coastal risk in Peta S

The practical tasks in mapping coastal risk in Peta T

The practical tasks in mapping coastal risk in Peta U

The practical tasks in mapping coastal risk in Peta V

The practical tasks in mapping coastal risk in Peta W

The practical tasks in mapping coastal risk in Peta X

The practical tasks in mapping coastal risk in Peta Y

The practical tasks in mapping coastal risk in Peta Z

The practical tasks in mapping coastal risk in Peta AA

The practical tasks in mapping coastal risk in Peta AB

The practical tasks in mapping coastal risk in Peta AC

The practical tasks in mapping coastal risk in Peta AD

The practical tasks in mapping coastal risk in Peta AE

The practical tasks in mapping coastal risk in Peta AF

The practical tasks in mapping coastal risk in Peta AG

The practical tasks in mapping coastal risk in Peta AH

The practical tasks in mapping coastal risk in Peta AI

The practical tasks in mapping coastal risk in Peta AJ

The practical tasks in mapping coastal risk in Peta AK

The practical tasks in mapping coastal risk in Peta AL

The practical tasks in mapping coastal risk in Peta AM

The practical tasks in mapping coastal risk in Peta AN

The practical tasks in mapping coastal risk in Peta AO

The practical tasks in mapping coastal risk in Peta AP

The practical tasks in mapping coastal risk in Peta AQ

The practical tasks in mapping coastal risk in Peta AR

The practical tasks in mapping coastal risk in Peta AS

The practical tasks in mapping coastal risk in Peta AT

The practical tasks in mapping coastal risk in Peta AU

The practical tasks in mapping coastal risk in Peta AV

The practical tasks in mapping coastal risk in Peta AW

The practical tasks in mapping coastal risk in Peta AX

The practical tasks in mapping coastal risk in Peta AY

The practical tasks in mapping coastal risk in Peta AZ

The practical tasks in mapping coastal risk in Peta BA

The practical tasks in mapping coastal risk in Peta BB

The practical tasks in mapping coastal risk in Peta BC

The practical tasks in mapping coastal risk in Peta BD

The practical tasks in mapping coastal risk in Peta BE

The practical tasks in mapping coastal risk in Peta BF

The practical tasks in mapping coastal risk in Peta BG

The practical tasks in mapping coastal risk in Peta BH

The practical tasks in mapping coastal risk in Peta BI

The practical tasks in mapping coastal risk in Peta BJ

The practical tasks in mapping coastal risk in Peta BK

The practical tasks in mapping coastal risk in Peta BL

The practical tasks in mapping coastal risk in Peta BM

The practical tasks in mapping coastal risk in Peta BN

The practical tasks in mapping coastal risk in Peta BO

The practical tasks in mapping coastal risk in Peta BP

The practical tasks in mapping coastal risk in Peta BQ

The practical tasks in mapping coastal risk in Peta BR

The practical tasks in mapping coastal risk in Peta BS

The practical tasks in mapping coastal risk in Peta BT

The practical tasks in mapping coastal risk in Peta BU

The practical tasks in mapping coastal risk in Peta BV

The practical tasks in mapping coastal risk in Peta BW

The practical tasks in mapping coastal risk in Peta BX

The practical tasks in mapping coastal risk in Peta BY

The practical tasks in mapping coastal risk in Peta BZ
RESULT

The damage to the coastal area caused by the 2018 Sumba earthquake and tsunami is very severe and spread in a very limited area. The disaster occurred in a coastal village with a percentage absorption rate of 1,000 people. The highest damage was in the village of Kupang, which had an estimated absorption rate of 300 people. The village of Kupang had the highest absorption rate of 300 people, with an estimated absorption rate of 300 people and the village of Kupang had an estimated absorption rate of 300 people.

Presentation Task

Name: Anggita Adhistha de Silva
Affiliation: Postgraduate School (Master of Environmental Science) of Diponegoro University

RS & GIS are

1. An information technology that effectively handles the management process of natural disasters.
2. To monitor and respond to natural disasters at every stage. Information, maps, population, and circumstances of the earth can be made into a clear map format before disaster occurs.
3. Can make things easier in some disastrous situations by incorporating information technology with emergency management knowledge.

RS & GIS APPLICATION IN DISASTER MITIGATION

Based on Presentation of Prof Dr Mazlan Hashim, F.ASc

RS & GIS are very useful and effective tools in disaster management. Because in disaster management, the objectives of the disaster experts to use RS & GIS are to monitor the situation, simulate the complicated disaster occurrence as accurately as possible so as to come up with better prediction models, suggest appropriate contingency plans and prepare spatial databases.
HS and Geospatial application in disaster mitigation:

- GIS is used in managing the huge levels of data required for vulnerability and hazard assessment, a tool for planning evacuation routes, designing centers for emergency operations, and for the integration of satellite data with other relevant data in the design of disaster warning systems.
- When GIS, in combination with GPS, is extremely useful in search and rescue operations in areas that have been devastated and where it is difficult to find one’s bearings.
- GIS is used to organize the damage information and post-disaster census information and in the evaluation of sites for reconstruction.

The impact of climate change on the coastal area

Budi Wardhani
Diponegoro University

Main interest in climate change as this one of the courses I am taking.

Biological impacts of climate change

- Increased heat, drought and insect outbreaks; all linked to climate change, have increased wildfires.
- Additional concerns on the declining water supplies can:
  1. reduced agricultural yields,
  2. health impacts in cities due to heat,
  3. flooding and erosion in coastal areas

Effects of climate change on coastal/coastline bio evolution

- Climate change threatens coastal areas, which are already stressed by human activities, pollution, invasive species, and storms.
- Sea level rise could erode and inundate coastal ecosystems and eliminate wetlands.
- Warmer and more acidic oceans are likely to disrupt coastal and marine ecosystems.

The use of ArcGIS was beneficial for the practical exercise

- The practical was on the sayung sub District and below is my end result.
DIPONEGORO UNIVERSITY

Dellia Da Costa

Climate Change Impacts on Marine Ecosystems

Training Experience

Climate change will fundamentally alter the structure of oceans and directly impact marine ecosystems and coastal societies.

Climate induced changes and other developmental as well as geo-economic changes will be impercepted through reduced food fishery resources such as over fishing, pollution, damming of rivers and habitat loss in coastal areas.

Training Experience

1. Theory of climate change-based and hydrological disasters: A case of Semarang and Demak (Dr. M. Helmi – Diponegoro University)
2. Large Scale Mapping (The Ohio State University)
3. Basic GIS

THANK YOU...
ANALYSIS R FOR LAND USE
FERI NUGROHO
Affiliation: Master of Science Program, Coastal and Marine Resources Management, Faculty of Marine Science and Technology, Universitas Indonesia.
Email: ferinugroho@gmail.com

Implementation:
- SPBEA solution
- Theory of Aquaculture INA

Methods:
- Assess the environmental impact of marine mangrove ecosystem
- Evaluate the potential for food production from fish farming
Final Report: CBA2019-11SY-SUTRISNO

Condition of Coastal Alluvial Plains at Java Island

- Coastal alluvial plains
- Urban growth at young alluvial plains
- Dense population
- High urban growth
- Otherization
- Medium to high rain intensity
- Inshore area high of soil flood, storm surge

Condition of Coastal Alluvial Plains at Ayeyarwady Delta

- Lowest expanse of land in Myanmar that falls out from the limit of tidal influence at Myaung U to the Bay of Bengal and Andaman Sea
- Density populated
- Cultivation of rice
- High Urban Growth
- Decleration ( Manning's or Lena and npp gain)
- On Myaung U, Delta suffered by Cyclone Nargis
**Photogrammetric Processing of digital images captured using a drone**

**Results**

- **Data Processing:**
  - 4:3 format output: the images are captured in a 4:3 format to ensure compatibility with standard display devices.
  - Data processing is performed using professional software tools.
  - The results are presented in a comprehensive report.

- **Application:**
  - The processed images are used for various applications such as urban planning, environmental monitoring, and disaster management.

**Thank you!**
MY REFLECTIONS ON THE TRAINING ON THE PRACTICAL WAYS OF INTEGRATED COASTAL SPATIAL PLANNING-BASED ECOSYSTEM ADAPTATION (SPBEA)

Topic of Interest and its relevance to my country

- The topic presented in the training is very interesting. I have found the topic on the practical ways of integrated coastal spatial planning is a good tool for addressing coastal issues in my country.
- I work in a coastal area, and I believe that the topic covered in the training will be very helpful for my work.

The Experience

- Enriching, valuable, and informative
- Extensive and eye-opening
- Interactive and engaging
- Setting the foundation for future research and collaborations
- New ideas and materials for work and teaching

Personal reflections and take away points

- The fields of GIS and remote sensing are vital in SPBEA. Understanding the use and applications of GIS/RS is crucial for adaptation strategies.
- Practice makes perfect. Learning GIS/RS requires time commitment.
- This training has sparked my interest in ecosystem-based adaptation to which I am planning to conduct doctoral research.

My sincere thanks to the organizers, the lecturers and fellow participants.

Best wishes to all!
Final Report: CBA2019-11SY-SUTRISNO
Keeping the Merit of Coastal Areas

COASTAL VULNERABILITY INDEX

- Coastal area of Myanmar
  - Rakhine Coast Region
  - Arakan Bay Rivers (Gulf of Martaban Coastal Region)
  - Kachin coastal Region
- Main sources for Myanmar’s economy
- Climate change harms the ecosystem
- Need to keep the value of coastal area
- Ecosystem exploitation and management like mangrove restoration are needed to practice
- Need to bring out the coastal vulnerability

Why Coastal Vulnerability Mapping Using GIS?

- Tropics that have been given by the lectures are very valuable
- Climate Change Impact Assessment for coastal areas using Coastal Vulnerability Index (CVI)
- Myanmar has a coastline of nearly 2,900 km
- These areas provide natural resources for livelihood
- As the climate change, the ecosystem of the coastal area also change
- Both of natural hazard and disasters and man-made issues also hit these area