ASIA-PACIFIC NETWORK FOR GLOBAL CHANGE RESEARCH

CAPaBLE Programme Final Report




Project Reference Number: CBA2019-11SY-Sutrisno

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

The following collaborators worked on this project:

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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

OVERVIEW OF PROJECT WORK AND OUTCOMES

1. Project Information

Project Duration	:	1.5 year
Funding Awarded	:	US$ 40,000
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 a
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
5. ISPRS International Journal of Geo-information, Vol 10(3), 2021; https://doi.org/10.3390/ijgi10030176
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, Phillipines
    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

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3. Roebeling P., Elia,E., Coelho,C., & Alves, T. (2018). Efficiency in the design of coastal erosion adaptation strategies: An environmental-economic modeling approach. *Ocean & Coastal Management*, Vol160:175-184. https://doi.org/10.1016/j.ocecoaman.2017.10.027
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5. Sutrisno, D., Darmawan, M., Rahadiati, A., Helmi, M., Yusmur, A., Hashim, M., Shih, P.T., Qin, R., & Zhang, L. (2021). Spatial-planning-based ecosystem adaptation (spbea): a concept and modeling of prone shoreline retreat areas. *ISPRS Int. J. Geo-Inf*. 2021, 10(3), 176; https://doi.org/10.3390/ijgi10030176

Acknowledgments

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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 discussion (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.

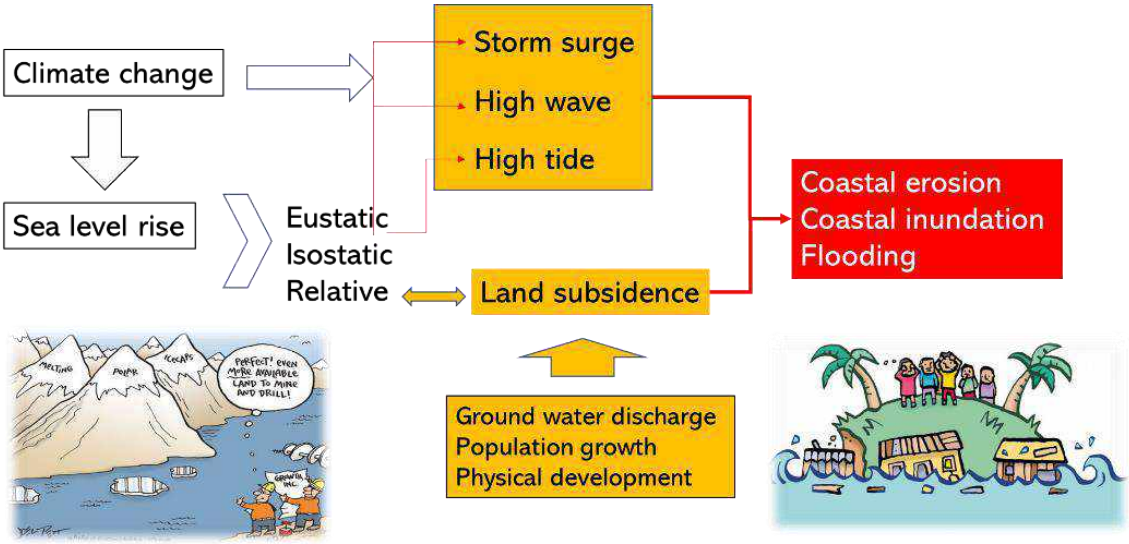


Figure 1. Illustration of the root of the problems in the coastal area (Sutrisno, 2019)

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:

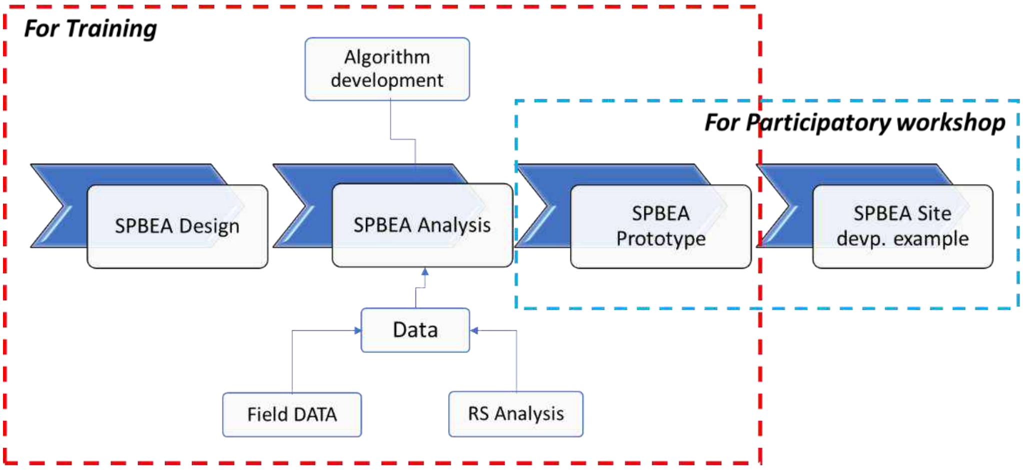


Figure 2. Flowchart of the SPBEA steps development

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

Activities	Date		The method		Numbers		Explanation
	Before	New	Before	New	Before	New	
[1]FGD in National Technology Institute Bandung	September 17th , 2019	September 17th 2019	offline	offline	10	10	Discussion on the SPBEA method developme nt

Activities	Date		The method		Numbers		Explanation
	Before	New	Before	New	Before	New	
[2]FGDs in UTM, Kuala lumpur	October, 31st 2019	October, 31st 2019	offline	offline	10	10	Discussion on the SPBEA method developme nt
[3] Kick-off meetings in Semarang	November, 5th 2019	November, 20th 2019	offline	offline	30	30	1. Launching the project 2. Method Improvement 3. expansion of cooperation with several institutions
[4] finalizing the method and management planning with local partners, Semarang - Indonesia	November, 6th - 7th, 2019	Meeting on November 15th, 2019 in Diponegoro University and FGD in Diponegoro University on November, 21st, 2019	offline	offline	10	10	input Method of SPBEA and agenda of the training and workshop
[5] socializing and promoting project DBAR Bangkok	December 2019	Shenzen-China, December, 18th 2019	offline	offline			socializing and promotion of the project
Pre-fieldwork for determining the demonstration site	February 2020	Sayung sub-district, February 27st - 28th 2020 and December, 17th – 21st 2020	offline	offline			- Data of demonstration site - social-economic data and environment observation
Pre-field-work data analyzing		January 22nd-26th 2020					Drone-based map
[6] Training on spatial planning-based ecosystem adaptation: a tool to support climate change adaptation in Semarang	May 4th - 8th, 2020 - Changed to April, 13th - 20th 2019	February 15th - 19th 2021	offline	Combin e offline and online	30	10 offline, 30 online	The implementation of the hybrid training, combine offline and online
[7] Participatory workshop on-site planning of ecosystem adaptation to climate change in Demak, Central Java Province	May 9th - 11th 2020, changed to April, 17th-19th 2020	February 20th - 22nd 2021	offline	offline	40	10	The implementation of the participatory workshop of SPBEA and demonstration site

Activities	Date		The method		Numbers		Explanation
	Before	New	Before	New	Before	New	
8 FGDs in Bogor FGDs/technical meetings on the evaluation of the capacity development	June 2th 2020	Semarang, February 19th , 2021	offline	offline	10	10	Evaluation of the training
9 technical meetings in Bogor	June 3th 2020	Bogor, February, 23rd 2021	offline	online	10	10	Evaluation of the whole project

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 1st and 5th 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 15th, 2019.

The next meeting was on February 3rd, 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.

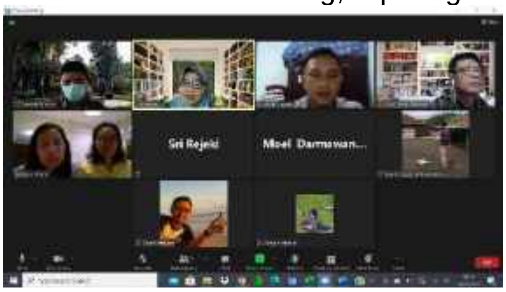
Following the acceptance of the Special Circumstances No-Cost Extension, the following meetings were rescheduled and held either offline or online. The offline meeting was conducted in compliance with the health policy, with all participants being subjected to a negative covid test. Committee meetings, 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.

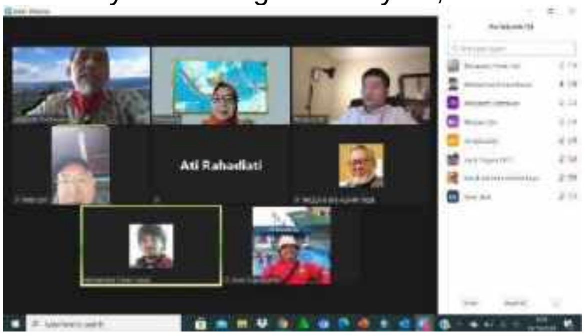


Preparation meeting, Bogor, September 1st, 2019

Diponegoro University-Semarang, November 15th 2019

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

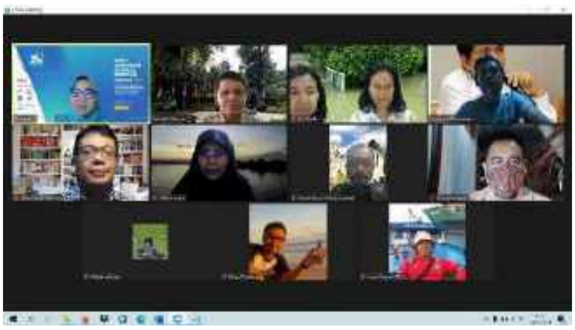




Committee meeting, April 2020

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 Kualalumpur was provided by APN and in-kind of BIG.

1st FGD in National technology institute (ITN) Bandung-Indonesia on September 17th 2019

2nd FGD in Unirversiti Teknologi Malaysia, Kualalumpur on October 31st, 2019

FGDs for Kick-off meeting evaluation, determining SPBE method and management planning with local partners, Semarang November 21st, 2019

Figure 4. FGDs for project preparation

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 20^{th,} 2019

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

Figure 6-a. Fieldworks in Sayung Sub-district

Social-economic survey

Drone mapping

Figure 6-b. Field surveys 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

Data	Type	data output
Land system	ancillary data	
The land-use/land cove	ancillary data/ RS-Derived map	
Base map	ancillary data	
Spatial plan	ancillary data	
Soil map	ancillary data	
Geomorphology map	ancillary data	
Geology map	ancillary data	
slope	ancillary data	

Data	Type	data output
Flooding prone area	RS Derived-map	
Green belt	GIS-derive map	
Protection zone	GIS- derive map	
pH	field data	
Salinity	field data	
Social, culture and economy	field data	
High-resolution orthorectified image		- Land-used map -green belt -protection zone - coastal change -sedimentation map
Landsat 8 Oli		-Flooding prone - protection zone - coastal change
Drone -Based map	field data	-Detailed Land-used map -green belt -protection zone - slope and elevation map - planning map

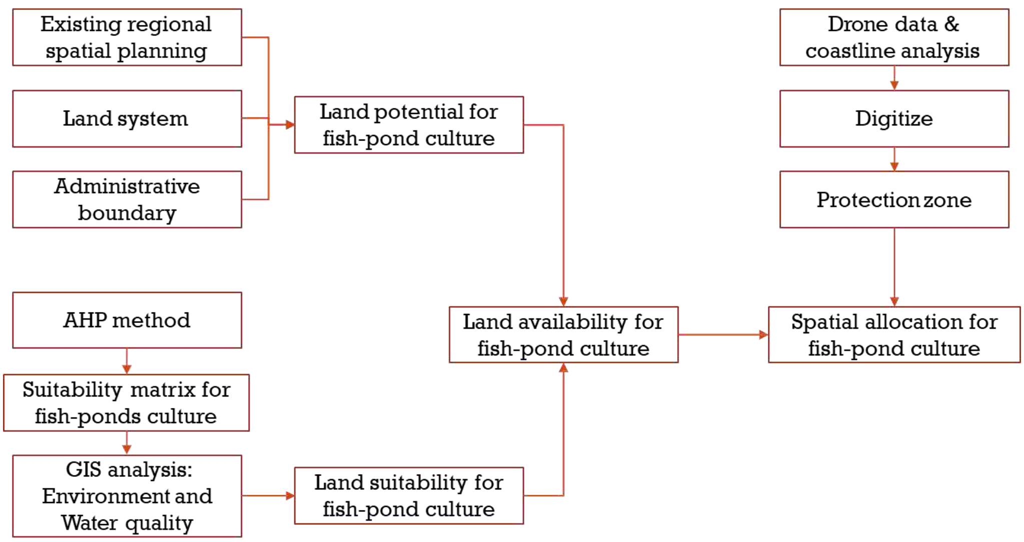


Figure 7. Steps of SPBEA model development (Rahadiati et al., 2021)

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:

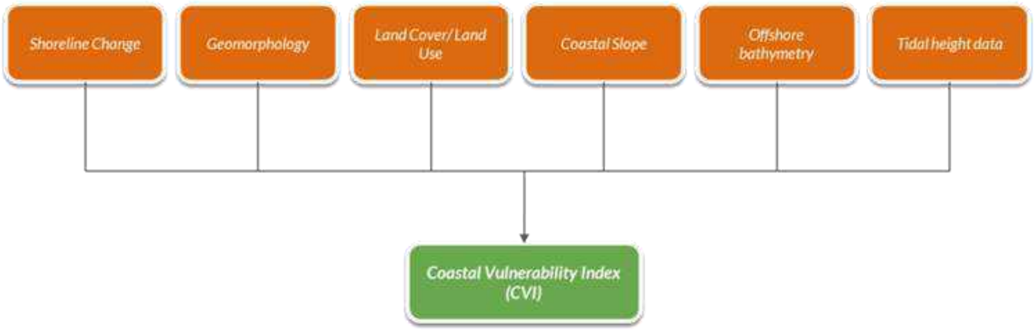


Figure 8. steps of coastal vulnerability index (Armaiki et al., 2021)

b. Drone large scale-map

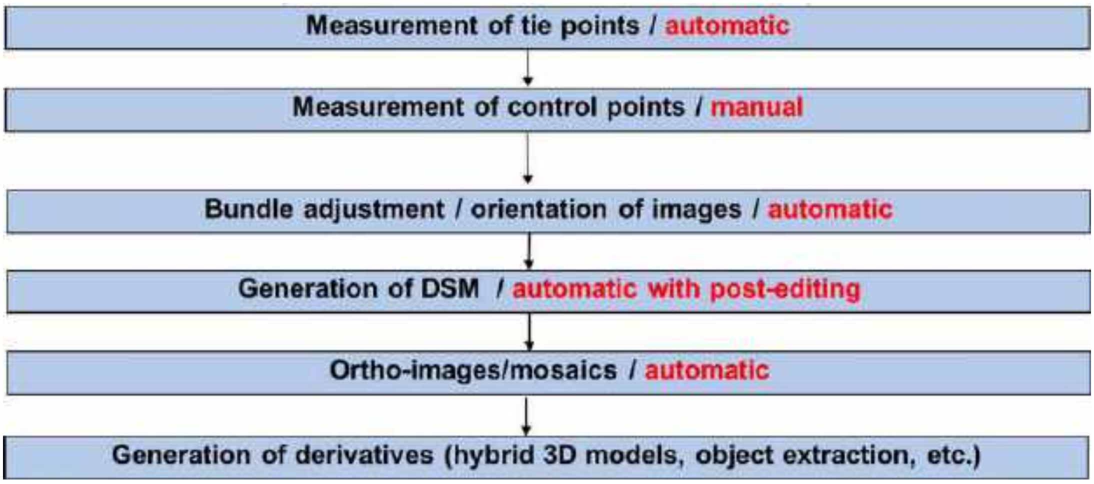


Figure 9. The process for deriving drone large scale-map (Qin, 2021)

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.

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 15^{th,} 1021 to February 19^{th,} 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.

Figure 10. Opening Ceremony

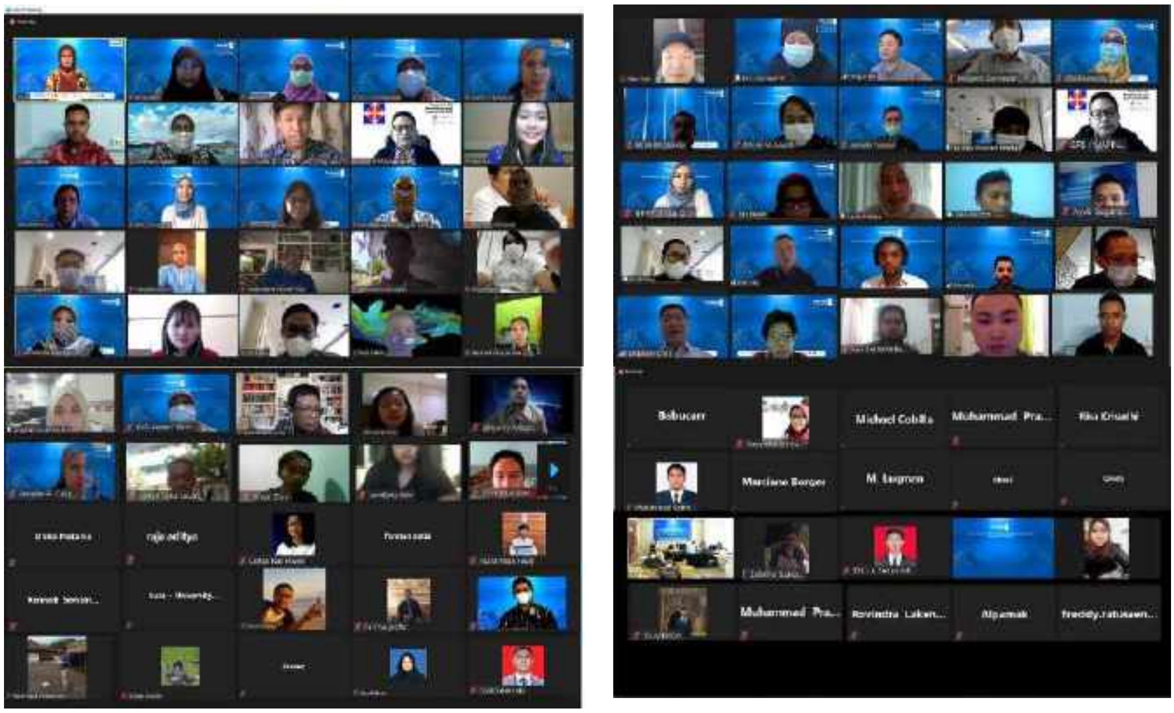


Figure 11. Online participants

Figure 12. offline participants and technical team

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.

Figure 13. Offline and online training

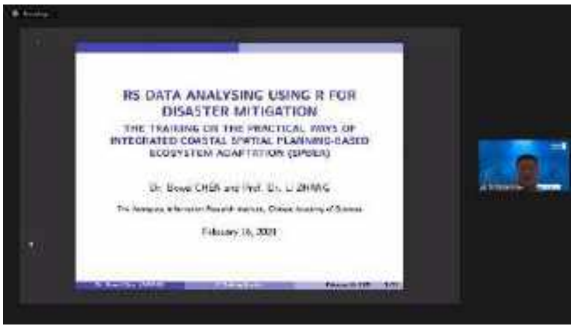
The training material given adheres to the original agreement, beginning with a basic understanding of coastal disasters in relation to climate change and practicing how to develop the disaster model. The second day began with an understanding of the services, products, and ecological functions of coastal 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

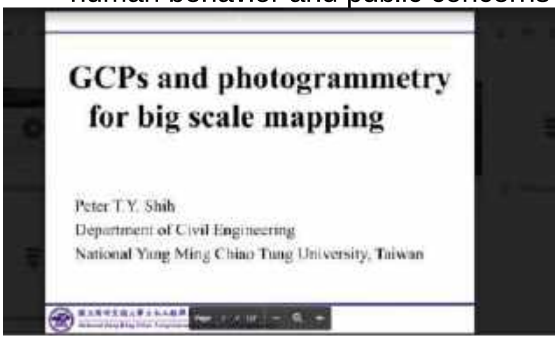
Practicing the impact of climate change on the coastal area

Theory and concept of coastal ecosystem functions and services

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

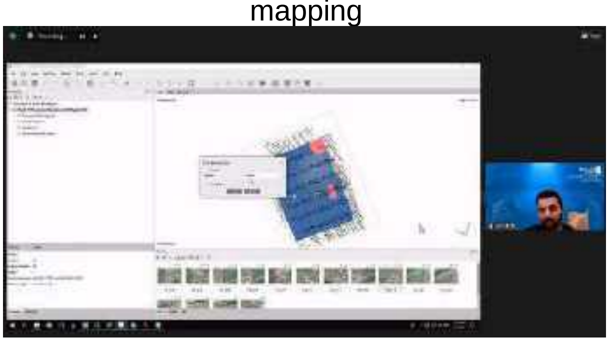


Practice: RS data analysis using R for disaster mitigation



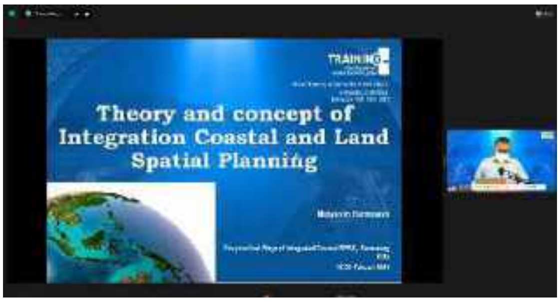
GCPs and photogrammetry for big-scale mapping

Spatial data acquisition using UAVs and their processing



Practicing: Big Scale Mapping

Figure 14-a. Illustration of the training implementation



Theory and concept of integration coastal and land spatial planning

Spatial planning-based ecosystem adaptation

Sustainable Coastal Aquaculture: Mangrove Aquaculture (AMA), Low External Input for Sustainable Aquaculture (LEISA), Integrated Multi Trophic Aquaculture (IMTA).

Practicing SPBEA

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.

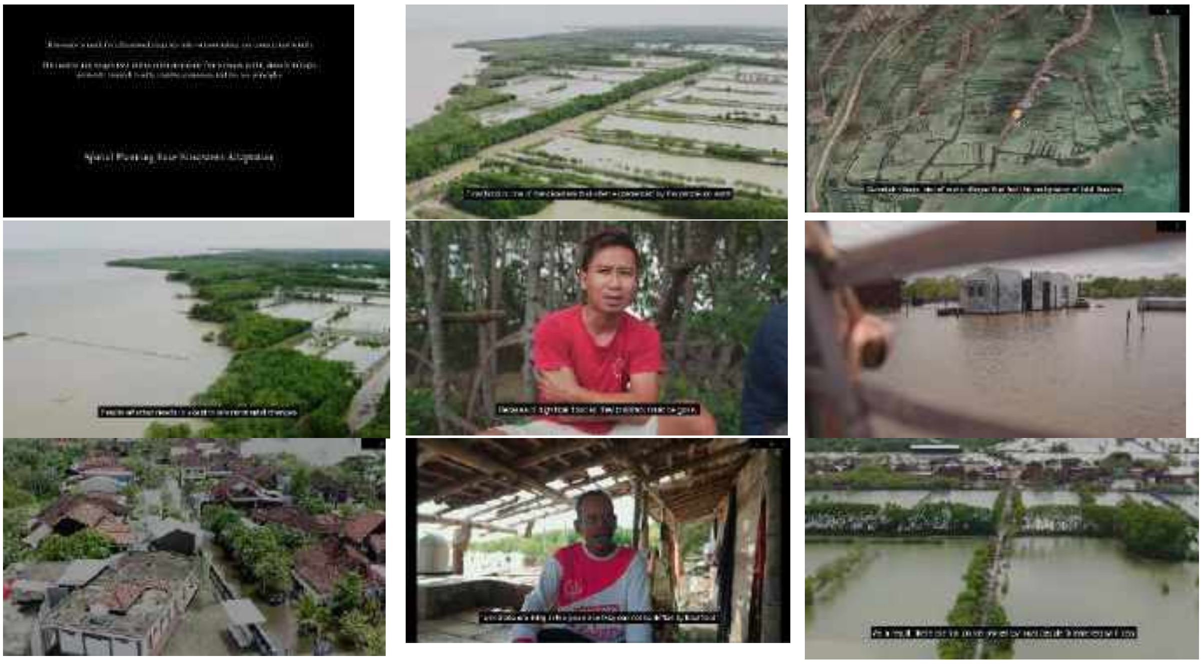


Figure 15-a. Illustration of virtual field-visit

Figure 15-b. 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 odeKhairum Mastu, Indonesia
15. Lusita Meilana, China Taipei

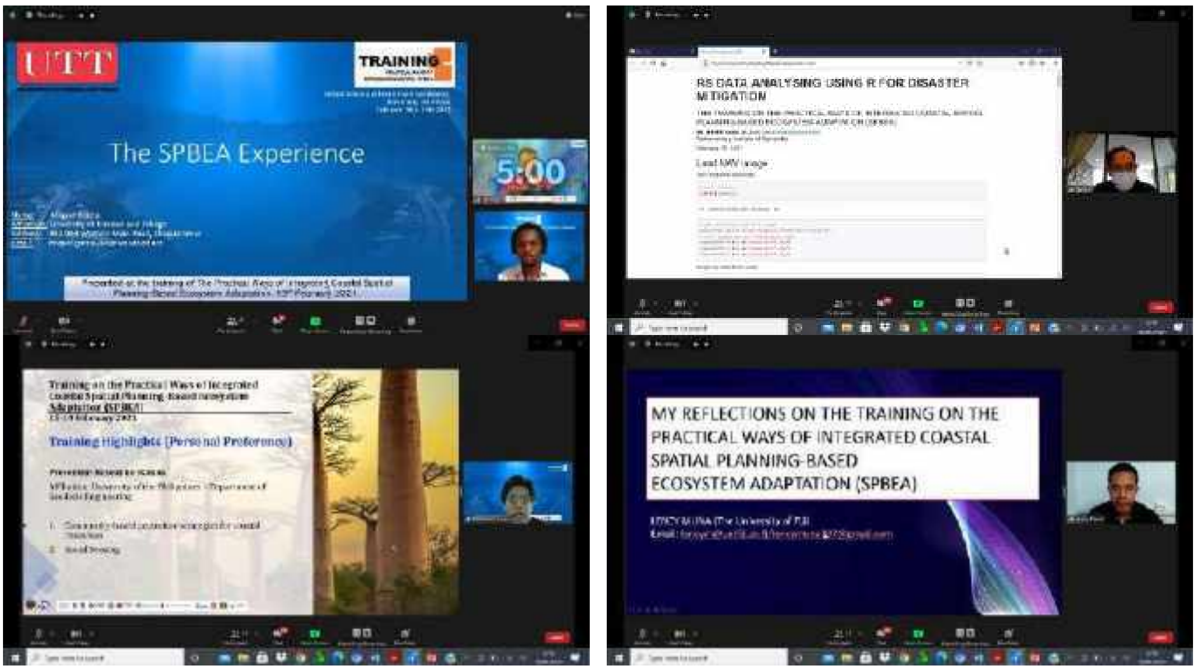


Figure 16-a. Presentation from the participants

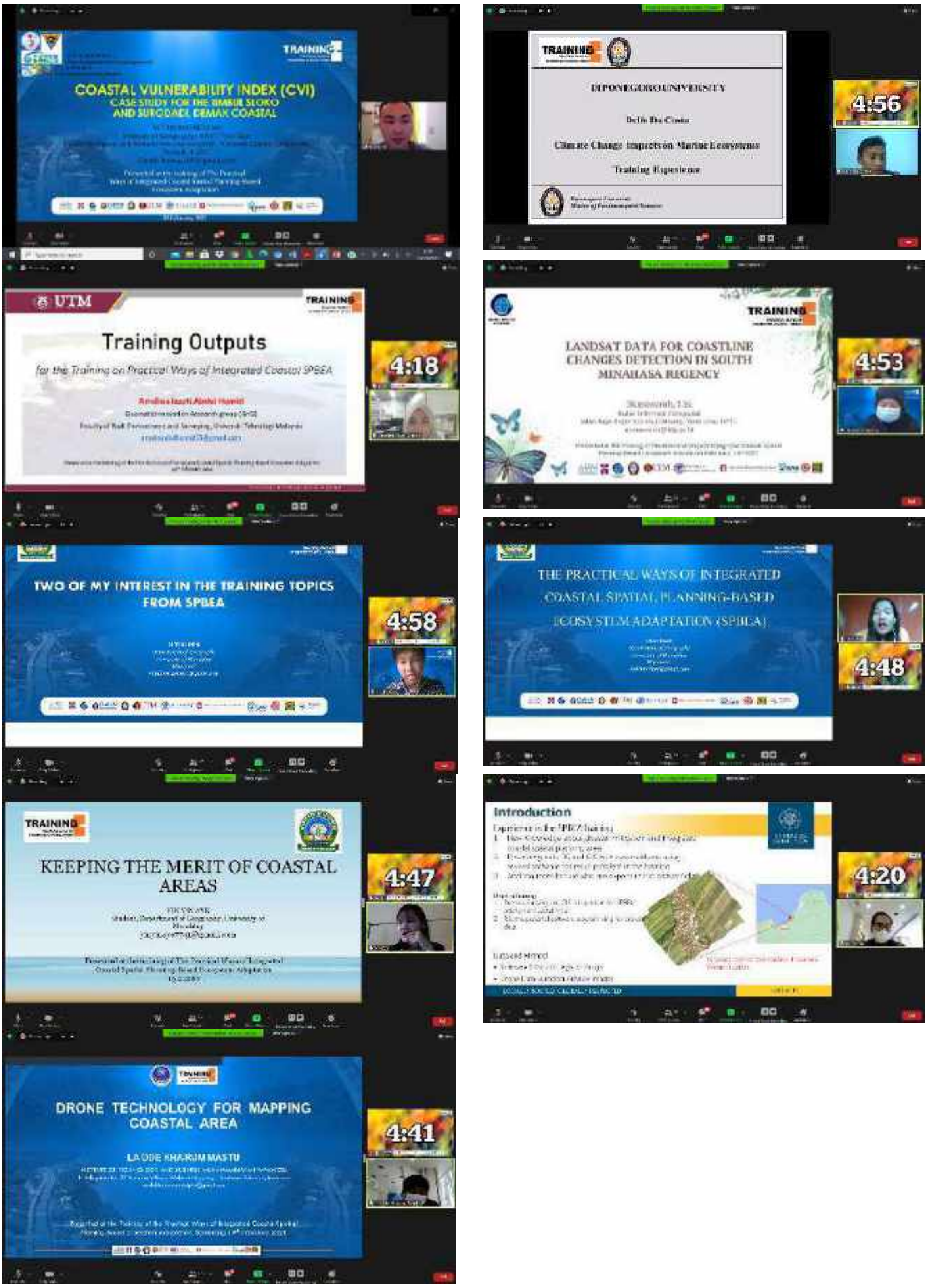


Figure 16-b. Presentation from the participants

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

10:04:55 From Ayub Sugara 2011 : Congratulations for the best participants
10:06:19 From Ayub Sugara 2011 : *For all participants, keep communication between participants. if there is a chance we will meet again at another time and other activities ;)
10:06:34 From Si Thu Min : Congratulations Spbea 2020! It was excellent training for me. And, thank you very much!!
10:06:53 From Lusita Meilana : Thank u so much ALL, and congratulation
10:07:02 From Htet Htet : Congratulations Spbea 2020. Thank you so much for valuable training programs
10:07:16 From Miquel Garcia : This was an amazing event, thanks so much to the committee for putting this together!
10:07:17 From Lency Muna : Thank you, everyone!!!. Take care and all the best with your endeavors.
10:07:20 From Seila N : Thank you so much for the training!
10:07:21 From Joren Mundane A. Pacaldo : Thank you, everyone!
10:07:41 From Hoang Vo : Thank you, everyone!
10:07:46 From afdal_ ziqri : thank you, everyone!
10:07:50 From Gusto Almeida : thank you so much for all committee members, and all friends (participants)
10:08:20 From IDN-Dewayany : Thank you very much for you all. See you again at a similar event that we are going to hold.Hopefully, after the pandemic is over
10:08:30 From Amalina Abdul Hamid : Congratulations to the committees and organizers! Hope we can meet again in the next training! and thank you again for this opportunity
10:08:41 From Si Thu Min : Like the song and I want to see you again.

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.

Figure 18. Example of Certificate of appreciation

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.

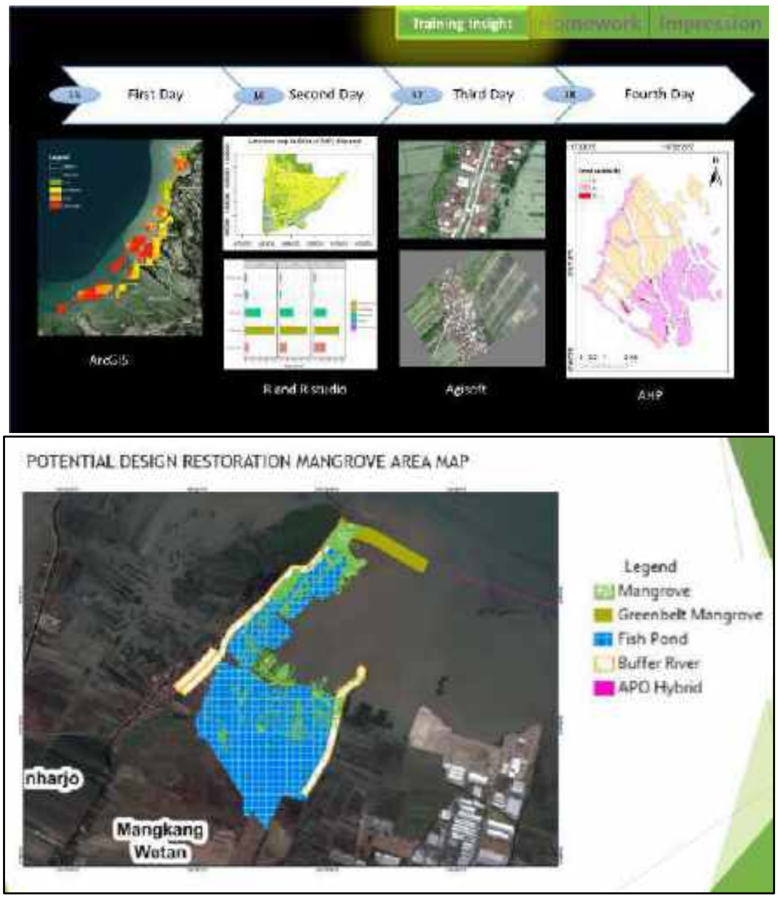


Figure 19. Example of the training result from the participants

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

distribution of seeds for the demonstration site


Group-1 discussion for rural SPBEA

Figure 20-a. Local community participatory mapping

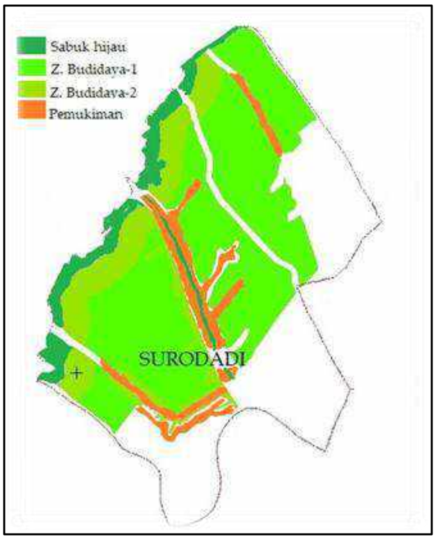
Group-2 discussion for rural SPBEA

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.

Drone-Map of Surodadi Village

Figure 21-a. Training-map derived for the participatory workshop



Zonation map of Surodadi Village booklet

Figure 21-b. 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.

Figure 22. Workshop demonstration site, planting mangrove along the riverbank, implementation of AMA and poly-culture

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.

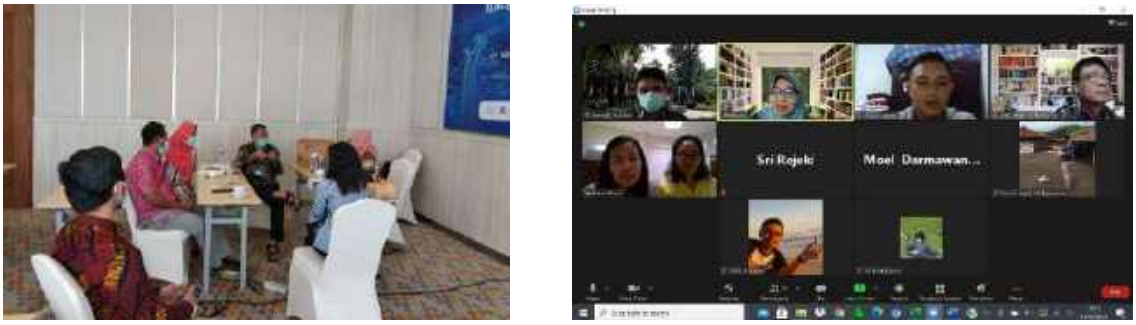


Figure 23. The evaluation FGDs

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

Activities	Objective	Indicator	Achievement
The SPBEA Method	model of Spatial planning-based ecosystem Adaptation model and site planning-based ecosystem	1. Data 2. model	1. Data for analysis (report) 2. SPBEA model (report in a journal)
Training on integrated coastal SPBEA	Improved the science-based knowledge of the young scientist in spatial planning ecosystem based adaptation model	1. 20 participants 2. Training documents	3. 71 participants 4. Documents: report, material of training, video of training
Participatory workshop on-site planning of ecosystem adaptation	Improved knowledge and awareness of local community in ecosystem-based approach activities	1. 20 participants 2. Document	1. 10 participants (due to the pandemic) 2. Document: Booklet, Report
Publication	Publication of the project	1. Article for science bulletin(1) 2. Article for journal (1)	1. Submitted 2. Published (https://doi.org/10.3390/ijgi10030176).

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

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APPENDICES

Appendix.1. Special No Cost extension

APN ASIA-PACIFIC NETWORK FOR GLOBAL CHANGE RESEARCH

Ref. CovEx1-CBA09-1

APN Secretariat, East Building 4F, 1-5-2 Wakinohama Kaigan Dori, Chuo-ku, Kobe, 651-0073 Japan
Phone: +81-(0)78-230-8017 Fax: +81-(0)78-230-8018 Email: info@apn-gcr.org Website: www.apn-gcr.org

1 June 2020

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

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

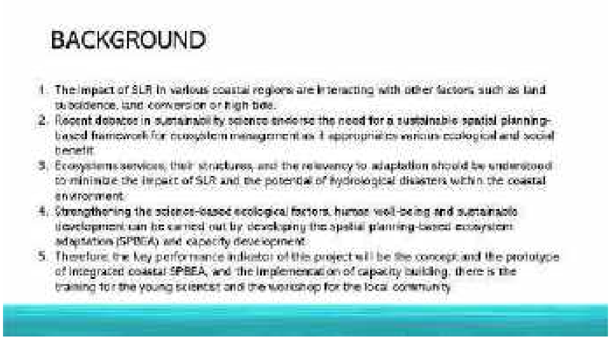
If you require any additional information or assistance, please do not hesitate to contact the APN Secretariat at COVID-19@apn-gcr.org quoting the Special Extension Reference number in the box above.

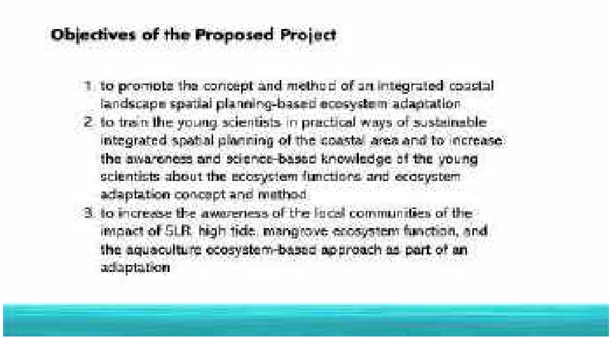
Sincerely,

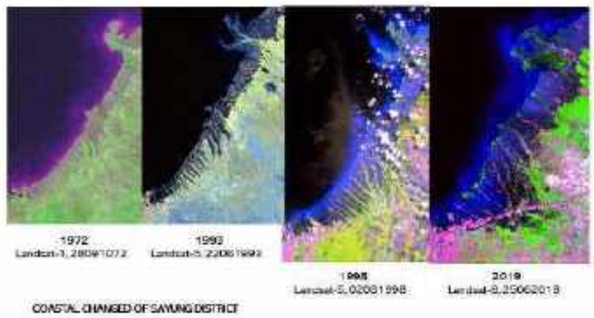
Dr Linda Anne Stevenson
Head, Communications and Scientific Affairs Division
APN Secretariat

Appendix 2. Material of FGDs

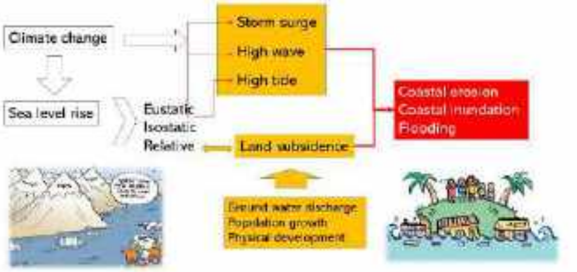
2.1. 1st FGD Bandung, Indonesia







What has been occurred in this area?



Expected Deliverables/Outputs

1. One report and at least one publication of the concept and method of integrated coastal SPBEA and the example of SPBEA prototype.
2. Implementation of training for integrated coastal SPBEA for 20 (twenty) young scientists (funded by APN and others). The integrated SPBEA issues are fish ponds, eco-tourism and water-based infrastructure such as channels
3. Implementation of the participatory workshop for 20 (twenty) local northern coast village communities' members and a demonstration site of silvo-fisheries/ eco-tourism.

Methodology and Work Plan

Activity-1 Compiling the concept and the method of integrated coastal SPBEA

The selection of concept and the method of integrated coastal SPBEA will be developed based on previous research, researchers' experiences, implementation of regional and local policy for spatial planning and previous data of the study area via focus group discussions (FGDs).

Activity-2 the training for the young scientists on the practical ways of integrated coastal SPBEA

For at least twenty young scientists
lecture and in-class discussion, in-class practicing and field-practicing

Activity-3 the local community participatory workshop

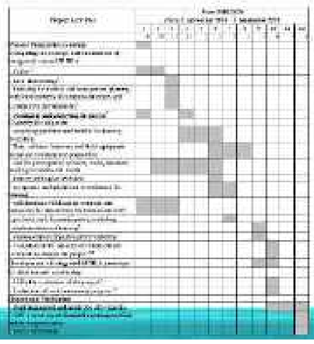
Sharing knowledge on how to maintain their coastal fish farming through an ecosystem-based approach will be learned and practiced by the locals

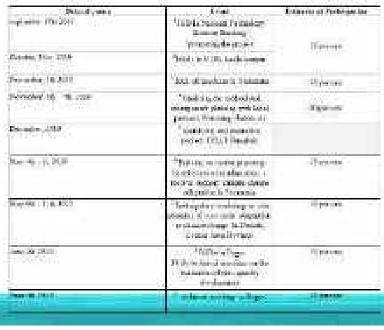
Methodology and Work Plan

Development of the integrated coastal SPBEA prototype.

Evaluation and monitoring of the project will be held through FGDs, field check and communication with participants

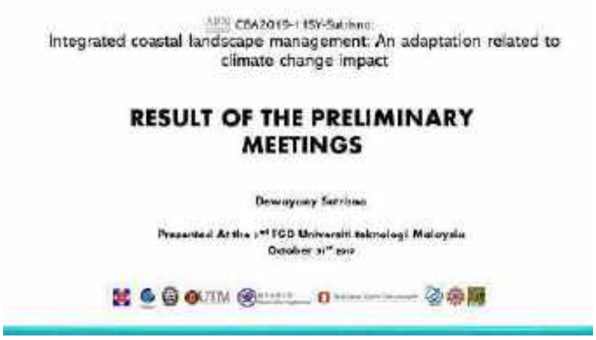
Report and publication.

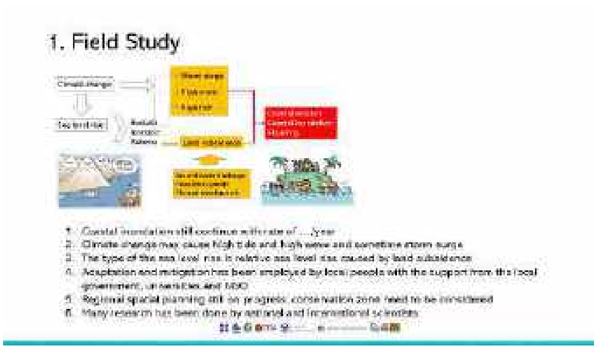


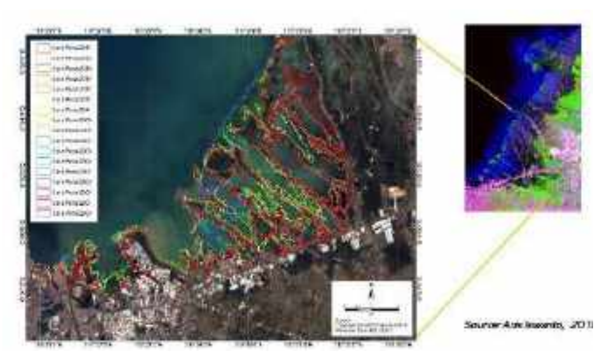


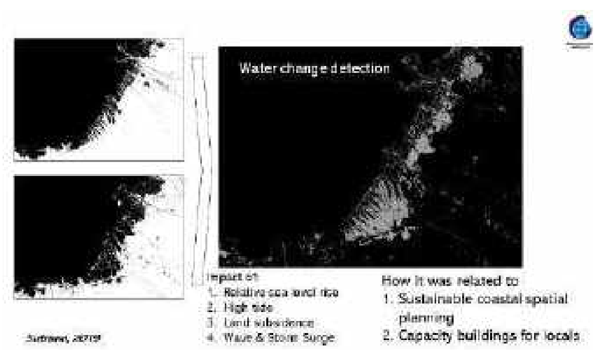
Thank You

2.2. 2nd FGD Kualalumpur, Malaysia









Evaluation of the HE
17 May 2017
9 September 2018
Source: M. Helmi, 2018

The HE structure is very susceptible to the waves of the western monsoon in Demak, which is much stronger compared to other seasons.
The location of the structure of the HE is crucial for success.
The structure of HE is very damaging by waves and requires continuous treatment.
There needs to be innovation that the structure of the HE can be stronger so that the age of the mangrove becomes longer and is strong enough to hold on to the undulating waves.
Source: M. Helmi, 2018

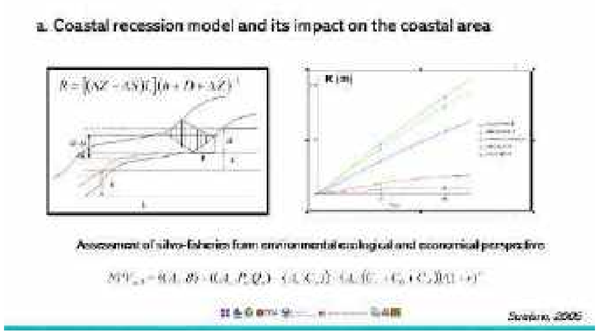
Adaptation
Raising the floor
House on stilts
elevated the building

See how the adaptation going on……

LIVELIHOOD ADAPTATION
Net cage instead of ponds
How a farmer become fishermen

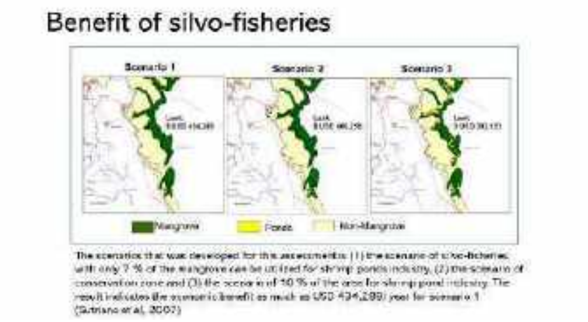
The die mangrove trees Caused of wave
People still working hard to protect their environment
They need assistance…. What we do for them??
What is your experiences?
Are there any better success?
If there are.. can you share with them?

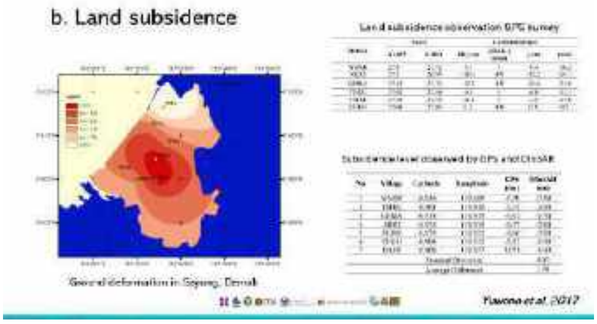
2. Assessment of the previous research

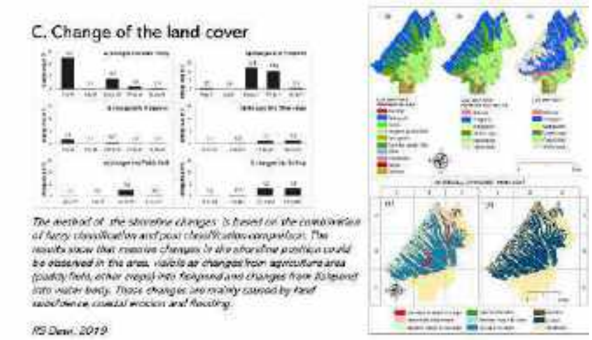


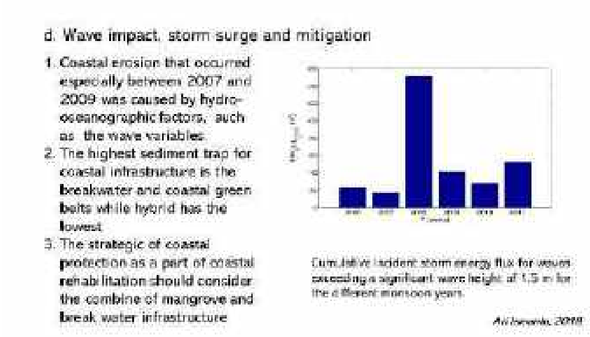
a. Coastal recession model and its impact on the coastal area
R (m)
Assessment of silvo-fisheries form environmental ecological and economical perspective
Sutrisno, 2005

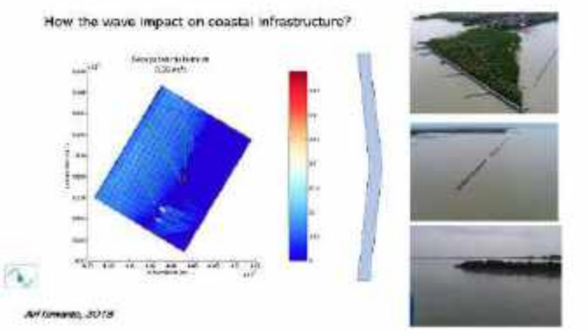
What We can Do for fish ponds management
Silvo Fisheries

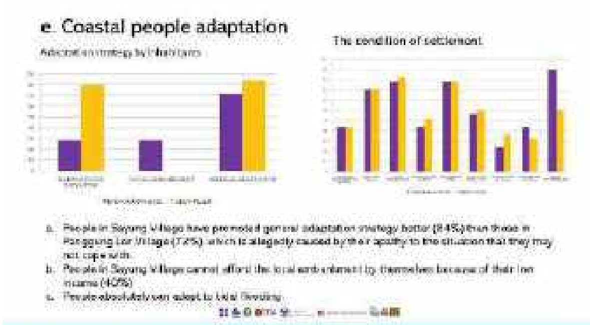

Benefit of silvo-fisheries
Scenario 1
Scenario 2
Scenario 3
Mangrove
Ponds
Non-Mangrove

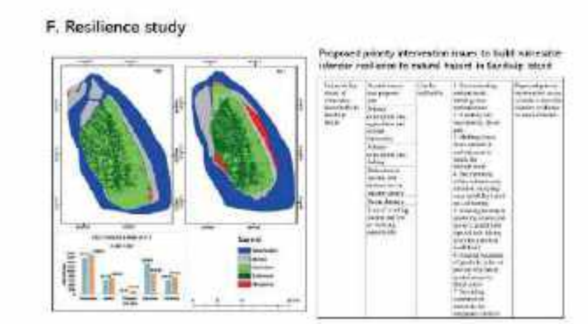

b. Land subsidence
Land subsidence observation GPS survey
Ground deformation in Sayung, Demak
Yuwono et al. 2017

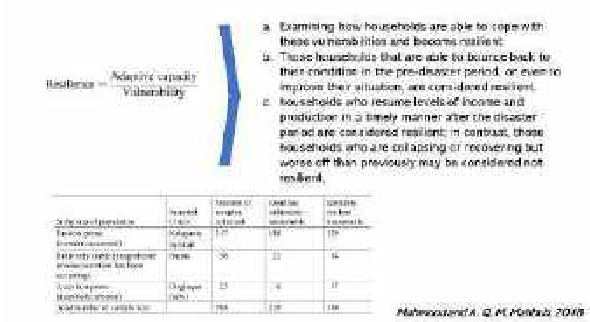

C. Change of the land cover
RS Dewi, 2019


d. Wave impact, storm surge and mitigation
1. Coastal erosion that occurred especially between 2007 and 2009 was caused by hydro-oceanographic factors, such as the wave variables.
2. The highest sediment trap for coastal infrastructure is the breakwater and coastal green belts while hybrid has the lowest.
3. The strategic of coastal protection as a part of coastal rehabilitation should consider the combine of mangrove and break water infrastructure
Cumulative incident storm energy flux for waves exceeding a significant wave height of 1.5 m for the different monsoon years.
Ari Ismanto, 2018


How the wave impact on coastal infrastructure?
Ari Ismanto, 2018


e. Coastal people adaptation
The condition of settlement
a. People in Sayung Village have promoted general adaptation strategy better (84%) than those in
b. People in Sayung Village cannot afford the local embankment
c. People absolutely can adapt to tidal flooding


F. Resilience study


Resilience = Adaptive capacity / Vulnerability
a. Examining how households are able to cope with these vulnerabilities and become resilient.
b. Those households that are able to bounce back to their condition in the pre-disaster period, or even to improve their situation, are considered resilient.
c. households who resume levels of income and production in a timely manner after the disaster period are considered resilient; in contrast, those households who are collapsing or recovering but worse off than previously may be considered not resilient.


g. Coastal infrastructure spatial planning
Kementerian pekerjaan umum dan perumahan rakyat


Kementerian pekerjaan umum dan perumahan rakyat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Helmi, M., Denny Nugroho and Rudhi Pribadi. 2019. Evaluasi dan Monitoring Rehabilitasi Kerusakan Pesisir Melalui Penggunaan Metode Hybrid Engineering. Pusat Unggulan Iptek (PUI) Pusat Kajian Mitigasi Bencana dan Rehabilitasi Pesisir (CoREM) Bekerjasama dengan Fakultas Perikanan dan Ilmu Kelautan Universitas Diponegoro
Ismanto, Ari. 2018. Kajian Perubahan Garis Pantai Akibat Proses Erosi Dan Evaluasi Bangunan Pantai Penangkap Sedimen Di Kecamatan Sayung, Demak. Disertasi. Fakultas Perikanan Dan Ilmu Kelautan Universitas Diponegoro
Kementerian pekerjaan umum dan perumahan rakyat. 2019. Pengelolaan Pantai BBWS Pemali Juana. Presented in UNDIP
Mahmood Riffat and A. Q. M. Mahbub. 2019. Building Vulnerable Islander Resilience to Natural Hazards: A Participatory Approach. © Springer International Publishing AG, part of Springer Nature 2018 W. Leal Filho (ed.), Handbook of Climate Change Resilience, https://doi.org/10.1007/978-3-319-71025-9_107-1
Ratna Sari Dewi and Wietske Bijker. 2019. Dynamics of shoreline changes in the coastal region of Sayung, Indonesia. The Egyptian Journal of Remote Sensing and Space Science. https://doi.org/10.1016/j.ejrs.2019.09.001


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Raden Roro Maria Immaculata Retno Susilowati, Desiana Vidayanti, Helmia Adita Fitra and Budi Santoso. 2019. Can We Adapt to Tidal Flooding? AIP Conference Proceedings 2114, 050010 (2019); https://doi.org/10.1063/1.5112454 Published Online: 28 June 2019
Sutrisno, Dewayany. 2014. Sea Level Rise And Its Impact On Rural Deltas: A Shoreline Retreat Approach. Lap Lambert Academic Publishing Company – Germany
Sutrisno D, M Darmawan and R Windiastuti. 2019. Water Change Detection and Its Effect on Land Value. The 4th International Conference of Indonesian Society for Remote Sensing. IOP Conf. Series: Earth and Environmental Science 280 (2019) 012041. doi:10.1088/1755-1315/280/1/012041
Yuwono B D, Y Prasetyo and L J F Islama. 2018. Investigation of Potential Landsubsidence using GNSS CORS UDIP and DInSAR Sayung, Demak, Indonesia. 2nd Geoplanning-International Conference on Geomatics and Planning IOP Publishing IOP Conf. Series: Earth and Environmental Science 123 (2018) 012005 doi: 10.1088/1755-1315/123/1/012005


The problems from the air


CBA2019-11SY-Sutrisno:
Integrated coastal landscape management: An adaptation related to climate change impact
Thank you very much for your attention

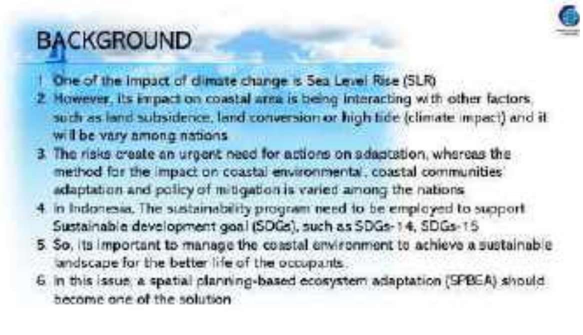
Appendix 3. Kick-off Meeting

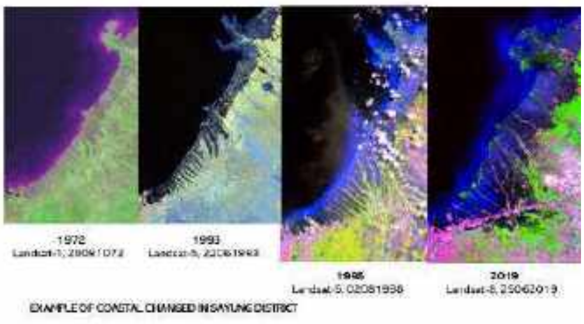
3.1. Kick-off Agenda

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

No.	Waktu	Kegiatan	Pelaksana
1	08.00 – 08.30	Registrasi Peserta	Panitia
2	08.30 – 09.00	Pembukaan dan Sambutan	1. Dekan Fakultas Perikanan dan Ilmu Kelautan, Universitas Diponegoro 2. Badan Informasi Geospasial
3	09.00 – 09.20	Spatial Planning Based-Ecosystem Adaptation: Concept and Planning	Prof. Dr. Dewayany Sutrisno, M.Appsc
4	09.20 – 09.40	Rencana Pembangunan Tol Tanggul Laut Semarang-Demak Provinsi JawaTengah	Dr. Prasetyo Aribowo, SH,MSoc,SC Kepala BAPPEDA Provinsi Jawa Tengah
5	09.40 – 10.00	Coffee break	Panitia
6	10.00 – 10.20	Integrated Coastal Zone Management (ICZM) di Pantura Propinsi Jawa Tengan Tahun 2019	Prof. Dr. Ir. Muhammad Zainuri, DEA
7	10.20 – 10.40	Integrated Coastal Zone Management: An Adaptation to Related Climate Change Impact. Case Study: Sayung District, Demak, Central Java	Dr. Muhammad Helmi S.Si. M.Si (Pusat Kajian Mitigasi Bencana dan Rehabilitasi Pesisir)
8	10.40 – 11.00	Analisis Parameter Oseanografi dan Mitigasi Bencana Kerusakan Pantai di Wilayah Pesisir	Prof. Dr. Denny Nugroho Sugianto, S.T., M.Si. Departemen Oseanografi, FPIK UNDIP
9	11.00 – 11.20	Rehabilitasi Berbasis Ekosistem Pesisir: Pembelajaran dari Lapangan	Eko Budi Priyanto (Wetland International)
10	11.20 – 11.40	Pendekatan Spasial Kawasan Raja Ampat: Trade-off antara fungsi budidaya dan lindung	Dr.rer.nat., Ir. Wisnu Pradoto, M.Sc. (Perencanaan Wilayah dan Kota undip)
11	11.40 – 12.30	Resume dan Diskusi	Moderator: Dr. Ir. Kunarso, M.Si. Prof. Dr. Dewayany Sutrisno, M.Appsc
12	12.30 - 12.40	Penutupan	Prof. Dr. Denny Nugroho Sugianto, S.T., M.Si. Departemen Oseanografi, FPIK UNDIP

3.2. Presentation 1

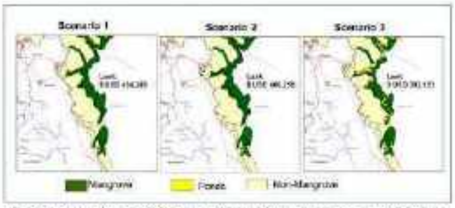




What we have learnt

1. Protection of the coastal ecosystem is important
2. All scientists propose the mangrove ecosystem as the important part for coastal protection
3. Some countries such as China do no allowed any activities in the mangrove area
4. Malaysia, Vietnam and Thailand still open for ecotourism and marine culture within the mangrove ecosystem
5. How the coastal protection has been done to face the problems of Climate change impact
   1. Malaysia
      1. developed hybrid of hard and soft engineering for mangrove protection and rehabilitation
      2. The development technology are wave breaker coral reef restoration (WABCORE) and hydrochossic porous breakwater system
   2. Vietnam: adopted a " city as a sponge" strategy such as in Vin city
   3. Bangladesh : similar case with Indonesia
   4. China: mangrove and coastal ecosystem are protected, also adopted the " city as a sponge" strategy, for example in Shanghai
   5. Indonesia: what the best for us is the coastal protection and the socio- welfare through marine culture??

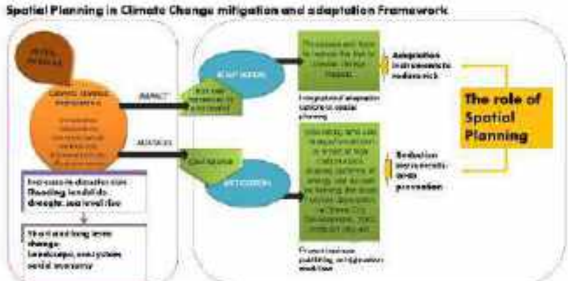
Benefit of silvo-fisheries



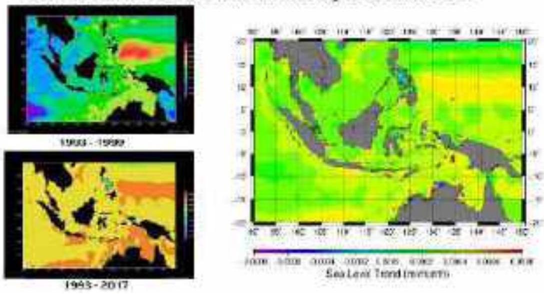
The scenarios that was developed for this assessments: (1) the scenario of silvo-fisheries with only 7 % of the mangrove can be utilized for shrimp ponds industry, (2) the scenario of conservation zone and (3) the scenario of 40 % of the area for shrimp pond industry. The result indicates the economic benefit as much as USD 434,289/ year for scenario 1 (Sutrisno et al, 2007)

RESEARCH

Spatial Planning in Climate Change mitigation and adaptation Framework



SEA LEVEL RISE, satellite altimetry Based model



Online application for sustainable planning for sea weed culture has been developed See : Sutrisno et al. 2017. The development of spatial decision support system tool for marine spatial planning. International Journal Of Digital Earth. Vol 11 (9): 863-879. dx.doi.org/10.1080/17538947.2017.1363825

Methodology and Work Plan

Activity-2 the training for the young scientists on the practical ways of integrated coastal SPBEA

For selected Southeast Asia young scientists

Lecture and in-class discussion, in-class practicing and field-practicing

Activity-3 the local community participatory workshop

Sharing knowledge in how to maintain their coastal fish farming through an ecosystem-based approach will be learned and practiced by the locals

Activity – 4 Development of the integrated coastal SPBEA prototype.

Methodology and Work Plan

Activity – 4 Development of the integrated coastal SPBEA prototype.

Activity – 5. Evaluation and monitoring of the project will be held through FGDs, field check and communication with participants.

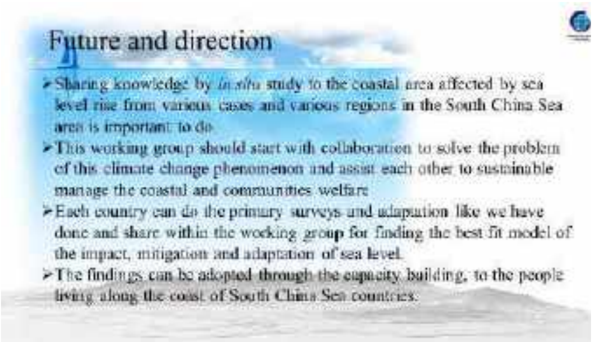
Activity- 6 Report and publication.

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 SPBE as the adaptation Strategies

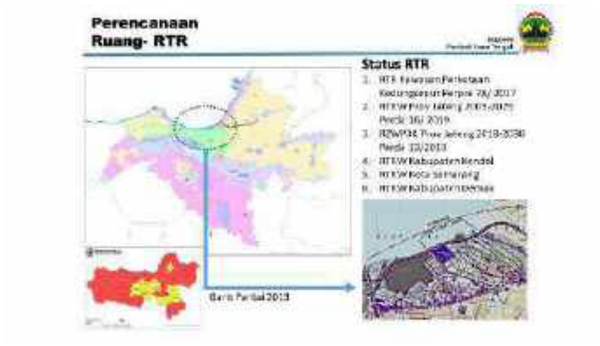

SOUTH CHINA SEA WORKING GROUP
Evaluation and Future Direction of the Technical Working Group on "The Study of Tides and Sea Level Change and Their Impacts on Coastal Environment in the South China Sea as Affected by Potential Climate Change"
Geospatial Information Agency of Indonesia
Ministry of Foreign Affair, Republic of Indonesia


Future and direction
➢ The working group has been discussing and sharing the research on the sea level rise model, the sea level rise impact on coastal environment and communities, the dynamic change of tidal, adaptation and mitigation to the sea level change, tidal dynamic and other related study to the climate change.
➢ However, an action regarding the extent to which the mitigation and adaptation model can be adopted by South China Sea members are still questionable.
➢ Therefore, knowledges of physical environment, social and economic impact as part of developing the mitigation and adaptation strategies can be shared among South China Sea regions' member.


Future and direction
➢ Sharing knowledge by in situ study to the coastal area affected by sea level rise from various cases and various regions in the South China Sea area is important to do.
➢ This working group should start with collaboration to solve the problem of this climate change phenomenon and assist each other to sustainable manage the coastal and communities welfare
➢ Each country can do the primary surveys 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 findings can be adopted through the capacity building, to the people living along the coast of South China Sea countries.

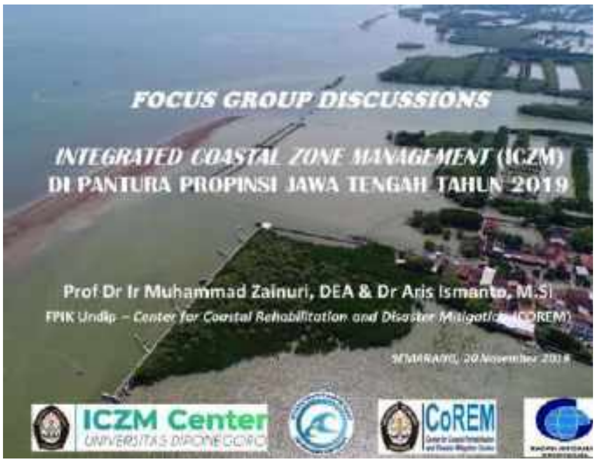

APN
UTM
THANK YOU

3.3. Presentation 2



Terima
Kasih

3.4. Presentation 3



SEMARANG 20 November2019

- Permasalahan :

1. Degradasi kondisi alam : abrasi, akresi, sedimentasi > Rob, *Land Subsidence, Sea Level Rise*
2. Penurunan Daerah Lindung yang tidak sesuai dengan Tata Ruang
3. Kebutuhan 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

SEMARANG 20 November 2019

- Wilayah Pesisir :

1. Garis Pantai > 12 Mil > Kewenangan
2. Ketetapan Peraturan dan Peruntukkannya
3. Perubahan Peruntukan pada Suatu Wilayah
4. Prioritas – prioritas peruntukkan tidak menimbulkan Tumpang Tindih Kebijakan / Peraturan

- Tantangan :

1. Koordinat
2. Ruang
3. Kebutuhan

→ Boleh, Tidak Boleh, Boleh Dengan Syarat

SEMARANG 20 November 2019

- Wilayah Pesisir :

1. Pantura Barat, *Coastal Cell* 5
2. Batas Wilayah > Pertimbangan Ekosistem
3. Pertimbangan Keterpaduan *Coastal Cell* dan *Watershed Cell*
4. Pendekatan Aspek Biologis, Ekologi, Biofisik dan Anthroposentris (SDM, Pengguna, Perusak)

- Tantangan :

1. Wilayah Pantai > Dumping Waste
2. Pembangunan/ Pengembangan / Bangunan Pantai
3. Perubahan Garis Pantai

→ Tingkah Laku dan Fungsionalisasi Ekologis

PERUMUSAN
FOCUS GROUP DISCUSSIONS

INTEGRATED COASTAL ZONE MANAGEMENT **(ICZM) DI PANTURA PROPINSI JAWA TENGAH TAHUN 2019**

PERENCANAAN

1. Analisis Luasan dan Daya Dukung Lingkungan
2. Analisis Potensi dan Nilai Tambah
3. Analisis Sosial dan Keberpihakan Partisipasi Masyarakat (Anthroposentris)
4. Sinergitas Kelembagaan
5. Proporsionalitas Peraturan dan Kebijakan Lembaga Pengelola

PERUMUSAN
FOCUS GROUP DISCUSSIONS

INTEGRATED COASTAL ZONE MANAGEMENT **(ICZM) DI PANTURA PROPINSI JAWA TENGAH TAHUN 2019**

IMPLEMENTASI

1. Kebijakan Penetapan Zonasi dan Tata Ruang untuk Luasan dan Daya Dukung Lingkungan serta Peruntukannya
2. *Coverage* / Kemampuan Penutupan Kebutuhan dan Keuntungan dalam Pengelolaan Jangka Panjang
3. Kebijakan Kependudukan dan Partisipatif SDM
4. Penetapan Kesepakatan Antar Lembaga agar tidak terjadi Tumpang Tindih Kebijakan

PERUMUSAN
FOCUS GROUP DISCUSSIONS

***INTEGRATED COASTAL ZONE MANAGEMENT* (ICZM) DI PANTURA PROPINSI JAWA TENGAH TAHUN 2019**

MONITORING

1. BAPPEDA dan Pemda melakukan Pengawasan terhadap Kepatuhan Zonasi dan Tata Ruang untuk Luasan 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

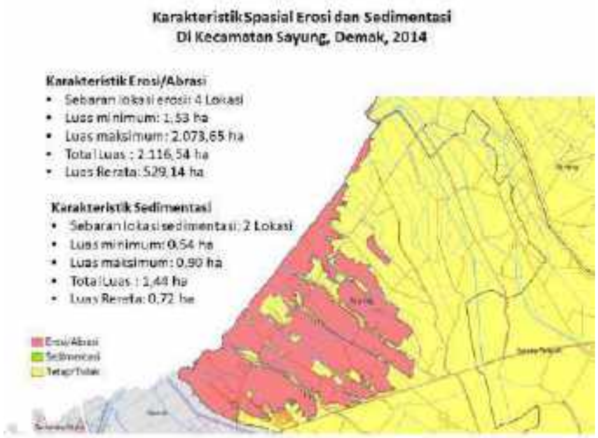
PERUMUSAN
FOCUS GROUP DISCUSSIONS

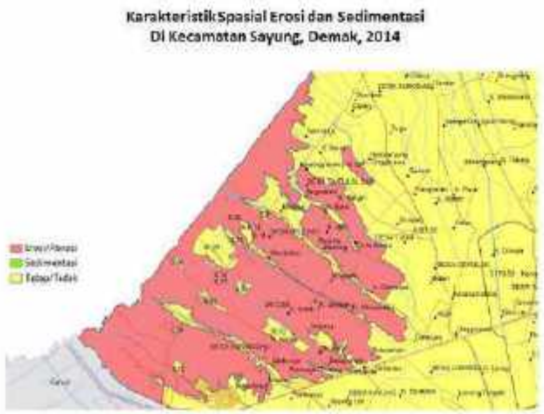
***INTEGRATED COASTAL ZONE MANAGEMENT* (ICZM) DI PANTURA PROPINSI JAWA TENGAH TAHUN 2019**

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

3.5. Presentation 4





Laju Penurunan Muka Tanah dan SLR, Desa Bedono, Demak 2012

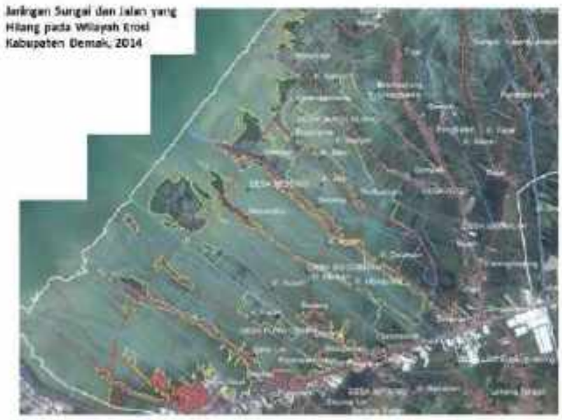
Laju Penurunan Muka Tanah dan SLR, Desa Bedono, Demak 2012 - 2018

Erosi Terkini 2014 Sebagian Kabupaten Demak

Land Subsidence and Tidal Flood Inundation at Sayung, Demak 2017

Land Subsidence and Tidal Flood Inundation at Sayung, Demak 2019

Jaringan Sungai dan Jalan yang Hilang pada Wilayah Erosi Kabupaten Demak, 2014



Detail Kondisi Pesisir di Wilayah Erosi, 2014

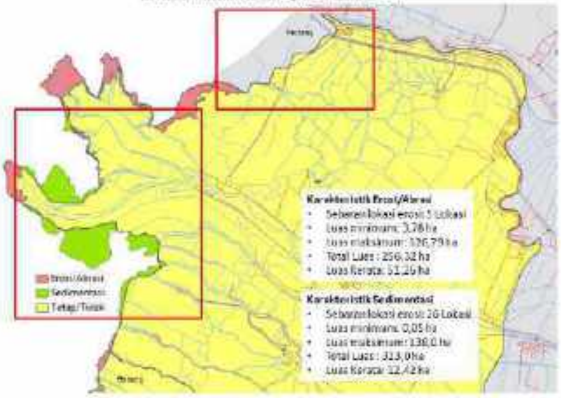
Detail Kondisi Pesisir di Wilayah Erosi, 2014

Detail Kondisi Pesisir di Wilayah Erosi, 2014

Detail Kondisi Pesisir di Wilayah Erosi, 2014

Detail Kondisi Pesisir di Wilayah Erosi, 2014

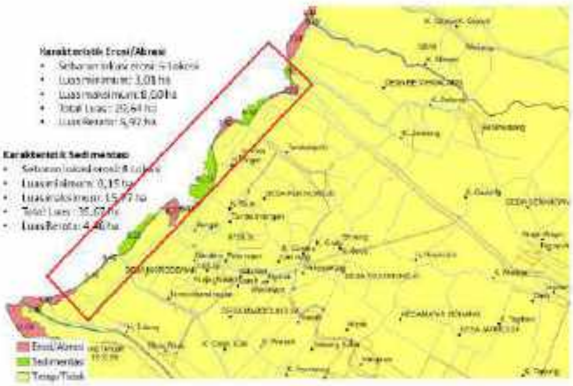
Peta Sebaran Wilayah Erosi dan Sedimentasi Di Kecamatan Wedung, Demak, 2014



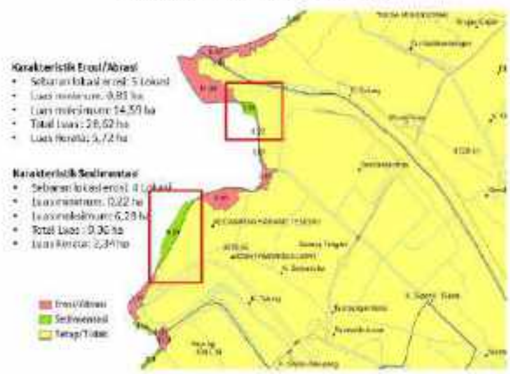
Detail Ares Sedimentasi di Perbatasan (Potensi Konflik pada RZWP3K) Kabupaten Demak dan Jepara, 2014

Kondisi Erosi dan Sedimentasi di Sekitar Delta Wulan Kabupaten Demak dan Jepara, 2014

Peta Sebaran Wilayah Erosi dan Sedimentasi Di Kecamatan Bonang, Demak, 2014



Peta Sebaran Wilayah Erosi dan Sedimentasi Di Kecamatan Karang Tengah, Demak, 2014



Siapa Status Pemilik Tanah Timbul Di Pesisir?

Status Tanah Timbul

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

"Tanah yang berasal dari tanah timbul atau hasil reklamasi di wilayah perairan pantai, pasang surut, rawa, danau dan bekas sungai dikuasai langsung oleh negara".

Surat Menteri Agraria/Kepala BPN No. 410-1293, tanggal 9 Mei 1996:

"Tanah-tanah timbul secara alami seperti delta, tanah pantai, tepi danau/situ, endapan tepi sungai, pulau timbul dan tanah timbul secara alami lainnya dinyatakan sebagai tanah yang langsung dikuasai oleh negara".

Teknik Pemetaan Tanah Tanah Timbul pada Kondisi Surut Kecamatan Sayung, 2013

Area Tanah Timbul Potensi Rehabilitasi

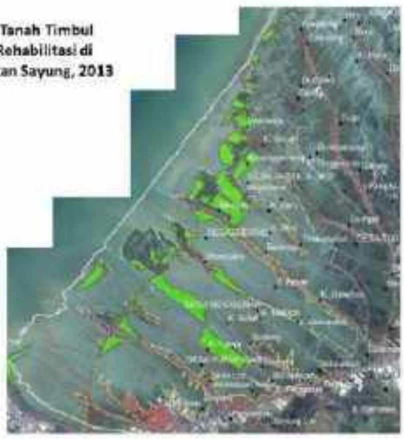
Kriteria penetuan area tanah timbul potensi rehabilitasi "mangrove":

1. Daerah erosi/sedimentasi
2. Terbentuk anah timbul
3. Enclave pada area mangrove
4. Wilayah di sekeliling mangrove
5. Jenis substrat dasar lumpur berpasir
6. Terlindung dari secara langsung gelombang

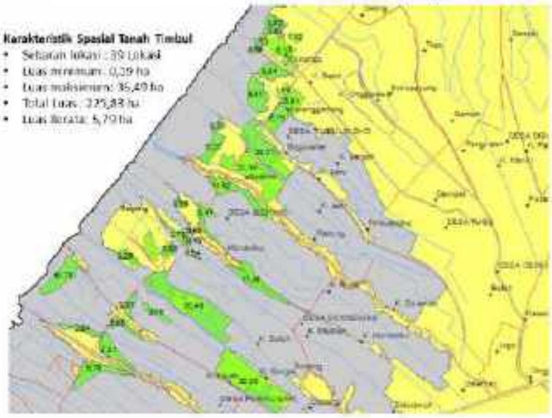
Tanah Timbul dpada Kondisi Surut di Kecamatan Sayung, 2013

Tanah Timbul pada Kondisi Surut di Kecamatan Sayung, 2013

Sebaran Tanah Timbul Potensi Rehabilitasi di Kecamatan Sayung, 2013



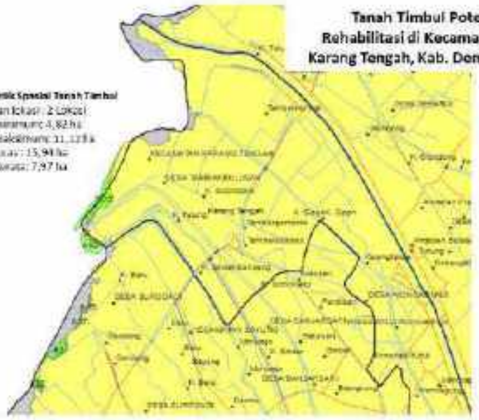
Tanah Timbul Potensi Rehabilitasi di Kecamatan Sayung, Kab. Demak



Tanah Timbul Potensi Rehabilitasi di Kecamatan Wedung, Kab. Demak

Karakteristik Spasial Tanah Timbul
- Sebaran lokasi : 9 Lokasi
- Luas minimum: 2,53 ha
- Luas maksimum: 70,68 ha
- Total Luas : 213,86 ha
- Luas Rerata: 23,76 ha

Tanah Timbul Potensi Rehabilitasi di Kecamatan Karang Tengah, Kab. Demak



Karakteristik Spasial Tanah Timbul
- Sebaran lokasi : 2 Lokasi
- Luas minimum: 4,82 ha
- Luas maksimum: 11,12 ha
- Total Luas : 15,94 ha
- Luas Rerata: 7,97 ha

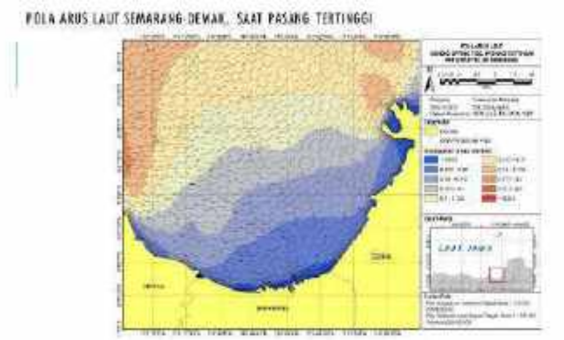
Sebaran Tanah Timbul pada di Kecamatan Karang Tengah, 2013

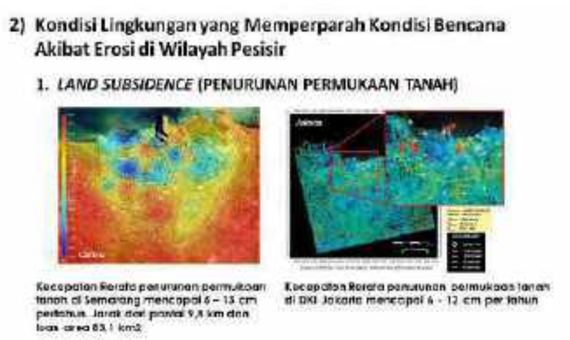
Tanah Timbul Potensi Rehabilitasi di Kecamatan Bonang, Kab. Demak

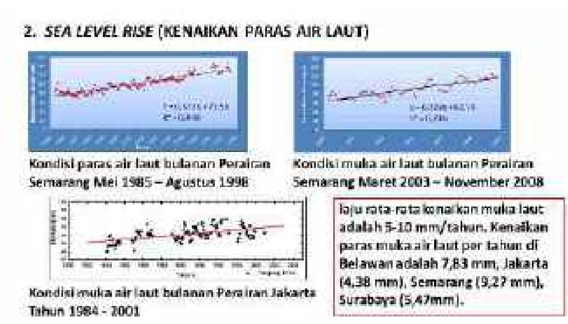
Karakteristik Spasial Tanah Timbul
- Sebaran lokasi : 6 Lokasi
- Luas minimum: 0,19 ha
- Luas maksimum: 4,30 ha
- Total Luas : 11,33 ha
- Luas Rerata: 1,89 ha

Terimakasih

3.6. Presentation 5







Hasil analisa model matematik Erosi dan Akresi pada setiap musim

No.	Musim	Akresi (m³)	Erosi (m³)	Netral
1	Barat	23,182	56,192	(+)
2	Peralihan I	35,907	178,403	(+)
3	Timur	803	87,007	(-)
4	Peralihan II	16,660	9,584	(-)
	Jumlah (m³/tahun)	74,552	137,904	(+)

(+) = ke kanan
(-) = ke kiri

No	Sumber (Source)	M. Barat	M. Peralihan	M. Timur	M. Peralihan 2
1	Sungai	28.356 m³	21.819 m³	86 m³	7.969 m³
2	Laut	2.393 m³	2.195 m³	2.195 m³	2.659 m³
No	Sink				
1	Offshore	16,31 m³	14,96 m³	14,96 m³	18,12 m³
2	Longshore	24.934 m³	161.432 m³	92.219 m³	756 m³

Proses Pembangunan Pelindung Pantai di Kab. Demak
Yang melibatkan partisipasi masyarakat lokal

Sabuk Pantai di Kec. Sayung (Desa Timbulsloko), August – Sept 2013

Sisi sebelah Selatan Sabuk Pantai Laut dengan kedalaman 1 meter

Sisi sebelah Utara Sabuk Pantai Laut dengan kedalaman 1 meter

Pembangunan Pelindung Pantai yang dikombinasikan dengan Rehabilitasi Pesisir Penanaman Mangrove

Pemukiman Penduduk Banyak yang terselamatkan

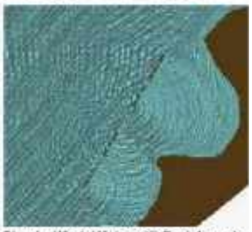
REKOMENDASI TINDAK LANJUT PENANGANAN KERUSAKAN PANTAI DENGAN PELINDUNG PANTAI (*COASTAL PROTECTION*)

Penanganan Menyeluruh dengan Pendekatan *Coastal Cell*

Hasil Pemodelan Oseanografi Gelombang Laut Untuk Penentuan Tata Letak Bangunan Pelindung Pantai

Kemampuan struktur *hybrid* dalam meredam gelombang, berdasarkan model matematik hidrodinamika diperoleh nilai efesiensi yang kecil

Sehingga penempatannya jangan berhadapan langsung dengan gelombang

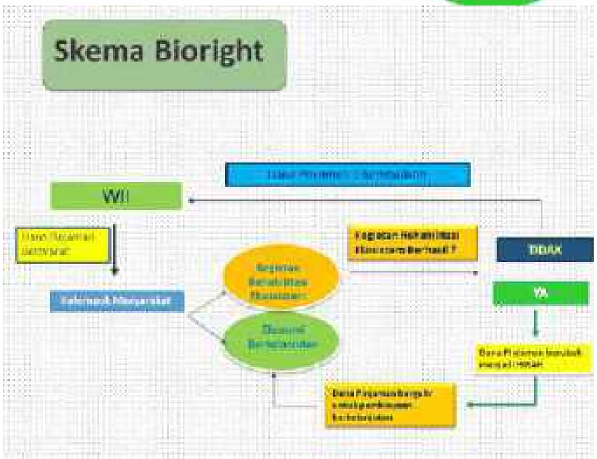


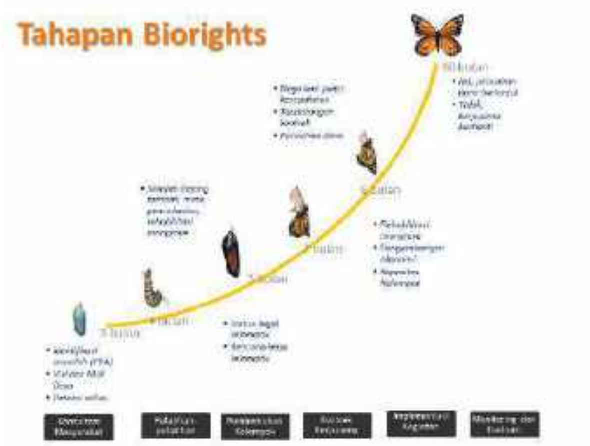
Simulasi Model Matematik Penjalaran dan Peredaman Gelombang di Sekitar Struktur Hybrid di Perairan Desa Timbulsloko Kab. Demak

TERIMA KASIH

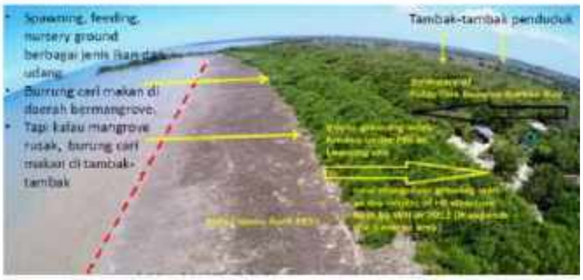
dennysugianto@live.undip.ac.id
08157649229
2019

3.7. Presentation 6

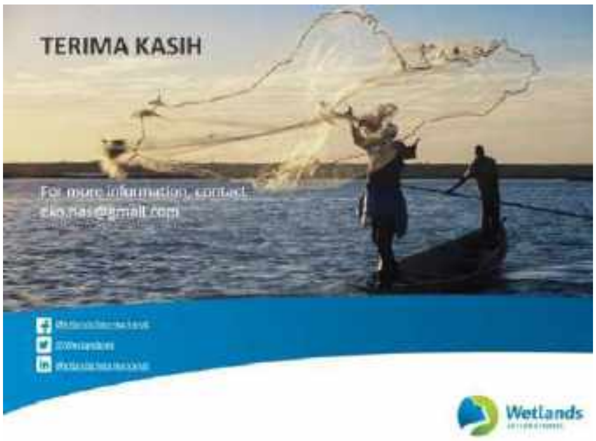




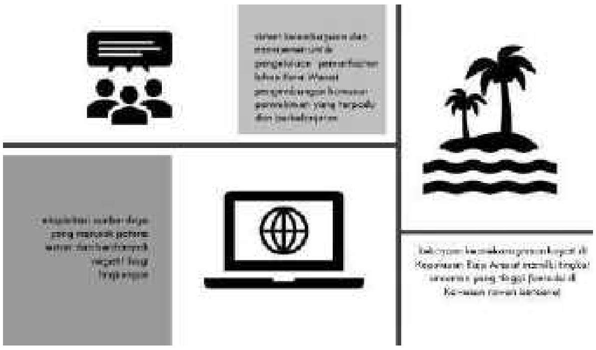
Penampakan Pantai Pulau Dua Setelah dilakukan perangkap sedimen dengan jaring dan karung berisikan pasir.




Mix Mangrove Aquaculture (MMA)
Februari 2018
Maret 2018
Oktober 2018
Januari 2019
Juni 2019


TERIMA KASIH
For more information, contact:
Wetlands

3.8. Presentation 7




tujuan, kebijakan dan strategi
1
Kawasan Raja Ampat sebagai
pusat konservasi terumbu karang dan nursery ground perikanan
perlindungan kawasan keanekaragaman hayati
pengembangan kawasan budidaya perikanan
menjaga keanekaragaman hayati laut beserta ekosistemnya
melestarikan dan merehabilitasi kawasan konservasi laut dan darat
menetapkan delineasi dan zonasi ruang


tujuan, kebijakan dan strategi
2
Kawasan Konservasi Keanekaragaman Hayati Raja Ampat
sebagai destinasi pariwisata dan pusat pengembangan kegiatan perikanan
untuk meningkatkan kesejahteraan Masyarakat
pengembangan kawasan pariwisata dengan memperhatikan daya dukung kawasan berbasis mitigasi bencana
pengembangan kegiatan perikanan secara berkelanjutan
mengembangkan pusat pelayanan kegiatan pariwisata
mengembangkan pusat pelayanan kegiatan perikanan
mengembangkan kegiatan usaha perikanan berbasis Masyarakat
mengembangkan sistem prasarana dan sarana dasar kegiatan pariwisata yang ramah lingkungan
mengembangkan sistem prasarana dan sarana dasar kegiatan perikanan yang ramah lingkungan

Appendix 4. List of Participants

4.1 List of Online participants

No	Name	E-Mail	Affilation	Country
1	NHIEP Seila	Seilanhiep@Gmail.Com	Parliamentary Institute of Cambodia	Cambodia
2	Hamadou Alioum	Hamadoualioum151@Gmail.Com	UNDIP	Cameroon
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11	Nurul Ihsan Fawzi	Ihsan@Tayjuhanafoundation.Org	Tay Juhana Foundation	Indonesia
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15	Dhika Rino Pratama	Dhika.Pratama@Ykan.Or.Id	Yayasan Konservasi Alam Nusantara	Indonesia
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18	Feri Nugroho	Feri@Itkj.Ac.Id	Jakarta Global University	Indonesia
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21	Nisa Zafirah	Nisazafr@Gmail.Com	Institut Teknologi Bandung	Indonesia
22	Ati Rahadiati	Arahadiati@Gmail.Com	Badan Informasi Geospasial	Indonesia
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24	Jaka Suryanta	Jakaeriko@Gmail.Com	BIG	Indonesia
25	Zilda Dona Okta Permata, S.PWK	Zilda.Dona@Bppt.Go.Id	Pusat Teknologi Pengembangan Sumberdaya Wilayah - BPPT	Indonesia
26	Maslahatun Nashiha	Ika.Nashiha@Gmail.Com	BIG	Indonesia
27	Sri Lestari Munajati	Lestari.Munajari@Gmail.Com	Geospatial Information Authority Of Republic Of Indonesia (BIG)	Indonesia
28	Mohammad Rohmaneo Darminto	Rohmaneo@Its.Ac.Id	Institut Teknologi Sepuluh Nopember	Indonesia
29	Amandangi Wahyuning Hastuti	Amandangi.Wahyuning@Gmail.Com	Institute for Marine Research and Observation	Indonesia
30	Risa Krisadhi	Risakrisadhi@Gmail.Com	Badan Informasi Geospasial	Indonesia
31	Muhammad Pramulya	Muhammad.Pramulya@Faperta.Untan.Ac.Id	Tanjungpura University	Indonesia
32	Ayi Priana	Ayipriana@Mail.Ugm.Ac.Id	Universitas Gadjah Mada	Indonesia
33	Munawaroh	Munawaroh@Big.Go.Id	Badan Informasi Geospasial	Indonesia

No	Name	E-Mail	Affilation	Country
34	Lestari Lakhsmi Widowati	Rrwidowati@Yahoo.Com	Diponegoro University	Indonesia
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39	Afdal Ziqri	Afdalziqri98@Gmail.Com	IPB University	Indonesia
40	Cindy Claudea Hanami	Cicindy.Ami@Gmail.Com	Bengkulu University	Indonesia
41	Tri Atmaja	Atmaja@Env.T.U-Tokyo.Ac.Jp	The University of Tokyo	Japan
42	Ayin Tamondong	ayintamondong@gmail.com	Tokyo Institute of Technology	Japan
43	Andriamamapionona Lalaina Tienh	Tienhlai@Gmail.Com	Doktor Ilmu Sosial Undip	Madagascar
44	Rasolonjatovo Faniry Fanilo Fanantenana Valisoa Fihobiana	Rasolonjatovofaniry@Gmail.Com	Student	Madagascar
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49	Si Thu Min	Sithumin.Geog.1@Gmail.Com	Department of Geography, University Of Mandalay	Myanmar
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51	Yin Yin Aye	Yinyinaye7741@Gmail.Com	Student	Myanmar
52	Su Lat Phyu	engr.sulatphyu@gmail.com	Mandalay Technology University	Myanmar
53	Jenefer P. Calipusan	Jenefer.Calipusan@Msumain.Edu.Ph	Academe	PHILIPPINES
54	Joren Mundane A. Pacaldo	Jorenmundane.Pacaldo@Gmail.Com	MSU	Philippines
55	Edgardo G. Macatulad	Egmacatulad@Up.Edu.Ph	University of The Philippines	Philippines
56	Roseanne Ramos	Rvramos@Up.Edu.Ph	University of The Philippines-Department of Geodetic Engineering	Philippines
57	Michael Cobilla	Michael.Cobilla@Bicol-U.Edu.Ph	Bicol University	Philippines
58	Alexander Paza MAKINI	Alex.Makini@Sinu.Edu.Sb	Education	Solomon Islands
59	Freddy Ratusaenile	Freddy.Ratusaenile@Sinu.Edu.Sb	Solomon Island National University	Solomon Islands
60	Ravi Shankar Pandey	Babaravi1988works@Gmail.Com	National Central University	Taiwan
61	Babucarr Jassey	Baxjas@Students.Undip.Ac.Id	Diponegoro University	The Gambia
62	Lamin Rene Loua	Reneloua1@Gmail.Com	UNDIP	The Gambia
63	Augusto Almeida Da Silva	Augusto250992@Gmail.Com	Postgraduate of Environmental Science At Diponegoro University	Timor Leste
64	Custodio Assis Correia Ximenes	Custodioassis230119@Gmail.Com	Diponegoro University Semarang	Timor Leste
65	Delio Da Costa	Deliodacosta15@Gmail.Com	Diponegoro University	Timor Leste
66	Saturnina Maia Da Silva	Maia.Silvalina24@Gmail.Com	Julio Da Silva And Domingas Pereira	Timor Leste
67	Mariana Da Costa Pereira	Marianapereiradacosta753@Gmail.Com	Universitas Diponegoro	Timor-Leste
68	Marciano Borges Ximenes	Marcianoborgesximenes@Gmail.Com	Universitas Diponegoro Semarang, Indonesia	Timor-Leste

No	Name	E-Mail	Affilation	Country
69	Miquel Garcia	Miquel.Garcia284@We.Utt.Edu.Tt	University of Trinidad And Tobago	Trinidad & Tobago
70	Vo Trong Hoang	Hoang.Cli85@Gmail.Com	National Central University	Vietnam
71	Pham Tran Dinh Nho	nhoptdn.gis133@gmail.com	Independent Institute for Environmental Issues	Viernam

Appendix 5. Training and Workshop Agenda

5.1. Training Agenda

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

Time		Topics	Facilitators
Sunday14/02/2021			
16.00 - 20.00	pm	Registration & health security checked documents for offline trainees	Committee
Monday15/02/2021			
10.00 – 12.00	pm	Medical checked for the committee and offline trainees	Committee
12.00 – 13.00	Pm	- Registration for offline and online Virtual meeting room is opened - Lunch	Committee
13.00 - 13.30	pm	Opening ceremony	
13.00 - 13.05	pm	Training report	Training Proponent
13.05 – 13.15	pm	Welcome address	**Dr. Agustan** - The president of ISRS
13.15 – 13.20	pm	Forewords	**Dr. Suprajaka** - Director of Research, Promotion &Cooperation, BIG
13.20 – 13.30	pm	Opening remark & Opening of the training	**Prof. Dr. Tri Winarni Agustini, M.Sc.** Dean of Faculty of Fisheries and Marine Sciences, Diponegoro University.
13.30 – 14.30	pm	The significant impact of climate change-based and hydrological disasters to the coastal area: A case of Semarang, Demak, and Pekalongan, Central Java, Indonesia	**Dr. Muhammad Helmi** - Diponegoro University
14.30 – 15.30	pm	Practicing the impact of climate change on the coastal area	**Dr. Aslan** - SEAMEO Biotrop
15.30 – 16.00		Coffee break	
16.00 - 18.00	pm	Climate Change Impact Assessment for Sayung Sub District coastal using Coastal Vulnerability Index (CVI)	**Armaiki Yusmur** – SEAMEO Biotrop
Tuesday16/02/2021			
08.00 - 08.30	am	- Fill in the Attendees' list for both online and offline trainees - The virtual meeting room is opened	Committee
08.30 - 10.00	Am	- Theory and concept of coastal ecosystem functions and services - The concept for RS and geospatial application for disaster mitigation	**Prof. Dr. Mazlan Hashim** - Universiti Teknologi Malaysia
10.00 - 11.00	am	The use of social sensing data to track human behaviour and public concerns	**Prof. Dr. Zhang Li & Dr. Bowei Chen** – China Academy of Science
11.00 - 13.00	pm	Practice: RS data analysis using R for disaster mitigation	**Dr. Bowei Chen** - China Academy of Science
13.00 - 14.00	pm	Lunch for online and offline participants	

14.00 - 16.00	pm	Practice: RS data analysis using R for disaster mitigation	Dr. Bowei Chen
Wednesday, 17/02/2021			
08.00 - 08.30	am	- Fill in the Attendees' list for both online and offline trainees - The virtual meeting room is opened	Committee
08.30 - 09.00	am	Virtual field trip to the study area & QA	Committee
09.00 - 10.00	am	Spatial data acquisition using UAVs and its processing	**Prof. Dr. Rongjun Qin** - Ohio State University
10.00 - 11.00	am	GCPs and photogrammetry for big-scale mapping	**Prof. Peter Tian-Yuan Shih** - National Ciao Tung University, Taiwan
11.00 - 13.00	pm	Practicing: Big Scale Mapping	**Dr. Xiao Ling,** **Mr. Mostafa Elhashash** - Ohio State University
13.00 - 14.00	pm	Lunch for online and offline participants	
14.00 - 16.00	pm	Practicing: Big Scale Mapping	**Dr. Xiao Ling,** **Mr. Mostafa Elhashash** - Ohio State University
Thursday, 18/02/2021			
08.00 - 08.30	am	- Fill in the Attendees' list for both online and offline trainees - The virtual meeting room is opened - fill in health security form for offline trainees	Committee
08.30 - 09.30	am	Theory and concept of integration coastal and land spatial planning	**Dr. Mulyanto Darmawan** – Geospatial center of excellent, BIG
09.30 - 10.30	am	Spatial planning-based ecosystem adaptation	**Prof. Dr. Dewayany Sutrisno, M.AppSc** - ISRS/ Geospatial center of excellent BIG
10.30 - 11.30	am	Sustainable Coastal Aquaculture: Mangrove Aquaculture (AMA), Low External Input for Sustainable Aquaculture (LEISA), Integrated Multi Trophic Aquaculture (IMTA).	**Prof.Dr. Sri Rejeki** - Diponegoro University
11.30 - 13.00	pm	-Practising SPBEA	**Dr. Ati Rahadiati Lalitya Narieswari** - Geospatial center of excellent BIG
13.30 - 14.00	pm	Lunch for online and offline participants	
14.00 - 16.00	pm	Practicing SPBEA	**Dr. Ati Rahadiati Lalitya Narieswari** - Geospatial center of excellent BIG
16.00 - 19.00	pm	Preparation for presentation	All trainees (work will be done offline)
Friday,19.02/2021			

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

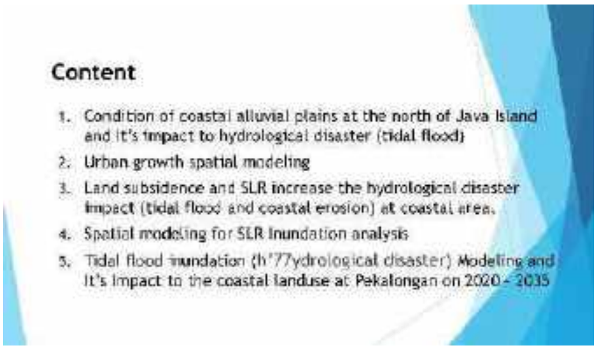
**At West Indonesian Time (WIB)*

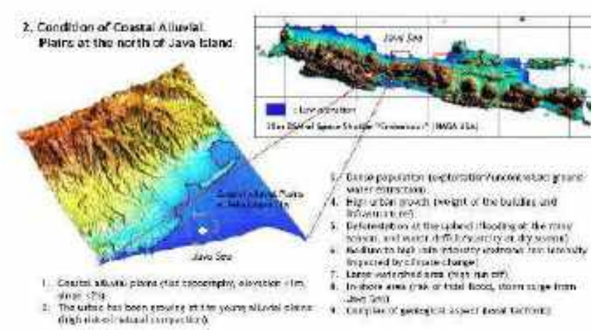
***Venue Surodadi Village, Sayung Subdistrict, Demak - Indonesia*

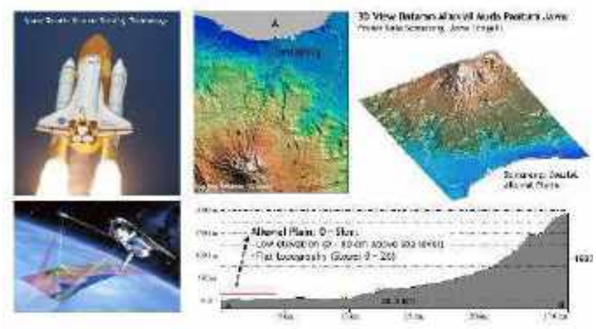
Time		Topics	Facilitators
Saturday 20/02/2021			
07.00 - 09.00	am	Travel to Surodadi Village	Committee
09.00 – 10.00	Am	- opening and delivery of seeds - spread fish seeds by each group member	Committee
10.00 – 12.00		SPBEA workshop group -1	**Dr. Mulyanto Darmawan** – Geospatial center of excellent,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

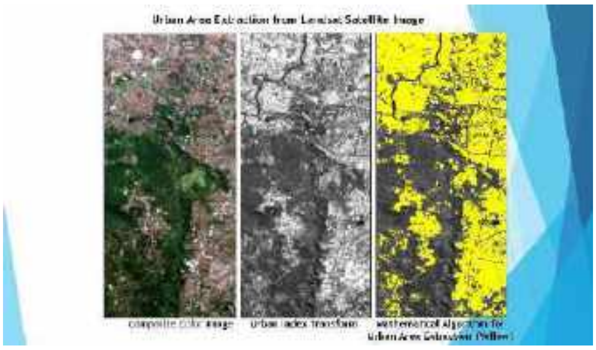
Appendix 6. Training material

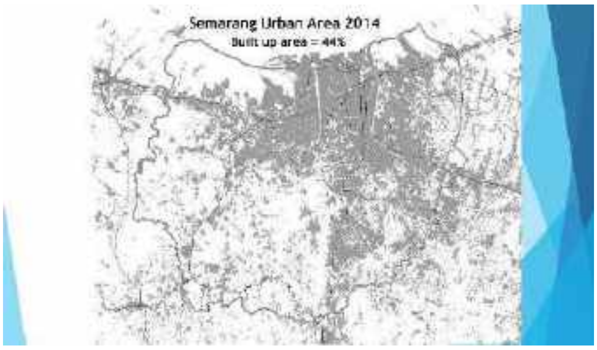
6.1. Day 1, Lecture 1: Dr. Muhammad Helmi

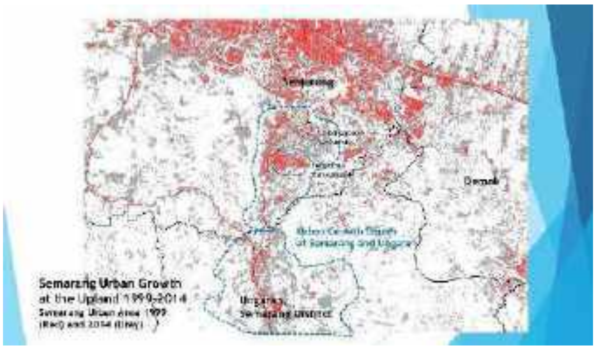


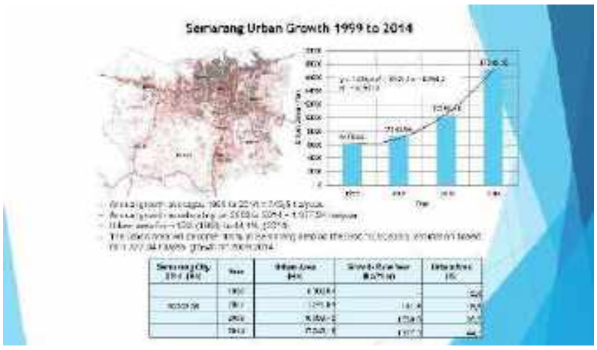


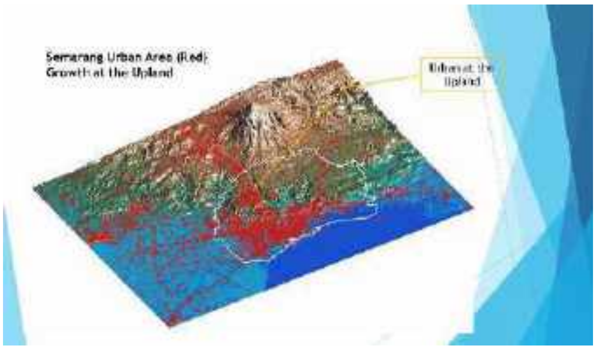







Semarang
Demak
Semarang Urban Growth at the Upland 1999-2014


Semarang Urban Growth 1999 to 2014

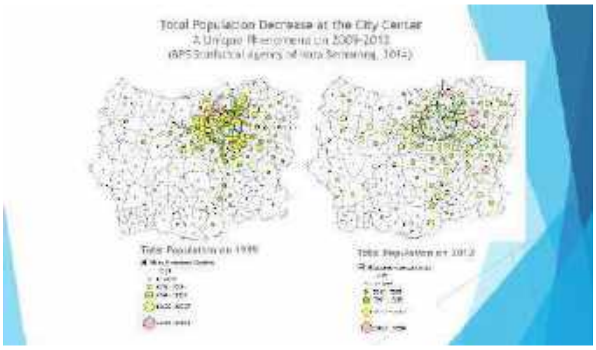

Semarang Urban Area (Red) Growth at the Upland


Land Subsidence and Land Inundation at Tugu, Semarang

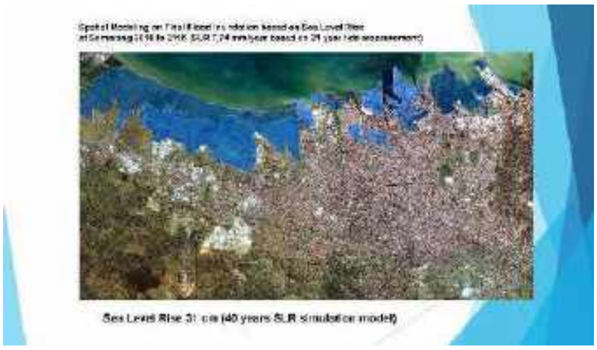

Land Subsidence and Inundation at Sayung Sub-District, Demak 2017

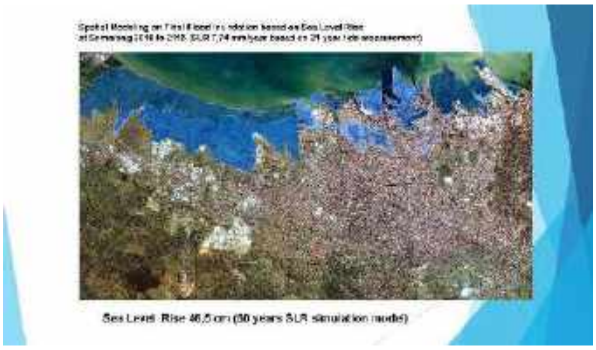

Land subsidence and Coastal Inundation and Erosion 1991 to 2014 at Sayung, Demak
Inundation and coastal erosion area:

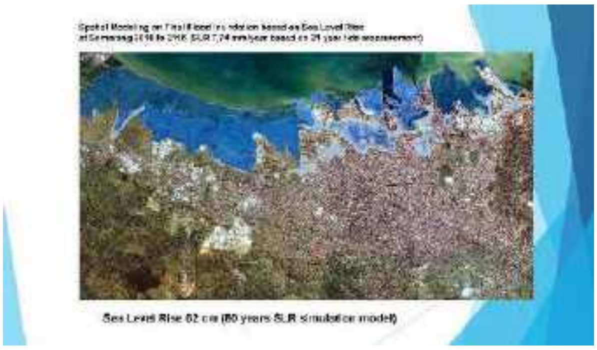

Mangrove Spreading around the Settlement


Total Population Decrease at the City Center

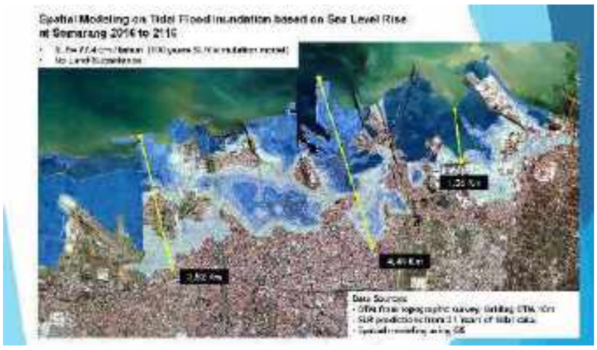

Sea Level Rise 15,5 cm (20 years SLR simulation model)

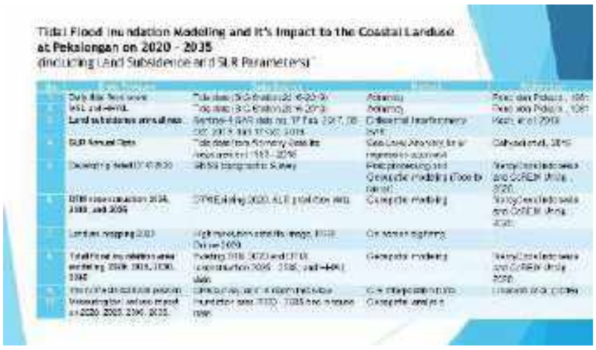

Sea Level Rise 31 cm (40 years SLR simulation model)

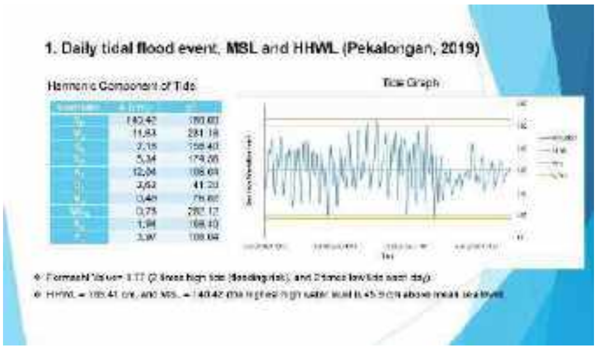

Sea Level Rise 46,5 cm (60 years SLR simulation model)


Sea Level Rise 62 cm (80 years SLR simulation model)

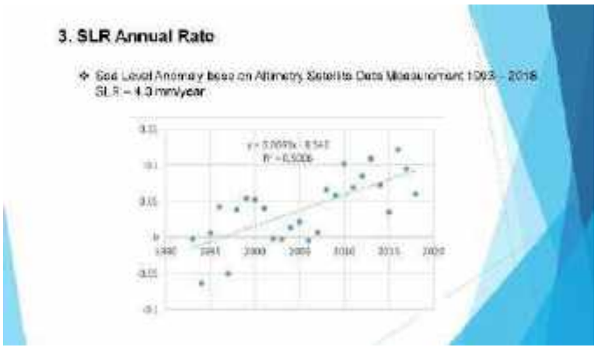

Sea Level Rise 77,4 cm (100 years SLR simulation model)


Spatial Modeling on Tidal Flood Inundation based on Sea Level Rise at Semarang 2016 to 2116

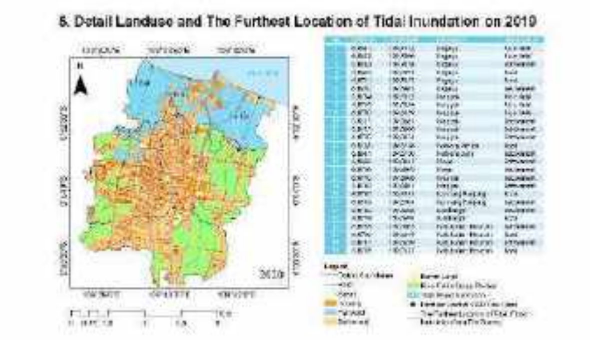

Tidal Flood Inundation Modelling and It's Impact to the Coastal Landuse at Pekalongan on 2020 - 2035
(including Land Subsidence and SLR Parameters)

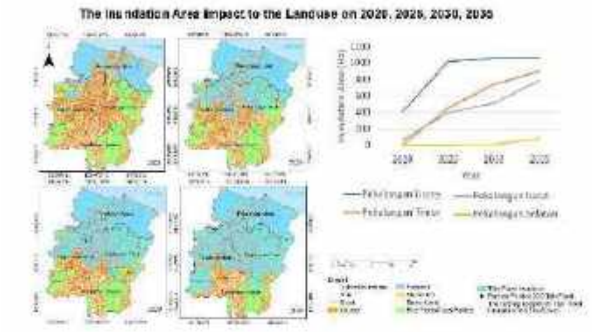

1. Daily tidal flood event, MSL and HHWL (Pekalongan, 2019)
Harmonic Component of Tide
Tide Graph

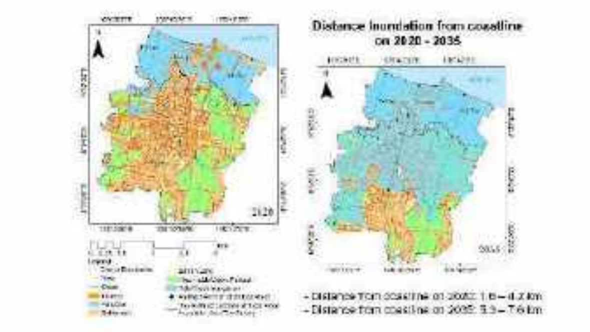

2. Land Subsidence Annual Rate at Pekalongan, DInSAR Data Processing, 2019

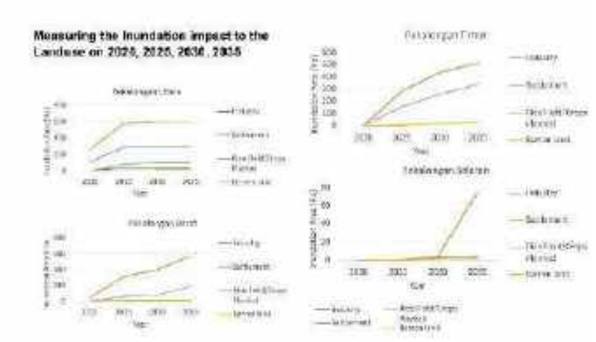

3. SLR Annual Rate
Sea Level Anomaly base on Altimetry Satelite Data Measurement 1993 - 2016
SLR = 4.3 mm/year


4. Developing detail DTM 2020
Produce a detail DTM based on GNSS Topographical Survey, 2020


5. Detail Landuse and The Furthest Location of Tidal Inundation on 2019


The Inundation Area Impact to the Landuse on 2020, 2025, 2030, 2035


Distance Inundation from coastline on 2020 - 2035


Measuring the Inundation Impact to the Landuse on 2020, 2025, 2030, 2035


Community Base for Coastal Protection at Semarang and Demak
2. "Sabuk Pantai" a Combination of Seawall and Breakwater
Supported by:

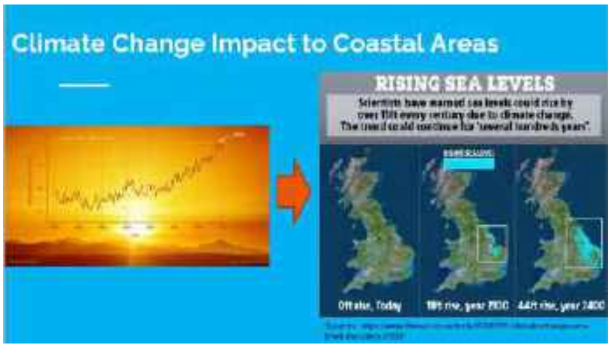

Adaptation and Mitigation
Implementing Adaptation and Mitigation:
Rain harvesting
Retention pond
Ground water regulation
Reclamation
Hybrid engineering, and
Hard and soft structures coastal protection

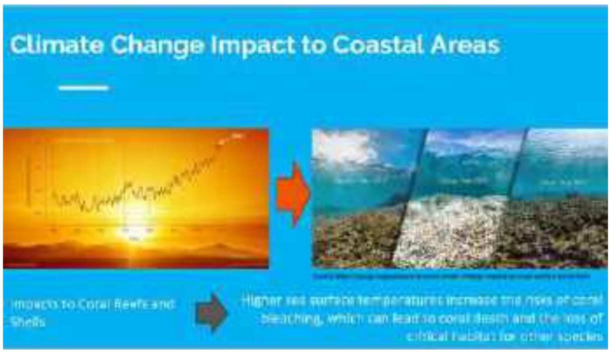

Planning Control System of Tidal Flood at Pekalongan

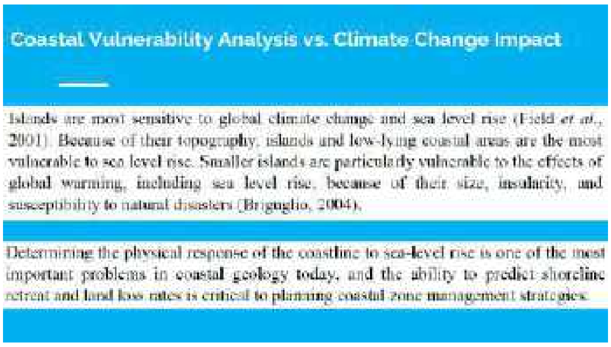

PENGENDALIAN BANJIR DAN ROB KOTA SEMARANG
JAWA TENGAH

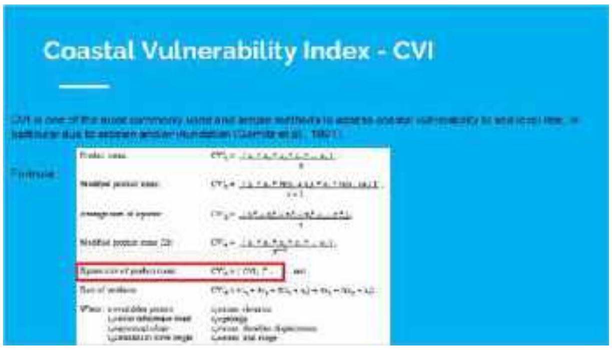

RENCANA TOL LAUT SEMARANG - DEMAK

6.2. Day 1, Lecture 2: Dr. Aslan

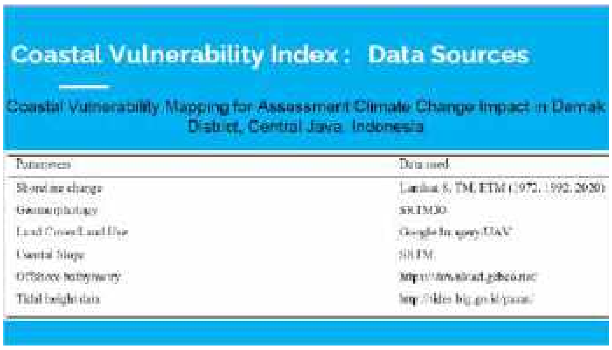


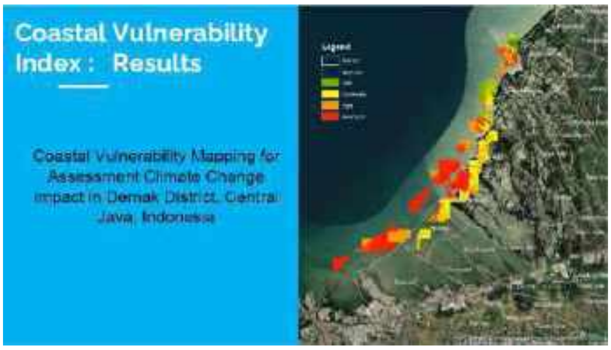






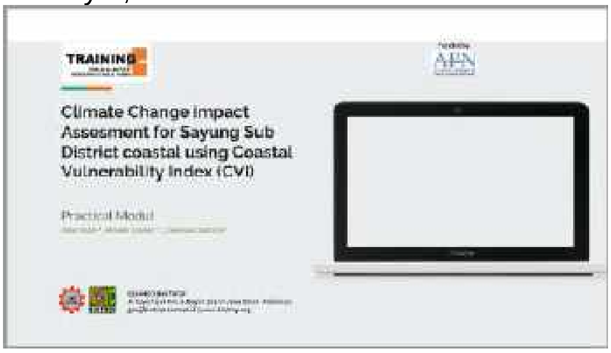

Coastal Vulnerability Index : Case Study
Coastal Vulnerability Mapping for Assessment Climate Change Impact in Demak District, Central Java, Indonesia
Central Java

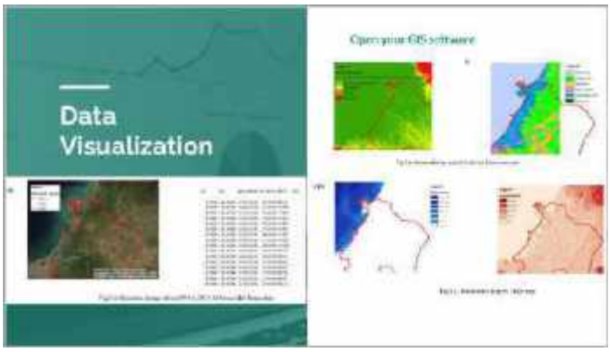

Coastal Vulnerability Index : Data Sources
Coastal Vulnerability Mapping for Assessment Climate Change Impact in Demak District, Central Java, Indonesia
Parameters
Data used
Shoreline change
Landsat 8, TM, ETM (1972, 1992, 2020)
Geomorphology
SRTM30
Land Cover/Land Use
Google Imagery/UAV
Coastal Slope
SRTM
Offshore bathymetry
Tidal height data

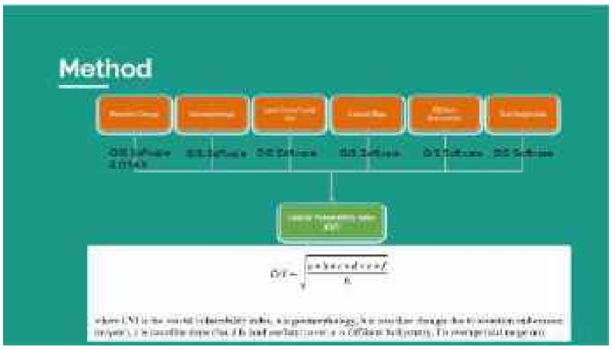

Coastal Vulnerability Index : Results
Coastal Vulnerability Mapping for Assessment Climate Change Impact in Demak District, Central Java, Indonesia
Legend

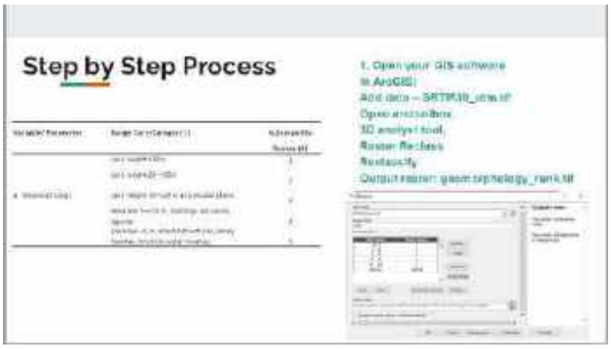

THANK YOU

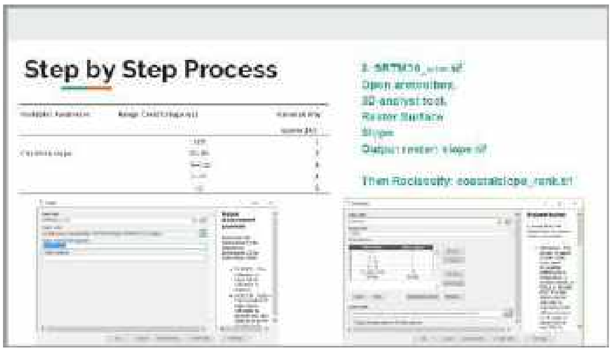
6.3. Day 1, lecture 3: Armaiki Yusmur

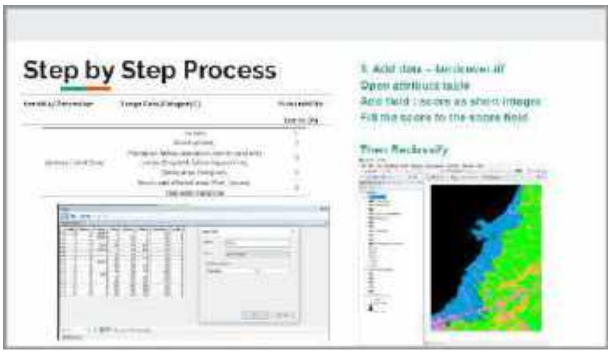


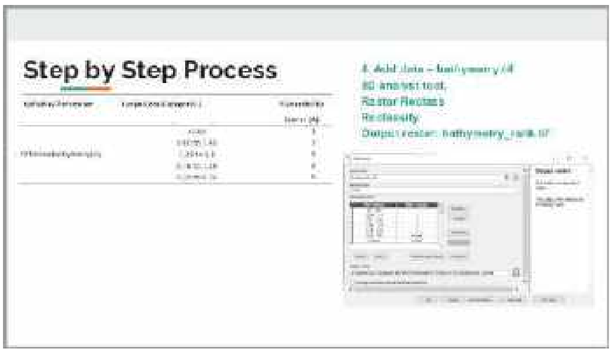


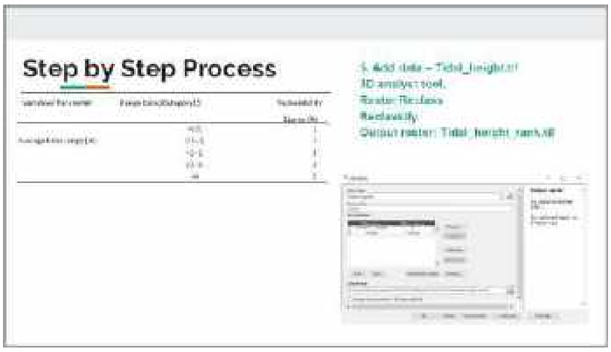




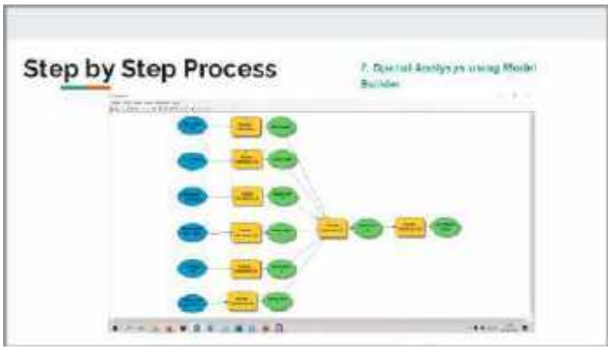


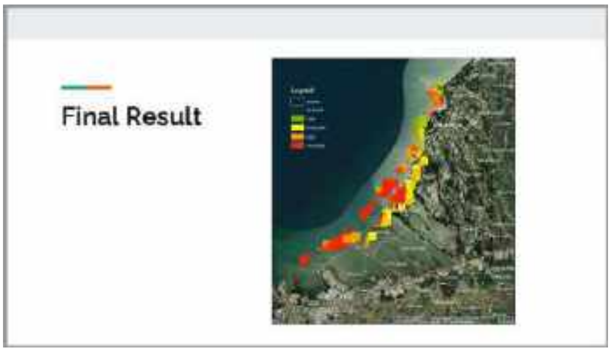





Step by Step Process
5. Add data – Tidal_height.tif
3D analyst tool,
Raster Reclass
Reclassify
Output raster: Tidal_height_rank.tif

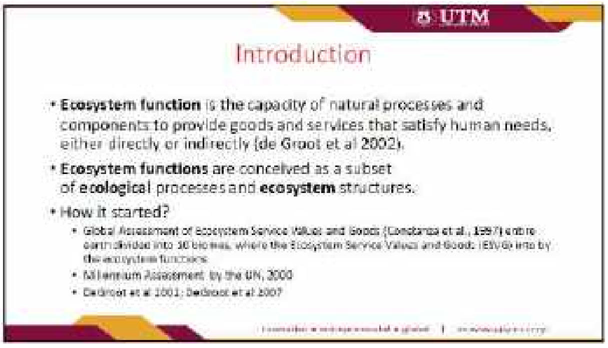

Step by Step Process
Result

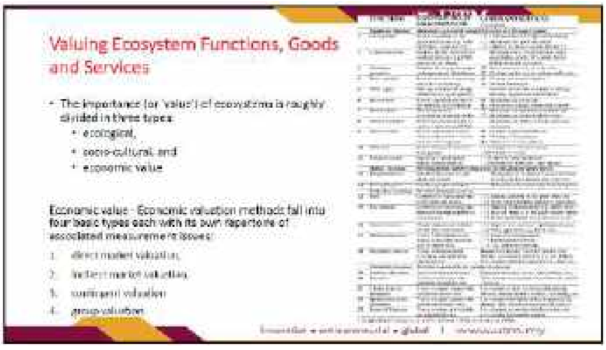

Step by Step Process
7. Spatial Analysis using Model Builder

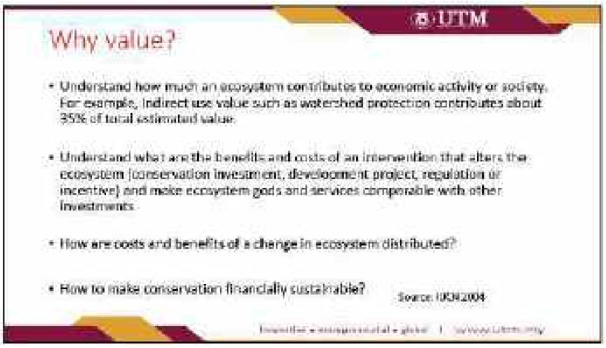

Final Result

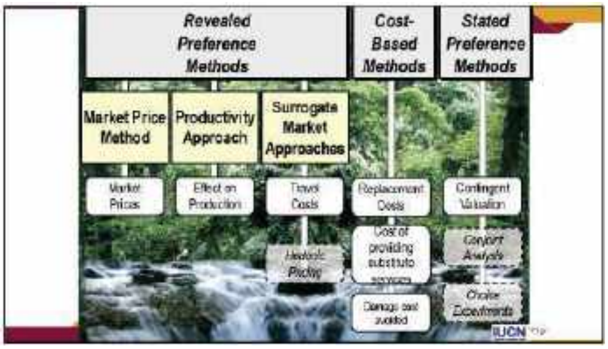

THANK YOU

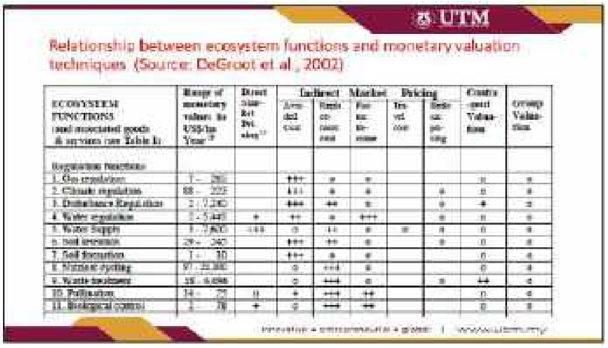
6.4. Day 2, lecture 1: Prof. Dr. Mazlan Hashim

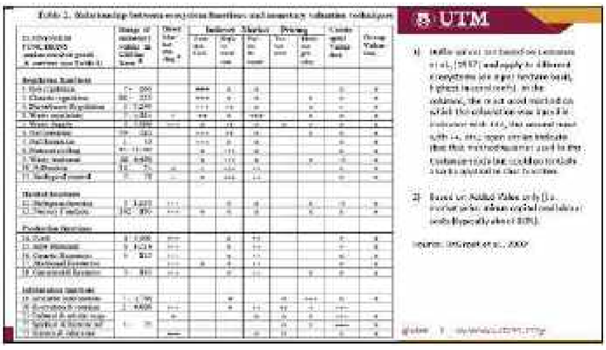


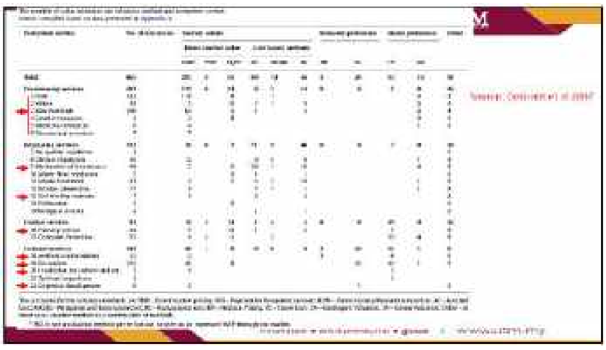


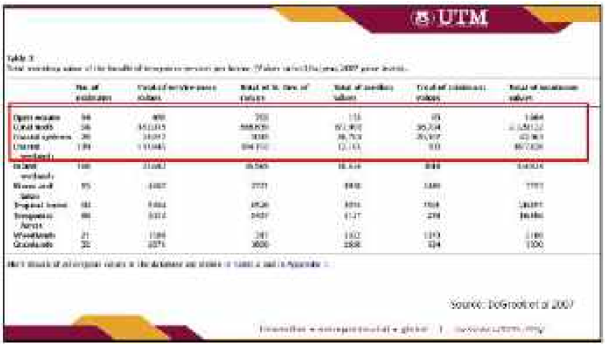


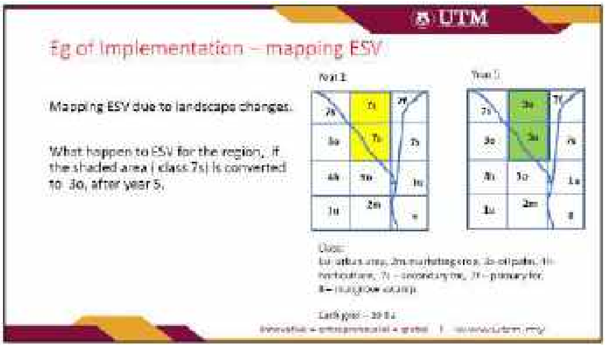











UTM
Eg of Implementation – mapping ESV
Mapping ESV due to landscape changes.
What happen to ESV for the region, if the shaded area (class 7s) is converted to 3o, after year 5.
Year 1
Year 5
Class:
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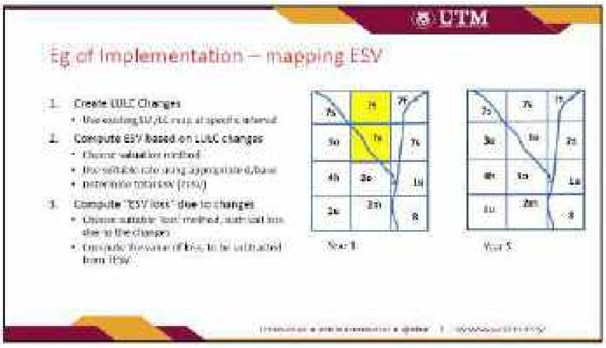
UTM
Eg of Implementation – mapping ESV
1. Create LULC Changes
2. Compute ESV based on LULC changes
3. Compute "ESV loss" due to changes
Year 1
Year 5
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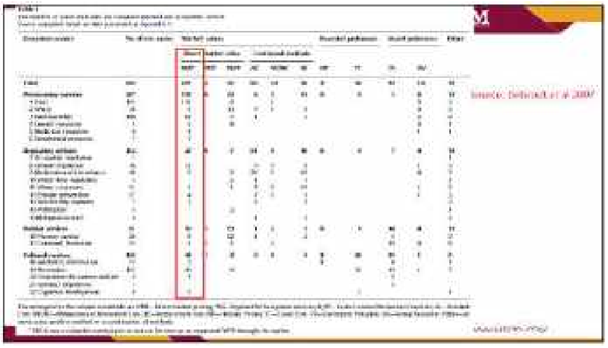
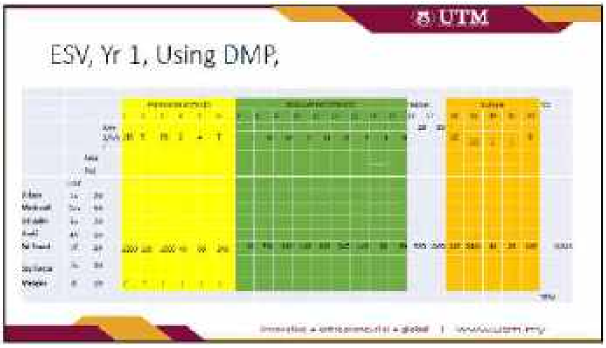

Source: Deboleet et al. 2007
www.utm.my


UTM
ESV, Yr 1, Using DMP,
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UTM
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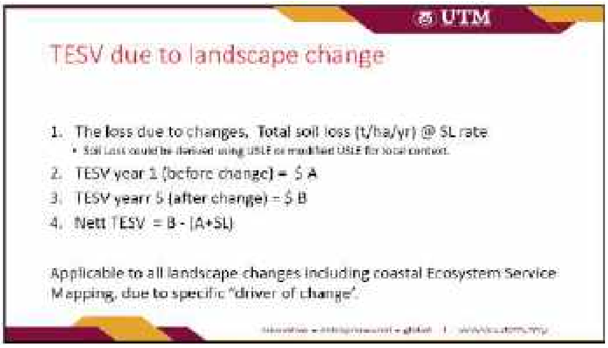
UTM
TESV due to landscape change
1. The loss due to changes, Total soil loss (t/ha/yr) @ SL rate
2. TESV year 1 (before change) = $ A
3. TESV yearr 5 (after change) = $ B
4. Nett TESV = B - (A+SL)
Applicable to all landscape changes including coastal Ecosystem Service Mapping, due to specific "driver of change".
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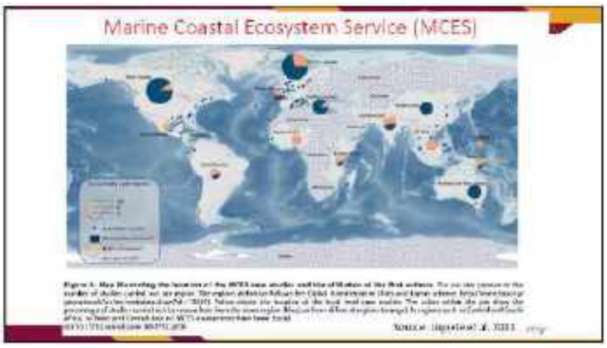
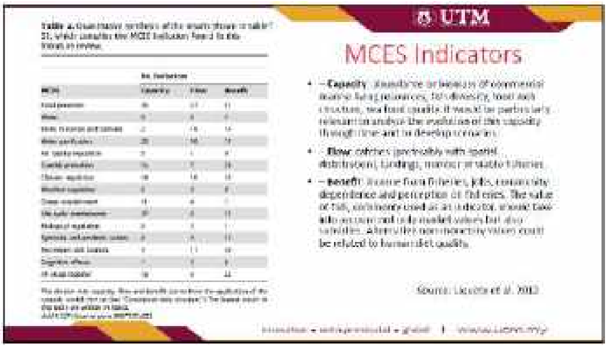

Marine Coastal Ecosystem Service (MCES)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MCES Indicators
Source: Liquete et al. 2013
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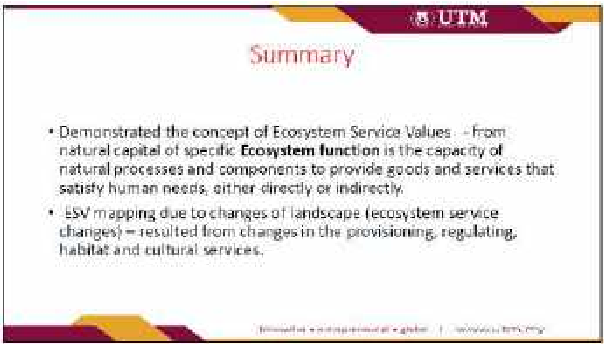
UTM
Summary
• Demonstrated the concept of Ecosystem Service Values – from natural capital of specific Ecosystem function is the capacity of natural processes and components to provide goods and services that satisfy human needs, either directly or indirectly.
• ESV mapping due to changes of landscape (ecosystem service changes) – resulted from changes in the provisioning, regulating, habitat and cultural services.
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UTM

TRAINING

The concept for RS and geospatial application for disaster mitigation

Prof Dr Mazlan Hashim, FASc

1. Research Institute for Sustainable Environment
2. Faculty of Built Environment & Surveying

Universiti Teknologi Malaysia

16 Feb 2021

Email: mazlanhashim@utm.my

UTM

What is Disaster?

- "A serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its own resources" (UNISDR, 2004)
  - as any source of potential, unpredictable, unanalysable and dangerous agent force that can cause damage to life, property, or the environment.
  - occurrence happens suddenly, is calamitous, leading to loss of property and/or life, it is then classified as a disaster.
  - Disaster – when a hazard that is unprepared for happens.

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RS and Geospatial application in disaster mitigation

1. RS and GIS are widely used and effective tools in disaster management.
   - Both RS & GIS have been the object of substantial interest for all countries and bodies concerned with space and in existing emergency services and disaster management.
2. In disaster management, the objectives of the disaster experts 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.
3. Remotely sensed data can be used very effectively for quickly assessing severity and impact of damage due to, earthquakes, landslides, flooding, forest fires, cyclones and other disasters.

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Reported Occurrence by disaster type: 2017 compared to 2007-2016.

Source: USAID and CRED.

UTM

RS data utilization for Disaster management

Disaster Type	Sensor/ Satellite	Spatial Resolution	Applications
Earthquakes	[illegible]	[illegible]	[illegible]
Cyclones	[illegible]	[illegible]	[illegible]
Floods	[illegible]	[illegible]	Flood detection, early warning, flood mapping, damage assessment, spatial planning
Landslides	[illegible]	[illegible]	[illegible]
Volcano	[illegible]	[illegible]	[illegible]
Drought	[illegible]	[illegible]	[illegible]
Fire	[illegible]	[illegible]	[illegible]

Source: Tiwari et al. 2019

UTM

RS and Geospatial application in disaster mitigation (cont'd)

4. During the disaster prevention stage, GIS is used in managing the huge levels of data required for vulnerability and hazard assessment.
5. In the disaster preparedness stage, it is a tool for planning evacuation routes, designing centres for emergency operations, and for the integration of satellite data with other relevant data in the design of disaster warning systems.
6. In the disaster relief phase, 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.
7. In the disaster rehabilitation stage, GIS is used to organise the damage information and post-disaster census information and in the evaluation of sites for reconstruction.
8. Natural hazard information should be included routinely in developmental planning and investment projects preparation.

UTM

RS and Geospatial application in disaster management phases

1. **Planning**
   - GIS is useful in helping with forward planning.
   - It provides the framework for planners and disaster managers to view spatial data by way of computer based maps.
2. **Mitigation**
   - Representation of High risk areas
     - Risk Mapping
   - Facilitates the implementation of necessary mechanism to lessen the impact.

UTM

RS and Geospatial application in disaster management phases (cont'd)

3. **Preparedness**
   - Identification of emergency areas
   - Positions of related departments, Agencies and Human Resources
   - Make it easier for security and shelters provides to plan the strategies
4. **Response**
   - Provide accurate information on exact location of an emergency situation
   - Time saving during the determination of trouble areas (Quick Response)
   - Used as floor guide for evacuation routes
5. **Recovery**
   - Mapping level of damage
   - Information related to disrupted infrastructure, number of
   - Fatality or injured and Impact on Environment

UTM

Data Requirement for Disaster management (pre-requisite)

- The data required for disaster management is coming from different agencies / depts, and should be integrated
- Data integration is one of the strongest points of GIS. **But can be a big challenge to facilitate swift, systematic data sharing among agencies / depts.**
- Data required:
  - **Data on the disastrous phenomena (e.g. landslides, floods, earthquakes, including historical records, their location, frequency, magnitude etc.**
  - **Data on the environment where disastrous events might take place: topography, geology, geo-morphology, soils, hydrology, land use, vegetation etc.** [HAZARD/ RISK MAP]
  - **Data on the elements that might be destroyed if the event takes place: infrastructure, settlements , population, socio-economic data**

UTM

Data Requirement for Disaster management (cont'd)

- Hazard information System should include cost/benefit analysis of investing in hazard mitigation measures and weigh them against the losses that are likely to occur if these measures are not taken.
- For Hazard / Risk mapping, RS and GIS can play a role at the following levels:
  - National level,
  - State level,
  - District level (high resolution RS data)
  - City level (high resolution RS data)
  - Site investigation scale (high resolution RS data)

Disaster mapping (useful for planning and mitigation phases)

1. Disaster mapping is about delineated areas due to a disaster natural or manmade disaster resulting in loss of life, property and national infrastructures.
   - delineate the area affected by the disaster.
   - depends on ground-based observations or remote sensing data classifying satellite images.
   - possible to map the affected areas and provide information to the relief supplying groups.
2. Disaster mapping is a tool for assessing, storing and conveying information on the geographical location and spread of the effects, or probable effects of disasters.
3. The difficulty with traditional manual maps is that they are tedious and time consuming to prepare, difficult to update and inconvenient to maintain.
4. Remote sensing is used for map preparation while GIS can be used for storage, analysis and retrieval.
5. Disaster maps generally show risk zones as well as disaster impact zones.
   - marked areas that would be affected increasingly with the increase in the magnitude of the disaster.
   - landslide hazard maps, flood zone maps, seismic zone maps, forest fire risk maps, industrial risk zone maps etc.

Eg RS and GS in Landslide disaster

Mitigation	Preparedness	Rescue	Recovery	Satellite data
Risk modelling; vulnerability analysis	Early warning; long-range climate modelling	Identifying escape routes; crisis mapping; impact assessment; landslide monitoring; storm surge predictions	Damage assessment; spatial planning	Medium to high resolution Landsat TM

Eg Landslides risk map (mitigation)

- Landslide hazard zone mapping involves a detailed assessment and analysis of the past occurrences of landslides in conditions of their location, size and incidence wrt various geo-environmental factors that cause landslides and mass movements.
- Landslide hazard zonation map included a map separating the draw out varying degrees of predictable slope stability.
  - The map has an inbuilt factor of forecasting and hence is of probabilistic nature.
- Depending upon the methodology adopted and the comprehensiveness of the input data used, a landslide hazard zonation map is able to provide help concerning some or all the following individual factor maps:
  - Landslide location, Slope steepness, Landuse/landcover, Geology or lithology, Density of drainages, Rainfall, proximity to river/lakes, etc

Eg Landslides risk map (mitigation) –cont'd

Modeling

LS = f (Landslide location, Slope steepness, LULC, Geology, Density of drainages, Rainfall, etc)

where f= model (choose suitable model)

- Use all LS records (including LS), and the corresponding variables
- Once solve the equation, all the parameters will be determined, refined, and validated

- Hazard zonation maps have different uses. Some of them are as follows:
  - Preparation of development plans for cities, dams, roads, and other development works.
  - General purpose master plans and land use plans
  - Discouraging new development in hazard prone areas
  - Selection of best activity pattern based on risk zones
  - Quick decision making in rescue and relief operations

Case study

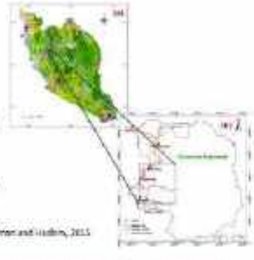
- **Project** - Landslide susceptibility mapping using GIS-based statistical models and Remote sensing data in tropical environment

- **Journal:** Scientific Reports vol 5, Article number: 9899 (2015)
- Cite this article - Shahabi, H., Hashim, M. Landslide susceptibility mapping using GIS-based statistical models and Remote sensing data in tropical environment. Sci Rep 5, 9899 (2015). https://doi.org/10.1038/srep09899

- **Objective** - To investigate GIS-based statistical models (analytical hierarchy process, weighted linear combination and spatial multi-criteria evaluation) for generation of landslide susceptibility mapping using geographic information system (GIS) and remote-sensing data for Cameron Highlands area in Malaysia

Study area

- About 40 km2
- geomorphology – rough with altitude 840 - 2150 m, estimated 15% of flat terrain elongated to the main river. Slope 60% > 20 deg
- Geology – granites, schists, phyllite, slate, limestone lithologies
- Climate- average annual rainfall 2,500 -3,000 mm between Mar, May and from Nov- Dec. Ave temp. 24°C and 14°C for day and nighttime.
- LULC – ~8% (5,500 ha) are agriculture, 85% (60,000 ha) of the area is forested, 4% (2,750 ha) is occupied by housing and the residuals are used for recreation and other activities.



Source: Hamid and Hashim, 2015

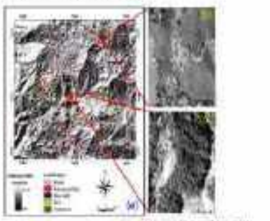
Methods

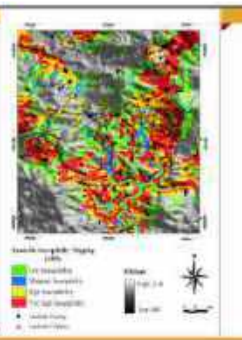
(a) a shallow translational rockslide, (b) a shallow translation of debris slide at the road side, (c) and (d) deep-seated rockslides. Arrow depicts the movement direction.

Source: Hamid and Hashim, 2015

Results

- Detection and location of landslides
- Landslide susceptibility maps





Source: Hamid and Hashim, 2015

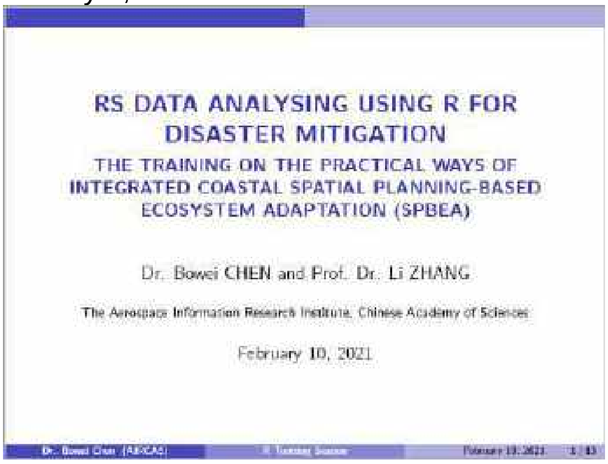
Summary - case study

- Validation result implies that 86% of the total landslide pixels were properly categorised by the three landslide susceptibility mapping models, which indicates a significant rational carrying out with regard to comparable studies accomplished by other researchers in tropical environments using statistical models
- the integration of AIRSAR data with high resolution satellite images can play important role in the production of a landslide inventory map in tropical regions.
- landslide susceptibility maps can be used for optimum management by decision makers and land use planners and engineers to decrease losses caused by current and also future landslides through suitable prophylactic assessments and minimization procedures.
- Repeatable approach (risk mapping) for other disaster with specific customizations

Conclusion

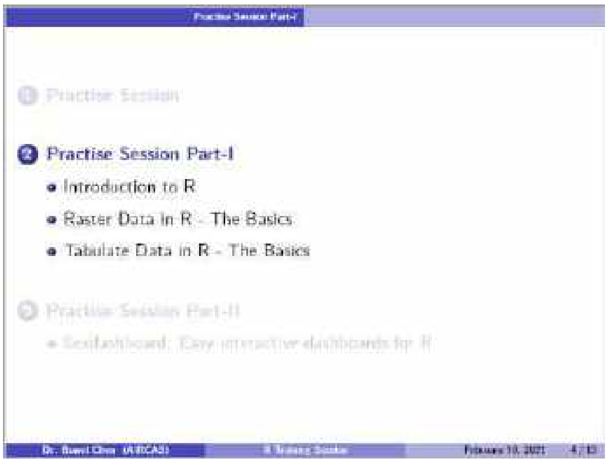
- Concept for RS and geospatial application for disaster mitigation:
  - RS data are best source of data to risk mapping for mitigation of disaster – planning (operational mapping)
  - Geospatial system enables systematic access, analyses and implementation improvement of risk mapping for mitigation and other phases disaster management.


UTM
References


RS DATA ANALYSING USING R FOR DISASTER MITIGATION
THE TRAINING ON THE PRACTICAL WAYS OF INTEGRATED COASTAL SPATIAL PLANNING-BASED ECOSYSTEM ADAPTATION (SPBEA)
Dr. Bowei CHEN and Prof. Dr. Li ZHANG
The Aerospace Information Research Institute, Chinese Academy of Sciences
February 10, 2021
Dr. Bowei Chen (AIRCAS)
R Training Session
February 10, 2021 1 / 13


Practise Session
1 Practise Session
2 Practise Session Part-I
Introduction to R
Raster Data in R - The Basics
Tabulate Data in R - The Basics
3 Practise Session Part-II
Flexdashboard: Easy interactive dashboards for R
Dr. Bowei Chen (AIRCAS)
R Training Session
February 10, 2021 2 / 13


Practise Session
Practise Session
Practise Session Part-I 11.00 - 13.00 am1 | Tuesday, February 16, 2021
Practise Session Part-II 14.00 - 16.00 pm | Tuesday, February 16, 2021
1*At West Indonesian Time (WIB)
Dr. Bowei Chen (AIRCAS)
R Training Session
February 16, 2021 3 / 13


Practise Session Part-I
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Flexdashboard: Easy interactive dashboards for R
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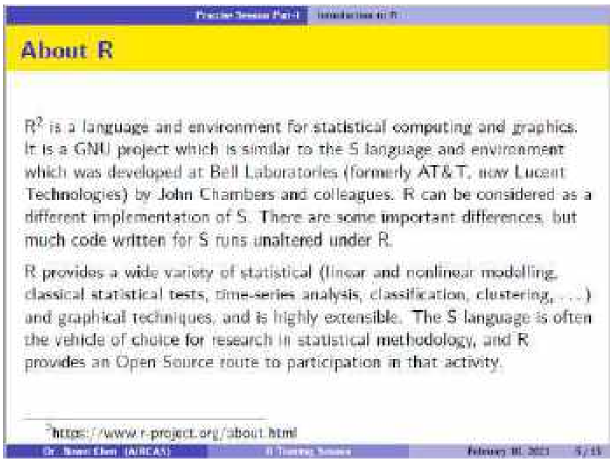
February 10, 2021 4 / 13


Practise Session Part-I
Introduction to R
About R
R2 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 a wide variety of statistical (linear and nonlinear modelling, classical statistical tests, time-series analysis, classification, clustering, ...) and graphical techniques, and is highly extensible. The S language is often the vehicle of choice for research in statistical methodology, and R provides an Open Source route to participation in that activity.
2https://www.r-project.org/about.html
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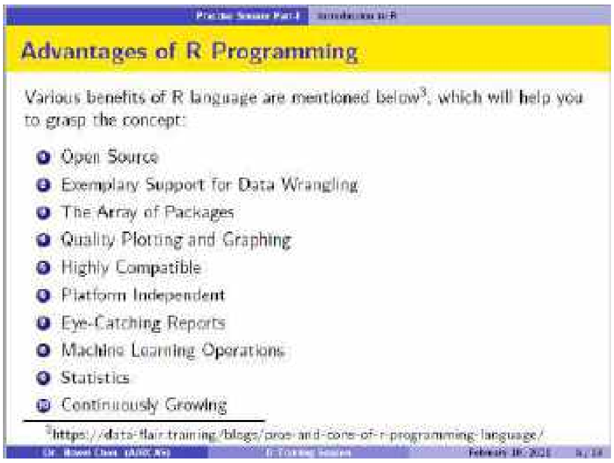
Practise Session Part-I
Introduction to R
Advantages of R Programming
Various benefits of R language are mentioned below3, which will help you to grasp the concept:
1 Open Source
2 Exemplary Support for Data Wrangling
3 The Array of Packages
4 Quality Plotting and Graphing
5 Highly Compatible
6 Platform Independent
7 Eye-Catching Reports
8 Machine Learning Operations
9 Statistics
10 Continuously Growing
3https://data-flair.training/blogs/pros-and-cons-of-r-programming-language/
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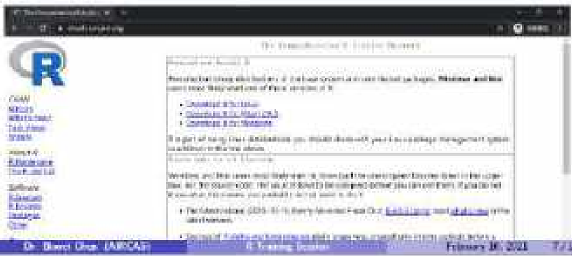
Practise Session Part-I | Introduction to R

How to Install R

Installing R on Windows 10

Installing R on Windows 10 is very straightforward. The easiest way is to install it through CRAN[3], which stands for The Comprehensive R Archive Network. Just visit the CRAN downloads page and follow the links as shown in the picture below:



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Practise Session Part-I | Introduction to R

Installing RStudio

Once R is installed, you can proceed to install the RStudio IDE to have a much-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[4]:

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Practise Session Part-I | Introduction to R

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 that it can do, which is why we have R packages such as dplyr for enhanced data-wrangling capabilities or ggplot2 for improved data visualizations. There are two simple ways to install R packages using RStudio. The first is to execute the following line of code in the console:

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

```
## Loading required package: raster

## Loading required package: sp
```

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Practise Session Part-I | Raster Data in R - The Basics

Raster Data in R - The Basics

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

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Practise Session Part-I | Tabulate Data in R - The Basics

Tabulate Data in R - The Basics

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

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Practise Session Part-II

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Practise Session Part-II | flexdashboard: Easy interactive dashboards for R

flexdashboard: Easy interactive dashboards for R

Please dive into the 'SPBEA_2nd_half' folder, and open 'SPBEA_2nd_half.Rmd' file

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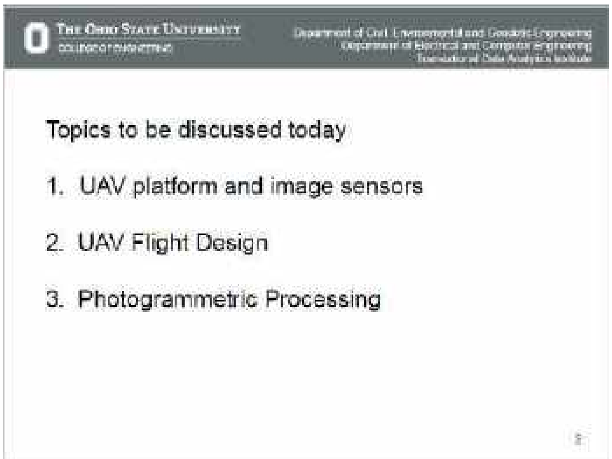
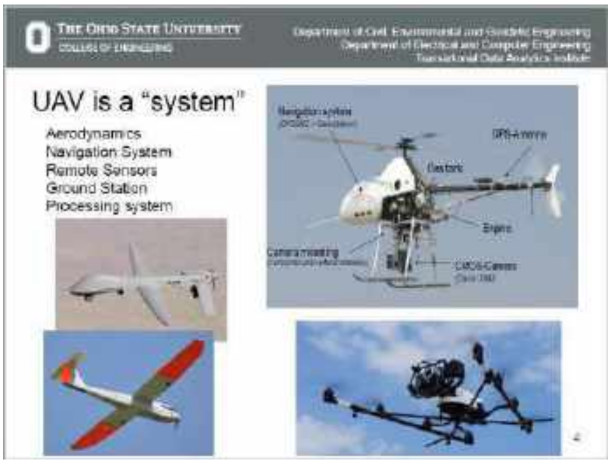
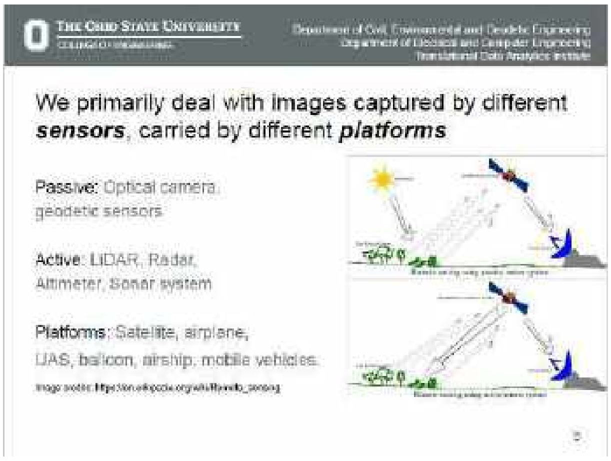
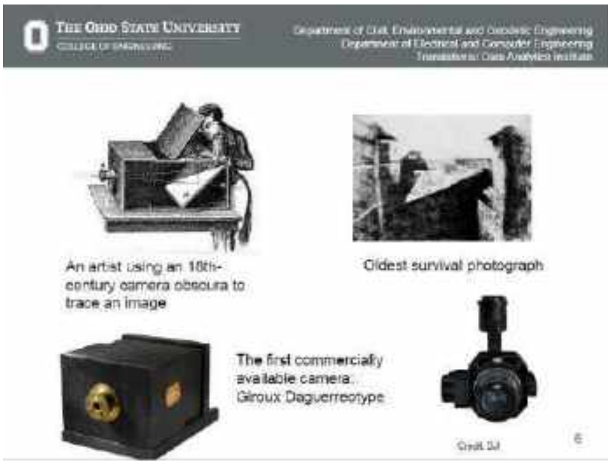
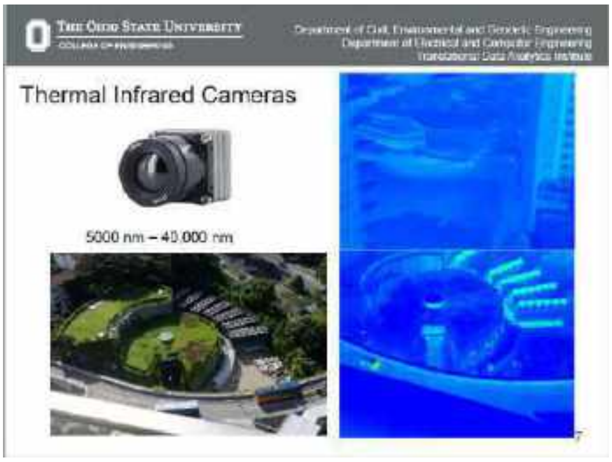
6.5. Day 3, Lecture 1: Prof. Dr. Rongjun Qin



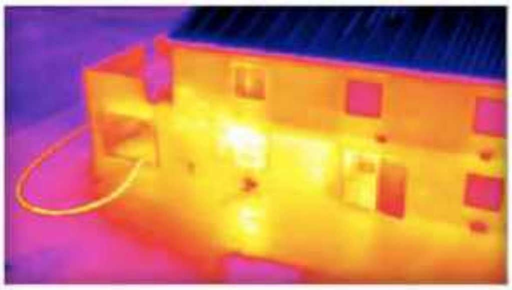








Finding the Fire Centers



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Short-wave Infrared

900-1700 nm

Low responses to water

qualitymag.com

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Rapid Mapping for Coastal spatial planning

+ Identify coastal lines
+ Accuracy measuring coastal lines with precise registration among different temporal collections to estimate costal line changes
+ Generate coastal line models for flood monitoring
+ Ecosystem monitoring and biomass computation

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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.

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Types of aerial photos

Vertical photos - camera axis vertical

Tilted photos - 1-3° off nadir, virtually all aerial photos are unintentionally tilted

High oblique - intentional inclination, including horizon

Low oblique - does not include horizon

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Overlapping Stereo-photography

To determine parallax and stereo/3D viewing

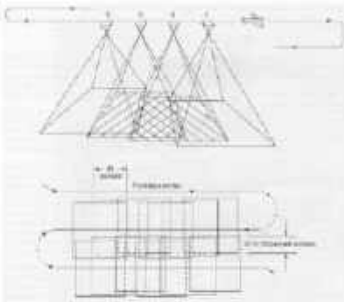
Forward overlap ~60%

Side overlap - ~20-30%

For UAV mission we always expect higher overlaps for flexibility concern:

80-90% forward

60-80% side



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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

$$\frac{\textit{Linear distance in the photograph}}{\textit{Actual Distance on the ground}}$$

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

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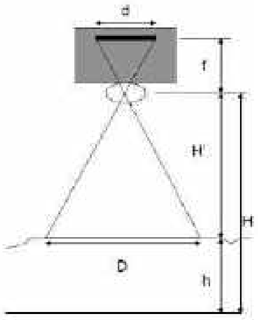
Photograph Scale

Scale = f /H' = d/D
where
f = focal length
H' = height above terrain
d = image distance
D = ground distance
h = terrain elevation
H = flying height (h + H')



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Scale Determination

Scale = f / H' where: f = focal length

H' = flying height above terrain

E.g. f = 20 mm

H = 400 m MSL ground elevation = 200 m

$$\text{Scale} = \frac{20\ \text{mm}}{(400\ \text{m} - 200\ \text{m})} * \frac{1\text{m}}{1000\ \text{mm}} = \frac{20}{200{,}000}$$

$$\text{Scale} = \frac{2}{20{,}000} \quad \text{or} \quad 1{:}10{,}000$$

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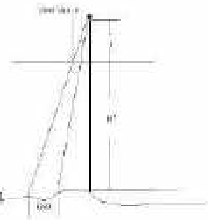
Ground Sampling Distance (GSD)

$$\text{GSD} = \frac{\text{d (pixel size)} * \text{H}}{\text{f (focal length)}}$$

Example: Pixel size = 5 microns = 0.005 mm

f = 20 mm H' = 200 m

$$\text{GSD(m)} = \frac{0.005\text{mm} \times 200\ \text{m}}{20\ \text{mm}} = 0.05\ \text{m}$$



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Motion Blur

$$\text{Pixel blur} \quad \frac{\textit{Ground Speed} \times \textit{Exposure Time}}{\textit{GSD}}$$

E.g. Ground Speed = 10/s, GSD = 5 cm
Exposure time = 1/200s

$$\text{Pixel blur} = \frac{10 \times 1/100}{5} = 2$$

This should be kept within 1 pixel !!!

http://anypanoleorobrpll.com/files/motion-blur-effect.html

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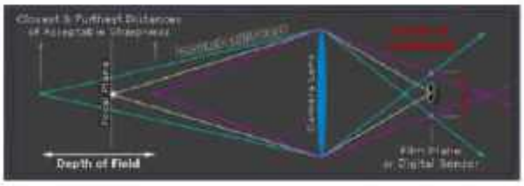
Depth of Field - Aperture



The larger Aperture, the smaller depth of field, but you will get image with good exposure (Note: you need to have short shutter time to avoid motion blur)

http://www.cambridgeincolour.com/tutorials/depth-of-field.htm

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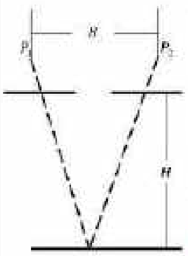
Base-high Ratio



B/H ratio determines the vertical accuracy of the ray resection relative to the horizontal accuracy:

V_accuracy (pixel) = H_accuracy / ½ B/H

Example: H_accuracy – 1 pixel, B/H = 0.6

V_accuracy = 1 / 0.3 = 3.3 pixel

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

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

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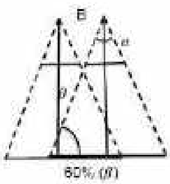
Photogrammetric Flight

Given regular blocks, the B/H ratio can be computed through overlaps



α Field of view (FOV): determined by focal length and CCD size

$$\theta = 90 - \frac{1}{2}\alpha$$

$$\frac{B}{H} = \frac{2(1-\beta)}{\tan\theta}$$

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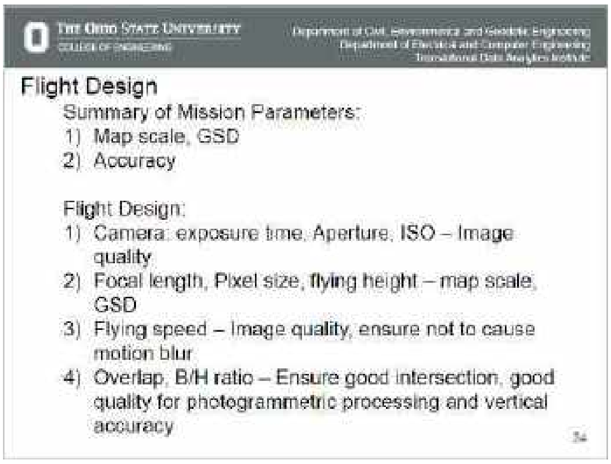
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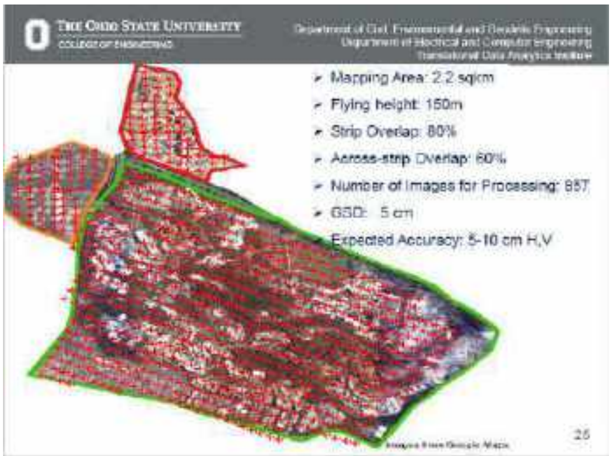
Flight Design
Summary of Mission Parameters:
1) Map scale, GSD
2) Accuracy
Flight Design:
1) Camera: exposure time, Aperture, ISO – Image quality
2) Focal length, Pixel size, flying height – map scale, GSD
3) Flying speed – Image quality, ensure not to cause motion blur
4) Overlap, B/H ratio – Ensure good intersection, good quality for photogrammetric processing and vertical accuracy
24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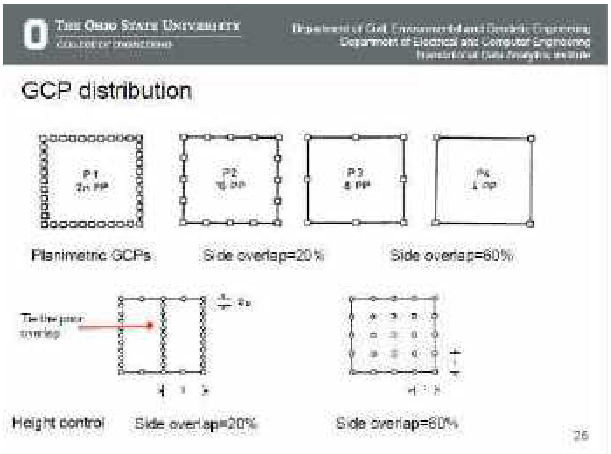
Mapping Area: 2.2 sqkm
Flying height: 150m
Strip Overlap: 80%
Across-strip Overlap: 60%
Number of Images for Processing: 857
GSD: 5 cm
Expected Accuracy: 5-10 cm H,V
Images from Google Maps
25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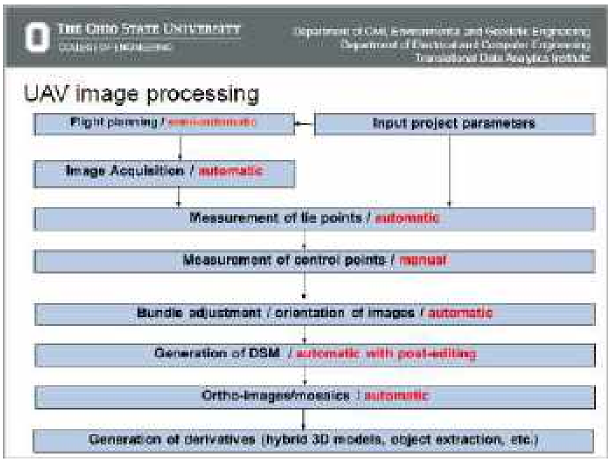
GCP distribution
Planimetric GCPs
Side overlap=20%
Side overlap=60%
Height control
Side overlap=20%
Side overlap=60%
26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UAV image processing
Flight planning / semi-automatic
Input project parameters
Image Acquisition / automatic
Measurement of tie points / automatic
Measurement of control points / manual
Bundle adjustment / orientation of images / automatic
Generation of DSM / automatic with post-editing
Ortho-images/mosaics / automatic
Generation of derivatives (hybrid 3D models, object extraction, etc.)


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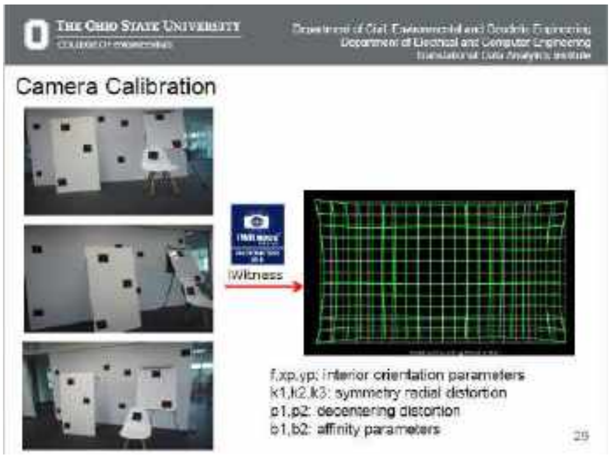
Lens distortion - Examples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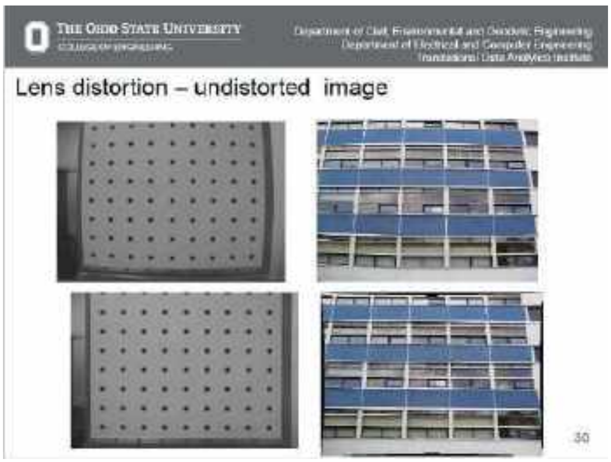
Camera Calibration
iWitness
f,xp,yp: interior orientation parameters
k1,k2,k3: symmetry radial distortion
p1,p2: decentering distortion
b1,b2: affinity parameters
29


The Ohio State University
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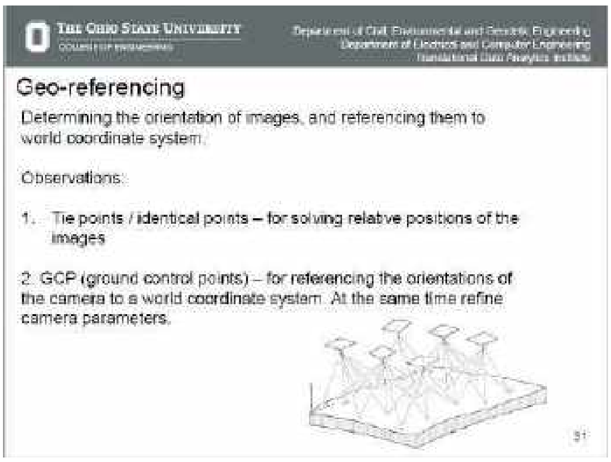
Department of Electrical and Computer Engineering
Translational Data Analytics Institute
Lens distortion – undistorted image
30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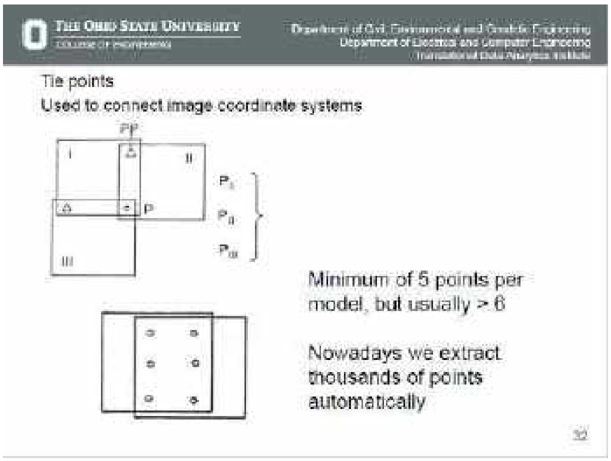
Translational Data Analytics Institute
Geo-referencing
Determining the orientation of images, and referencing them to world coordinate system.
Observations:
1. Tie points / identical points – for solving relative positions of the images
2. GCP (ground control points) – for referencing the orientations of the camera to a world coordinate system. At the same time refine camera parameters.
31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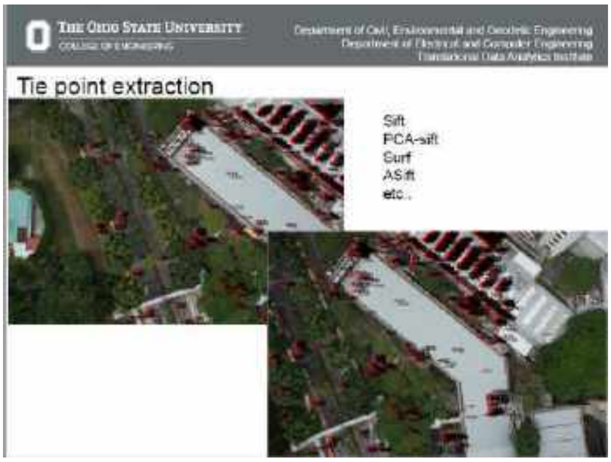
Tie points
Used to connect image coordinate systems
PP
I
II
III
P
P_I
P_{II}
P_{III}
Minimum of 5 points per model, but usually > 6
Nowadays we extract thousands of points automatically
32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Tie point extraction
Sift
PCA-sift
Surf
ASift
etc..


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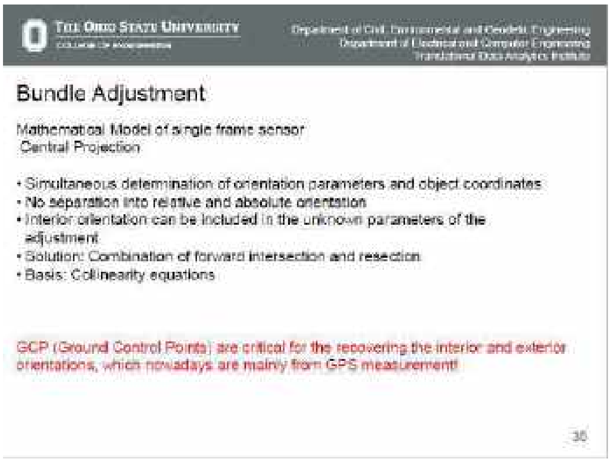
GCP Measurement
Coded Targets
Nature Targets
34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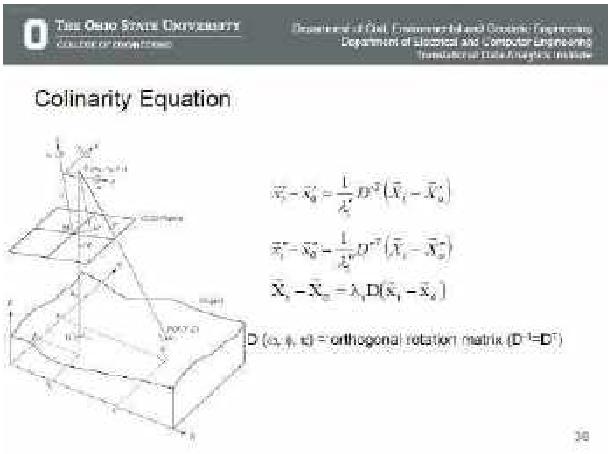
Department of Electrical and Computer Engineering
Translational Data Analytics Institute
Bundle Adjustment
Mathematical Model of single frame sensor
Central Projection
• Simultaneous determination of orientation parameters and object coordinates
• No separation into relative and absolute orientation
• Interior orientation can be included in the unknown parameters of the adjustment
• Solution: Combination of forward intersection and resection
• Basis: Collinearity equations
GCP (Ground Control Points) are critical for the recovering the interior and exterior orientations, which nowadays are mainly from GPS measurement!
35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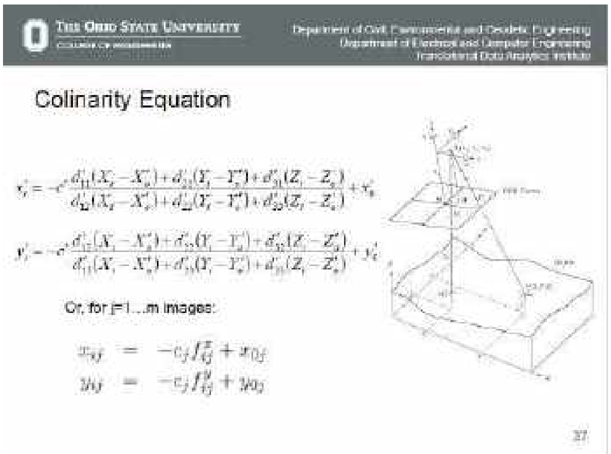
Department of Electrical and Computer Engineering
Translational Data Analytics Institute
Colinarity Equation
$\bar{x}_i' - \bar{x}_0' = \frac{1}{\lambda_i'} D^T (\bar{X}_i - \bar{X}_0')$
$\bar{x}_i'' - \bar{x}_0'' = \frac{1}{\lambda_i''} D''^T (\bar{X}_i - \bar{X}_0'')$
$\bar{X}_i - \bar{X}_0 = \lambda_i D(\bar{x}_i - \bar{x}_0)$
D (ω, φ, κ) = orthogonal rotation matrix ($D^{-1}=D^T$)
36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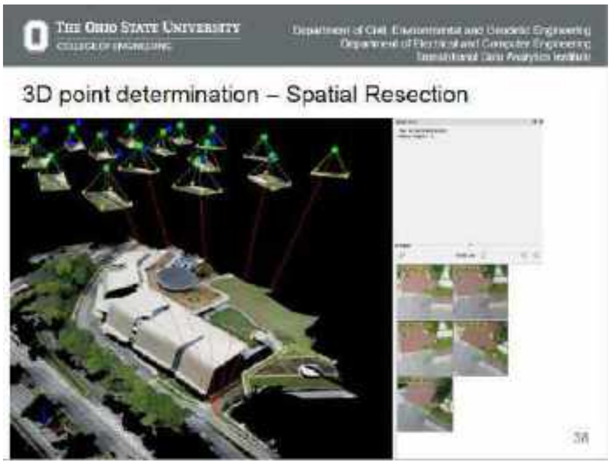
Colinarity Equation
$x_i' = -c' \frac{d_{11}'(X_i - X_0') + d_{21}'(Y_i - Y_0') + d_{31}'(Z_i - Z_0')}{d_{13}'(X_i - X_0') + d_{23}'(Y_i - Y_0') + d_{33}'(Z_i - Z_0')} + x_0'$
$y_i' = -c' \frac{d_{12}'(X_i - X_0') + d_{22}'(Y_i - Y_0') + d_{32}'(Z_i - Z_0')}{d_{13}'(X_i - X_0') + d_{23}'(Y_i - Y_0') + d_{33}'(Z_i - Z_0')} + y_0'$
Or, for j=1...m images:
$x_{ij} = -c_j f_{ij}^x + x_{0j}$
$y_{ij} = -c_j f_{ij}^y + y_{0j}$
37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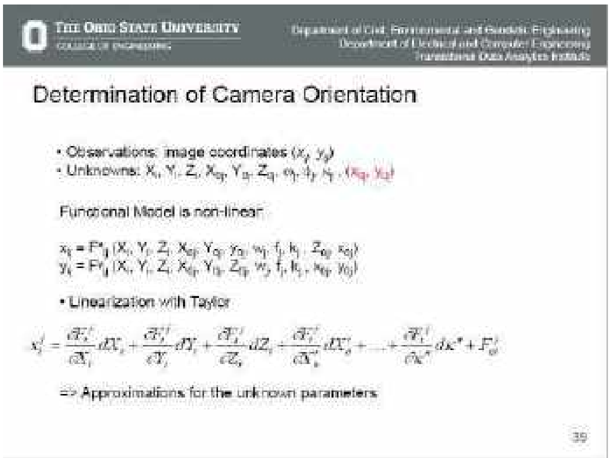
3D point determination – Spatial Resection
38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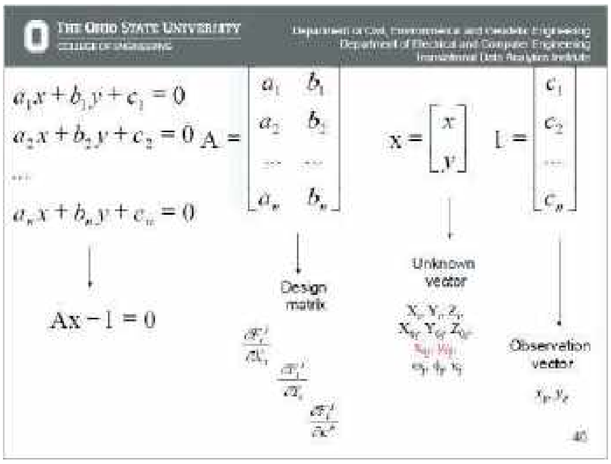
Determination of Camera Orientation
• Observations: image coordinates (x_{ij}, y_{ij})
• Unknowns: $X_i, Y_i, Z_i, X_{0j}, Y_{0j}, Z_{0j}, \omega_j, \phi_j, \kappa_j, (x_{0j}, y_{0j})$
Functional Model is non-linear
$x_{ij} = F^x_{ij}(X_i, Y_i, Z_i, X_{0j}, Y_{0j}, Z_{0j}, \omega_j, \phi_j, \kappa_j, x_{0j})$
$y_{ij} = F^y_{ij}(X_i, Y_i, Z_i, X_{0j}, Y_{0j}, Z_{0j}, \omega_j, \phi_j, \kappa_j, y_{0j})$
• Linearization with Taylor
$x_i^j = \frac{\partial F_i^j}{\partial X_i} dX_i + \frac{\partial F_i^j}{\partial Y_i} dY_i + \frac{\partial F_i^j}{\partial Z_i} dZ_i + \frac{\partial F_i^j}{\partial X_0^j} dX_0^j + \ldots + \frac{\partial F_i^j}{\partial \kappa^n} d\kappa^n + F_{i0}^j$
=> Approximations for the unknown parameters
39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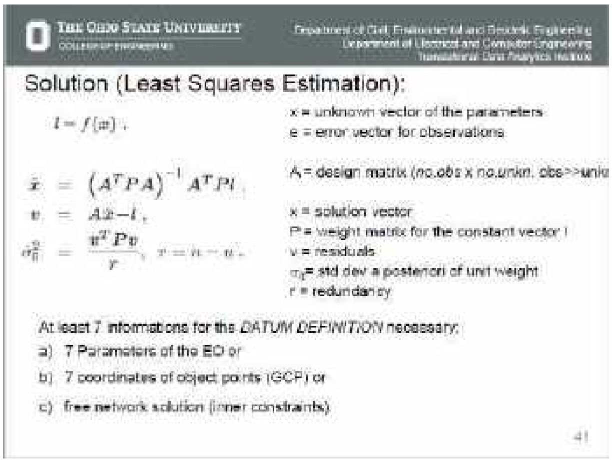
$a_1x + b_1y + c_1 = 0$
$a_2x + b_2y + c_2 = 0$
$a_nx + b_ny + c_n = 0$
$Ax - l = 0$
Design matrix
Unknown vector
Observation vector
40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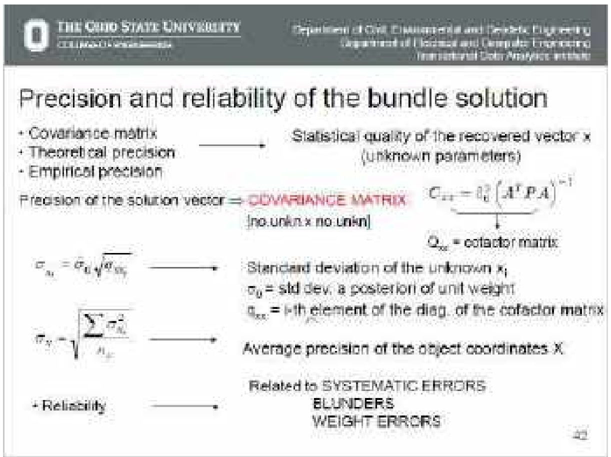
Solution (Least Squares Estimation):
x = unknown vector of the parameters
e = error vector for observations
A = design matrix
x = solution vector
P = weight matrix for the constant vector l
v = residuals
r = redundancy
At least 7 informations for the DATUM DEFINITION necessary:
a) 7 Parameters of the EO or
b) 7 coordinates of object points (GCP) or
c) free network solution (inner constraints)
41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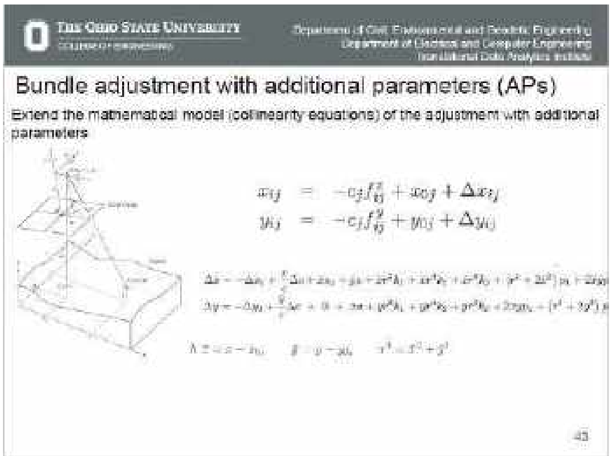
Precision and reliability of the bundle solution
- Covariance matrix
- Theoretical precision
- Empirical precision
Statistical quality of the recovered vector x (unknown parameters)
Precision of the solution vector ⇒ COVARIANCE MATRIX
[no.unkn x no.unkn]
Q_{xx} = cofactor matrix
Standard deviation of the unknown x_i
σ_0 = std dev. a posteriori of unit weight
Average precision of the object coordinates X
- Reliability
Related to SYSTEMATIC ERRORS
BLUNDERS
WEIGHT ERRORS
42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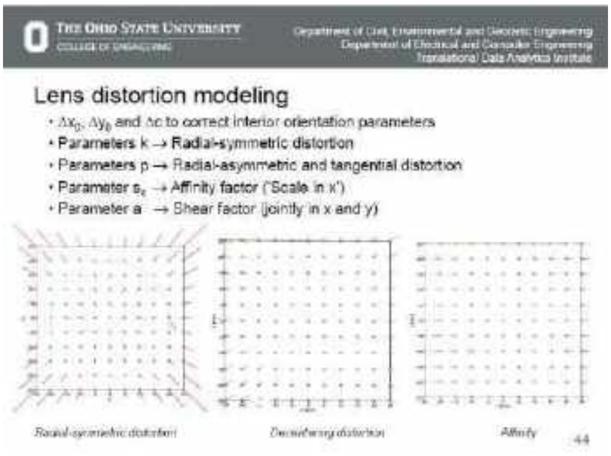
Bundle adjustment with additional parameters (APs)
Extend the mathematical model (collinearity equations) of the adjustment with additional parameters
43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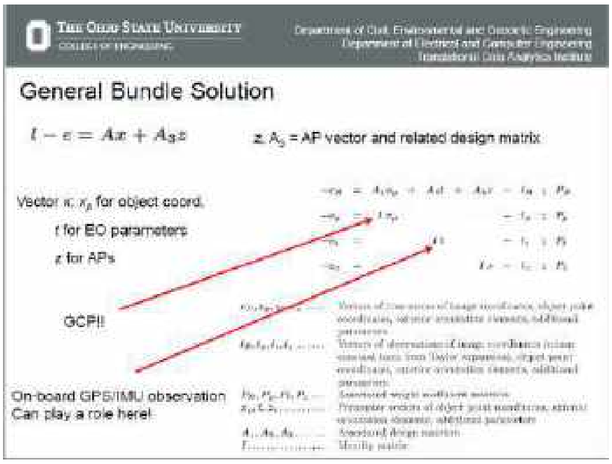
Lens distortion modeling
- Parameters k → Radial-symmetric distortion
- Parameters p → Radial-asymmetric and tangential distortion
- Parameter a → Shear factor (jointly in x and y)
Radial-symmetric distortion
Decentering distortion
Affinity
44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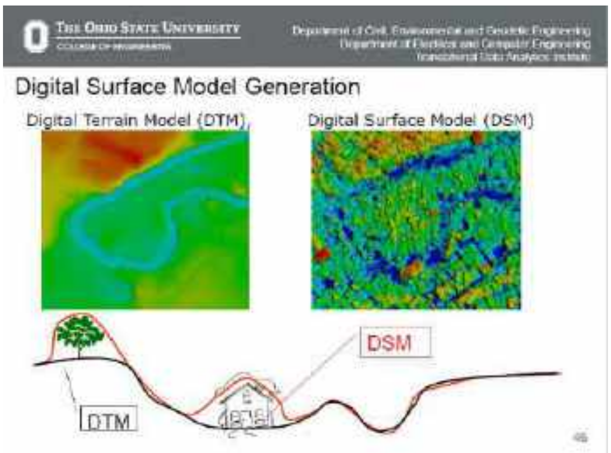
General Bundle Solution
Vector x: x_p for object coord.
t for EO parameters
z for APs
GCP!!
On-board GPS/IMU observation
Can play a role here!
45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Digital Surface Model Generation
Digital Terrain Model (DTM)
Digital Surface Model (DSM)
DSM
DTM
46

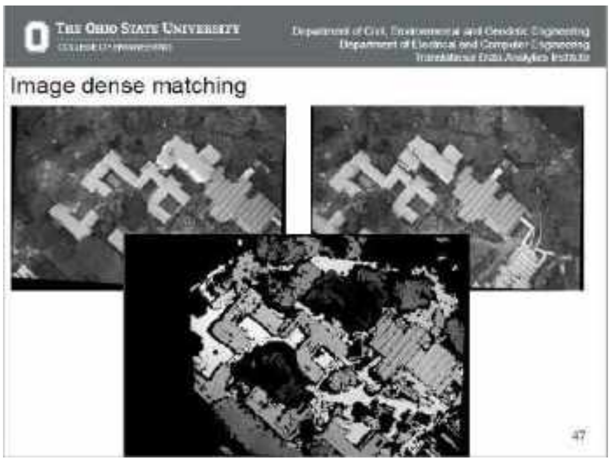
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Image dense matching
47


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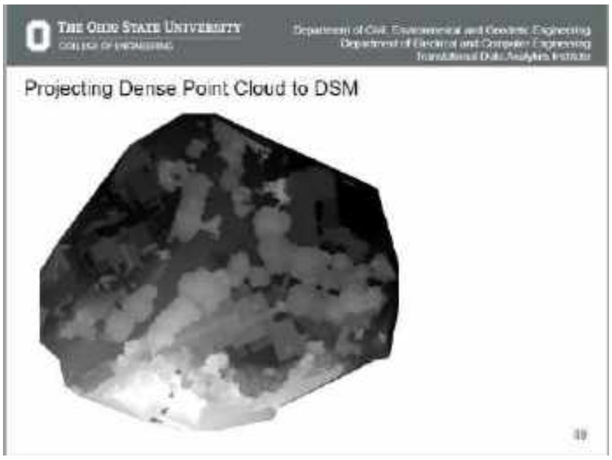
Triangulate the disparity (dense identical points) to point clouds
48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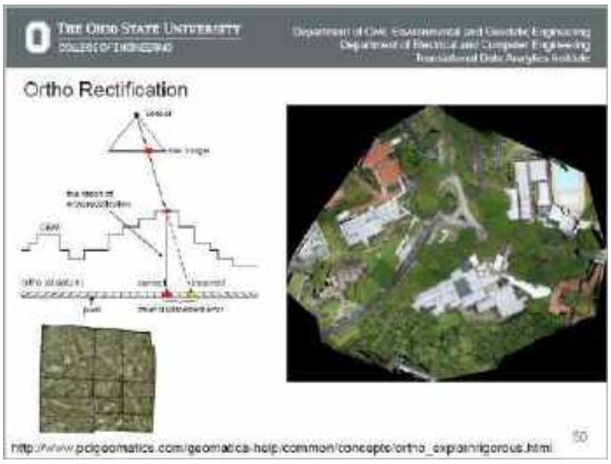
Translational Data Analytics Institute
Projecting Dense Point Cloud to DSM
49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Ortho Rectification
50
http://www.pcigeomatics.com/geomatica-help/common/concepts/ortho_explainrigorous.html


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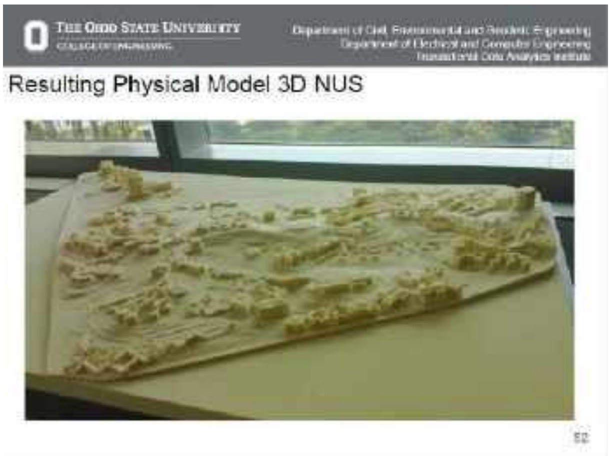
Translational Data Analytics Institute
Applications – 3D City Modeling
UAS modeling of National University of Singapore Campus
Ground resolution: 5 cm
Horizontal and vertical accuracy : 5-10 cm
Mobile LiDAR for 18 km
Application: solar panel analysis, wind simulation, urban design
51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Resulting Physical Model 3D NUS
52


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Traffic trajectory mapping
Obtaining critical driving parameters for multiple cars:
Speed, acceleration, break
Spaceborne video camera is also there!

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

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What is Big Scale Map?

Based on Wikipedia:

Classification	Range	Examples
large scale	1:0 – 1:600,000	1:0.00001 for map of virus; 1:5,000 for walking map of town
medium scale	1:600,000 – 1:2,000,000	Map of a country
small scale	1:2,000,000 – 1:∞	1:50,000,000 for world map; $1{:}10^{21}$ for map of galaxy

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https://en.wikipedia.org/wiki/Scale_(map)

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 presents also characteristics of the landscape (http://www.mapdesign.si/en/maps.html).

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Big Scale Mapping

- High spatial resolution satellite images
- Aerial photographs
- UAV collected photographs

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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.

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https://en.wikipedia.org/wiki/Photogrammetry

Collinearity Equation

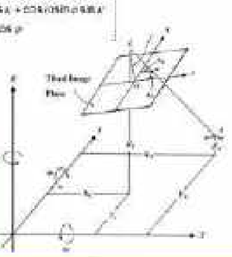
$$r_p^C = k_p^{-1} \cdot R_M^C \cdot (r_p^M - r_C^M)$$

$$R_M^C = \begin{bmatrix} \cos\varphi\cos\kappa & \cos\omega\sin\kappa + \sin\omega\sin\varphi\cos\kappa & \sin\omega\sin\kappa - \cos\omega\sin\varphi\cos\kappa \\ -\cos\varphi\sin\kappa & \cos\omega\cos\kappa - \sin\omega\sin\varphi\sin\kappa & \sin\omega\cos\kappa + \cos\omega\sin\varphi\sin\kappa \\ \sin\varphi & -\sin\omega\cos\varphi & \cos\omega\cos\varphi \end{bmatrix}$$

$$\begin{bmatrix} x \\ y \\ -f \end{bmatrix} = k^{-1} \begin{bmatrix} r_{11} & r_{12} & r_{13} \\ r_{21} & r_{22} & r_{23} \\ r_{13} & r_{23} & r_{33} \end{bmatrix} \begin{bmatrix} E_p - E_0 \\ N_p - N_0 \\ H_p - H_0 \end{bmatrix}$$

$$x = -f \frac{r_{11}(E_p - E_0) + r_{12}(N_p - N_0) + r_{13}(H_p - H_0)}{r_{31}(E_p - E_0) + r_{32}(N_p - N_0) + r_{33}(H_p - H_0)}$$

$$y = -f \frac{r_{21}(E_p - E_0) + r_{22}(N_p - N_0) + r_{23}(H_p - H_0)}{r_{31}(E_p - E_0) + r_{32}(N_p - N_0) + r_{33}(H_p - H_0)}$$



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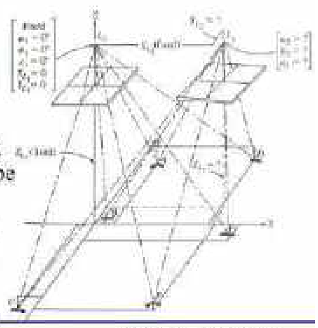
From Tseng, Y.H. (2016)

Coplanarity Conditions

- Coplanarity conditions

$$\left(r_p^{C_1}\right)^T \cdot K_{r_{C_2}^{C_1}} \cdot R_{C_2}^{C_1} \cdot r_p^{C_2} = 0$$

- Fix the E.O. of the left image and the baseline vector, then 5 independent parameters are remain to be determined
- Therefor, solution can be found with 5 pairs of conjugate points



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From Tseng, Y.H. (2016)

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)

Why GNSS?

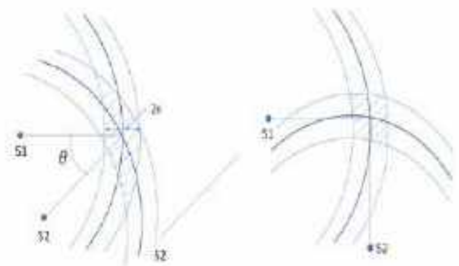
- Collecting ground control points for aerial triangulation;
- Determining the trajectory of the flight, obtaining the direct observation of the exterior orientation.

GNSS: A short introduction

GNSS positioning principle

- Arc 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.

Intersection error (Mohan, 2017)



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 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.

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/GPS Practice

The background

- GNSS (Global Navigation Satellite System)
- Operational systems: GPS, GLONASS, Beidou, Galileo

http://en.wikipedia.org/wiki/Satellite_navigation

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

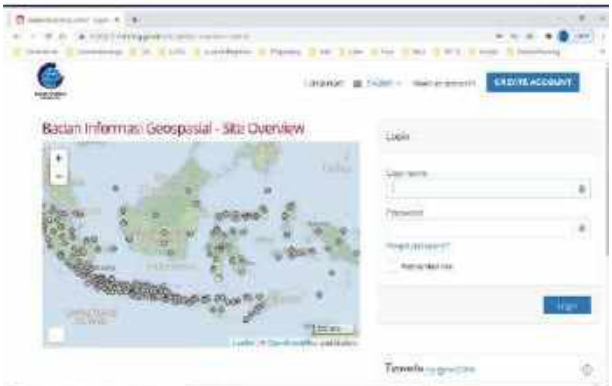
- Established with a network of CORS (Continuously Operating Reference Stations)
- Need both satellite and mobile communication availability
- Services in Taiwan: eGNSS from NLSC, a government agency, and several commercial services

network RTK -2

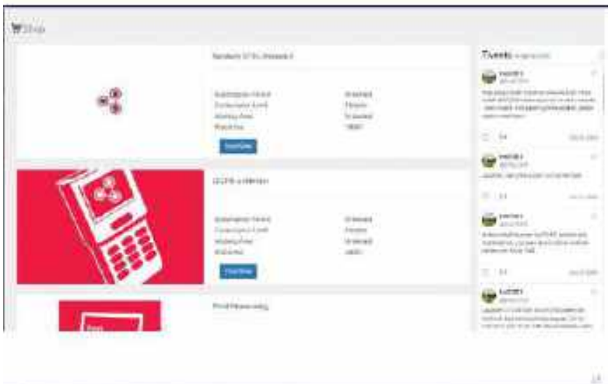
- There may be different datum, the GNSS (WGS84 for GPS, PZ-90 for Glonass), the nRTK coordinate system, the legal coordinate system …
- In Taiwan, eGNSS provides online coordinate system transformation.

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/SBC/spider-business-center



http://nrtk.big.go.id/SBC/User/Shop

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InaCORS BIG Satu Referensi Pemetaan Indonesia, Jan. 2019

- A total of 137 InaCORS stations spread from Sabang to Merauke. 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.

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GNSS: In the field

Learning about the sky

With android apps

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

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GPS Test

GPS Test

GPS Test

GPS Test

AGPS

- Assisted GPS, or augmented GPS
- AGPS server, services based on the System-On-Chip design
- Qualcomm: gpsOneXTRA Assistance
- Broadcomm: A-GPS-WWRN (https://www.broadcom.com/products/wireless/gnss-gps-socs/a-gps-wwrn)

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GPS Status & Toolbox

GPS Status & Toolbox

GPS Status & Toolbox

GNSS data and processing

Outline

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

How to get coordinates of GCPs?

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

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Type		Accuracy	Latency	Updates	Sample Interval
Broadcast	orbits	~100 cm	real time	—	daily
	Sat. clocks	~5 ns RMS ~2.5 ns SDev			
Ultra-Rapid (predicted half)	orbits	~5 cm	real time	at 03, 09, 15, 21 UTC	15 min
	Sat. clocks	~3 ns RMS ~1.5 ns SDev			
Ultra-Rapid (observed half)	orbits	~3 cm	3 - 9 hours	at 03, 09, 15, 21 UTC	15 min
	Sat. clocks	~150 ps RMS ~50 ps SDev			
Rapid	orbits	~2.5 cm	17 - 41 hours	at 17 UTC daily	15 min
	Sat. & Stn. clocks	~75 ps RMS ~25 ps SDev			5 min
Final	orbits	~2.5 cm	12 - 18 days	every Thursday	15 min
	Sat. & Stn. clocks	~75 ps RMS ~20 ps SDev			Sat.: 30s Stn.: 5 min

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https://www.igs.org/products/#about

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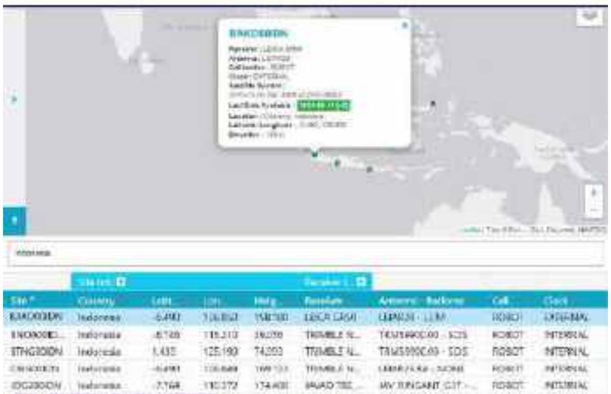
https://www.igs.org/stations



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https://www.igs.org/network/#station-map-list

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https://www.igs.org/data-access/#ftp

IGS ftp sites

- ftp://garner.ucsd.edu/
- ftp://igs.ensg.ign.fr/pub/igs/data/
- ftp://nfs.kasi.re.kr/gps/data/
- ftp://gssc.esa.int/gnss/data/
- cddis, using FileZilla

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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.

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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/

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Product and data to be downloaded

- RINEX file of CORS, usually I download the daily file
- Clock (clk), orbit (sp3), Earth Rotation Parameter (erp)

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

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ftp://garner.ucsd.edu/rinex/2020/021/

BAIE00CAN_R_20200210000_01D_30S_MO.crx.gz	1.3 MB	2020/1/21 上午8:00:00
BAKE00CAN_R_20200210000_01D_30S_MO.crx.gz	1.5 MB	2020/6/20 上午8:00:00
BAKO00IDN_R_20200210000_01D_30S_MO.crx.gz	1.4 MB	2020/1/22 上午8:00:00
BELE00BRA_R_20200210000_01D_30S_MO.crx.gz	2.3 MB	2020/1/21 上午8:00:00
BIK000KGZ_R_20200210000_01D_30S_MO.crx.gz	1.7 MB	2020/1/21 上午8:00:00
BOAV00BRA_R_20200210000_01D_30S_MO.crx.gz	2.3 MB	2020/1/21 上午8:00:00
BOGI00POL_R_20200210000_01D_30S_MO.crx.gz	2.0 MB	2020/1/22 上午8:00:00
BOGT00COL_R_20200210000_01D_30S_MO.crx.gz	2.1 MB	2020/1/21 上午8:00:00
BOR100POL_R_20200210000_01D_30S_MO.crx.gz	2.0 MB	2020/1/21 上午8:00:00
BRAZ00BRA_R_20200210000_01D_30S_MO.crx.gz	1.8 MB	2020/1/21 上午8:00:00
BREW00USA_R_20200210000_01D_30S_MO.crx.gz	2.1 MB	2020/1/21 上午8:00:00
BRST00FRA_R_20200210000_01D_30S_MO.crx.gz	2.0 MB	2020/1/22 上午8:00:00
BRUN00BRN_R_20200210000_01D_30S_MO.crx.gz	2.0 MB	2020/1/21 上午8:00:00
BRUX00BEL_R_20200210000_01D_30S_MO.crx.gz	1.8 MB	2020/1/21 上午8:00:00
BSHM00ISR_R_20200210000_01D_30S_MO.crx.gz	2.6 MB	2020/1/21 上午8:00:00
CAS100ATA_R_20200210000_01D_30S_MO.crx.gz	2.3 MB	2020/1/22 上午8:00:00

BONA and BTNG have no data on that day.

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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

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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

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Download brdc from cddis with Filezilla

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Download brdc

- ftp://gssc.esa.int/gnss/data/daily/2020/021/

brdc0210.20n.Z	23.6 kB	2020/1/22 上午8:00:00
brdc0210.20g.Z	20.9 kB	2020/1/22 上午8:00:00
izmi0210.20d.Z	179 kB	2020/1/21 上午8:00:00
izmi0210.20n.Z	18.5 kB	2020/1/21 上午8:00:00
krs10210.20g.Z	12.8 kB	2020/1/22 上午8:00:00
krs10210.20n.Z	18.5 kB	2020/1/22 上午8:00:00
BRDC00IGS_R_20200210000_01D_MN.rnx.gz	67.4 kB	2020/2/22 上午8:00:00

20**n**: for GPS; 20**g**: for GLONASS

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Convert dates

- http://sopac.ucsd.edu/convertDate.shtml
- 2020.021

Equivalent Dates	
GPS week, day of week	2089 2
Year, Day of Year	2020 021
Modified Julian Day	58869
Decimal Year	2020.056
YYYY-MM-DD	2020-01-21

Download igs products

- ftp://garner.ucsd.edu/pub/products/2088/

igs20882.sp3.Z	95.0 kB	2020/2/4 上午8:00:00
igs20883.clk.Z	1.5 MB	2020/2/4 上午8:00:00
igs20883.clk_30s.Z	3.1 MB	2020/2/4 上午8:00:00
igs20883.cls.Z	15.4 kB	2020/2/4 上午8:00:00
igs20883.sp3.Z	95.2 kB	2020/2/4 上午8:00:00
igs20884.clk.Z	1.5 MB	2020/2/4 上午8:00:00

The Final Orbit files generated and uploaded

- igs2088[0-6].sp3 IGS GPS ephemeris files in SP3 format.
- igs2088[0-6].clk IGS GPS satellite and station clocks in clock RINEX format.
- igs2088[0-6].cls IGS GPS clock combination summary report.
- igs20887.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.

igs20887.sum

GNSS processing

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.

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.

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/

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.

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http://www.rtklib.com/

Download

From GitHub:

- For 2.4.3 source and data; https://github.com/tomojitakasu/RTKLIB/tree/rtklib_2.4.3 ;
- For 2.4.2; https://github.com/tomojitakasu/RTKLIB

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rtklibexplorer

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

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rtklibexplorer

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https://rtklibexplorer.wordpress.com/

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https://github.com/rtklibexplorer/RTKLIB

Click "code" ➔ download zip

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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.

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File Structure

app	檔案資料夾
bin	檔案資料夾
brd	檔案資料夾
data	檔案資料夾
doc	檔案資料夾
lib	檔案資料夾
src	檔案資料夾
test	檔案資料夾
util	檔案資料夾
readme.txt	UltraEdit Document (.txt)

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Functions

	Function	GUI AP	CUI AP	Notes
(a)	AP Launcher	RTKLAUNCH (3.1)	-	
(b)	Real-Time Positioning	RTKNAVI (3.2, 3.3, 3.5)	RTKRCV (3.11, A.1)	
(c)	Communication Server	STRSVR (3.3)	STRSVR (3.11, A.5)	
(d)	Post-Processing Analysis	RTKPOST (3.4, 3.5)	RNX2RTKP (3.11, A.2)	
(e)	RINEX Converter	RTKCONV (3.6)	CONVBIN (3.11, A.4)	
(f)	Plot Solutions and Observation Data	RTKPLOT (3.7, 3.8)	-	
(g)	Downloader for GNSS Products and Data	RTKGET (3.9)	-	
(h)	NTRIP Browser	SRCTBLBROWS (3.10)	-	

Start RTKLIB

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

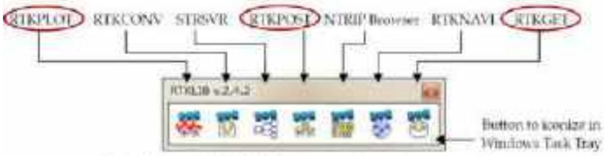

Figure 3.1-1 RTKLAUNCH window and launcher icons for APs

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Module 1: RTKGET

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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.

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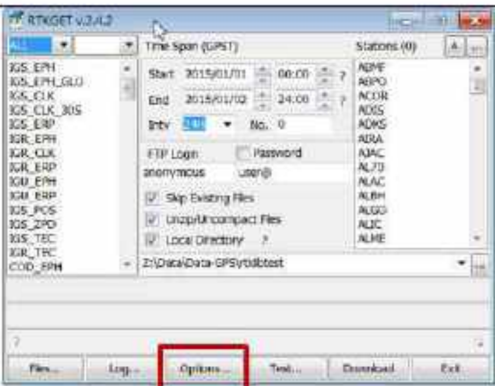

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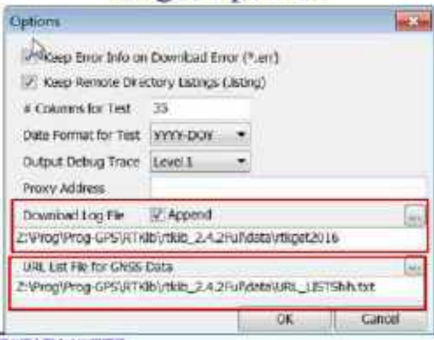
rtkget-options



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keywords in a url address are replaced as follows

- ■# **%Y -> yyyy : year (4 digits) (2000-2099)**
- ■# **%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-x)
- ■# %M -> mm : minutes (00-59)
- ■# **%n -> ddd : day of year (001-366)**

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- ■# %W -> wwww : gps week (0001-9999)
- ■# %D -> d : day of gps week (0-6)
- ■# **%s -> ssss : station name (lower-case)**
- ■# **%S -> SSSS : station name (upper-case)**
- ■# %r -> rrrr : station name
- ■# %{env} -> env : environment variable

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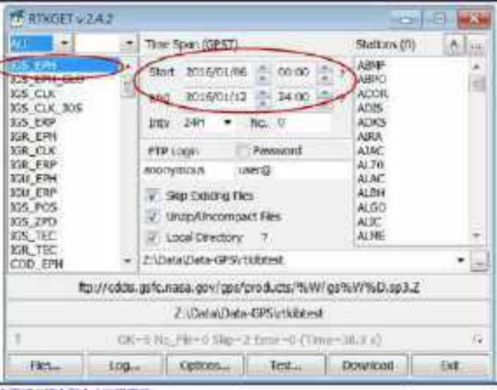


"Interval" parameters in the GUI

- 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 7day 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?

The Meaning of igs18783.sp3

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

18783

- GPS Week number (**1878**) and Day of Week (**3**)
- One online utc to gps date converter is located at,

http://sopac.ucsd.edu/convertDate.shtml

- 18783: 2016-01-06
- 18792: 2016-01-12
- Why igs18793.sp3 is downloaded?

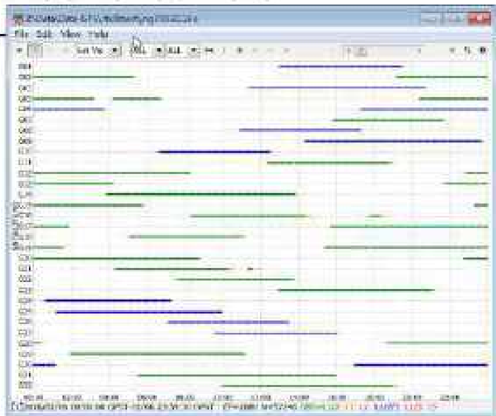
Hatanaka-Compression

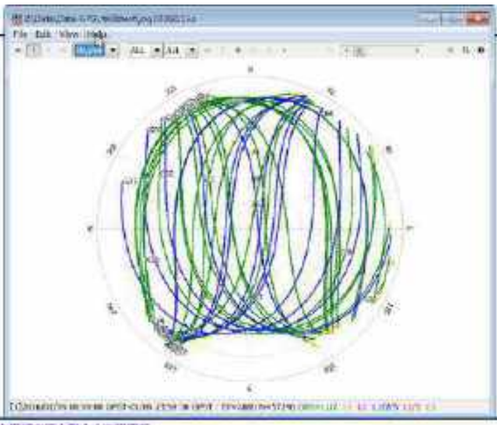
- The **.yyd** files are files with Hatanaka-Compression.
- This compression can convert a RINEX observation file into a smaller ASCII format.
- Yuki Hatanaka (hatagsi.go.jp) (GSI) wrote and maintains rnx2crx and crx2rnx, which allows the user to compress/decompress, respectively (https://www.unavco.org/data/gps-gnss/hatanaka/hatanaka.html).

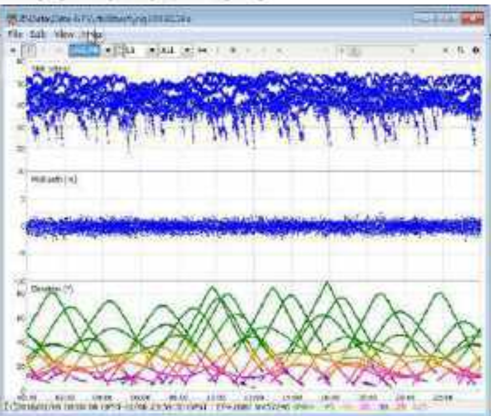
Module 2: RTKPLOT

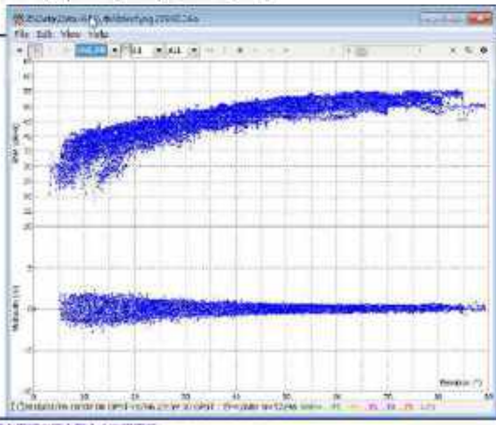
RTKPLOT

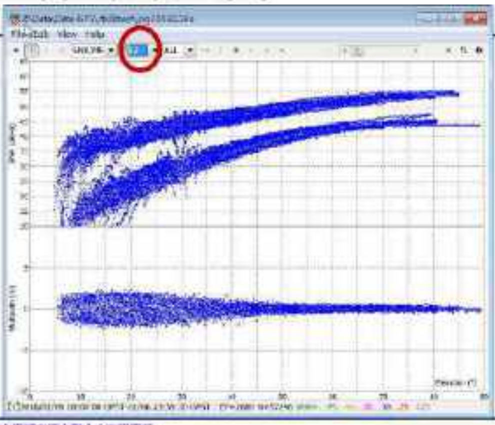
- Start from the rtklaunch GUI, press the most left icon.
- File → Open Obs Data **(jog20060.16o)**
- File → Open Nav Data **(brdc0060.16n)**







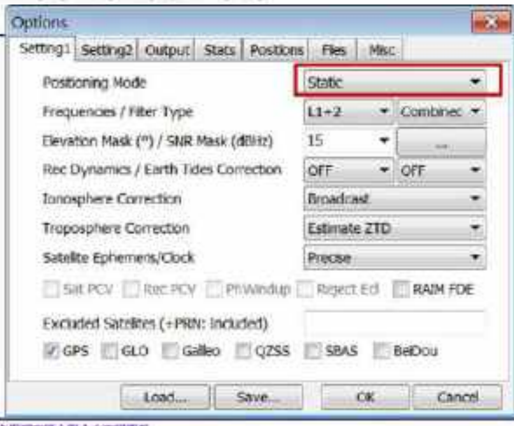


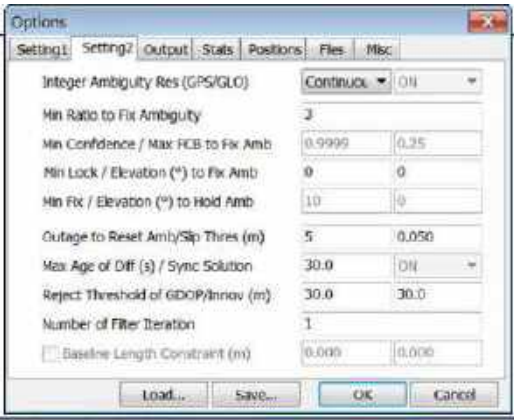


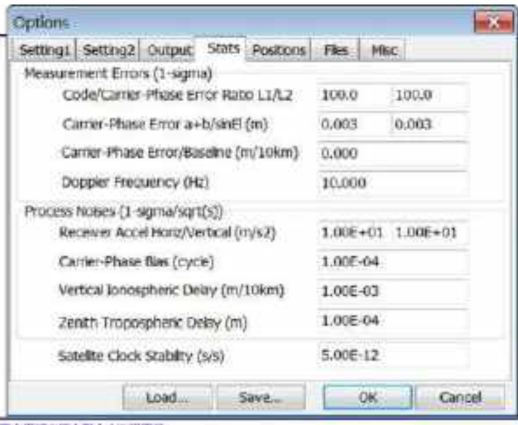
Module 3: RTKPOST

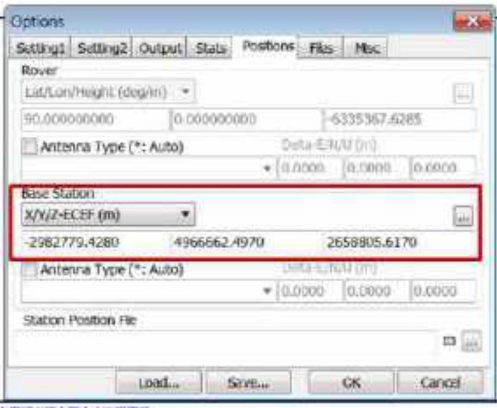
Subjects

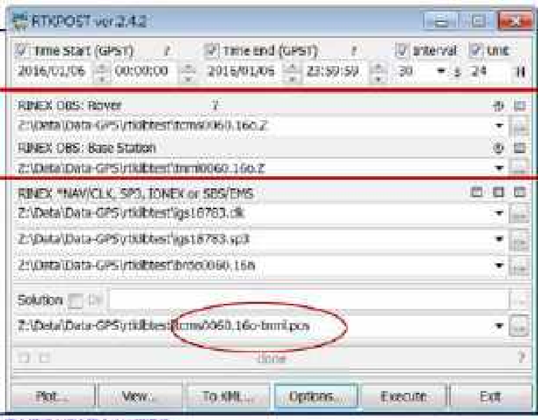
- ■Differential GNSS, Static
- ■Differential GNSS, Kinematic

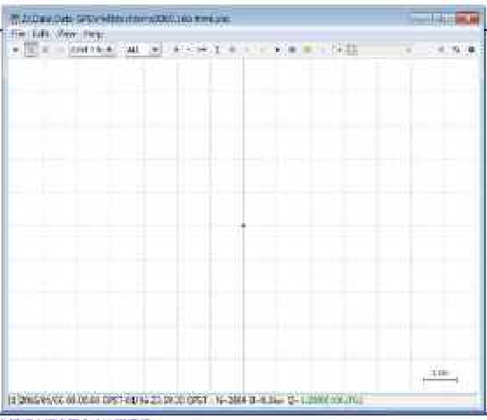


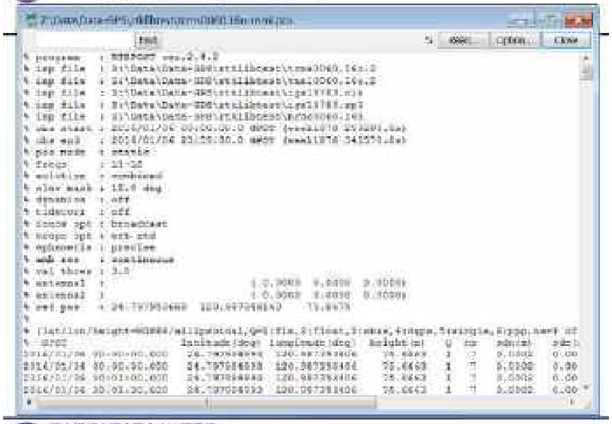




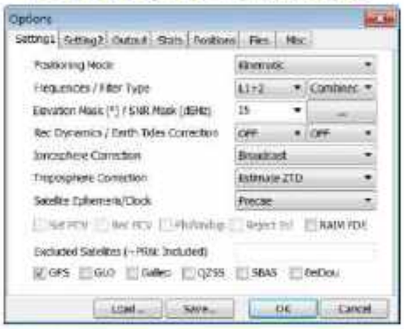








RTKPOST: Kinematic



Baseline

■ 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 USA NGA software, https://earth-info.nga.mil/GandG/update/index.php?action=home
- 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.

https://earth-info.nga.mil/GandG/update/index.php?action=home

End User Version:

The End User version is recommended for t

Windows users should determine whether t

installed.

- Windows 32-bit End User - SHA256: 0
- Windows 64-bit End User - SHA256: 6
- Windows End User - All Files - SHA256
- Linux End User - All Files - SHA256: 1A

https://earth-info.nga.mil/GandG/update/index.php?action=home

Master Version:

The Master version is for software developers and includes all of the GeoTrans executables for all platforms, all source code and all documentation. The only difference between the Windows and Linux version is the method used to zip the files.

- Windows Master - SHA256: 54EDB287FAB8AE5C4743F3CBEB1CF41A60DE5FEE1AF6EDDCF9189283928DC018
- Linux Master - SHA256: 8AA72D3B1AE12F237A8AD30F2DEB3FFD2B8DFE8759528EA0A7284842C877C565

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\GEOTRANS3\win_64
- runGeotrans.bat

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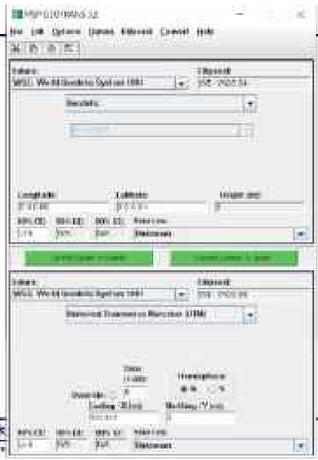

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An Exercise

- TNML

  X: -2982779.428

  Y: 4966662.497

  Z: 2658805.617

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Options/Format

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Change Format

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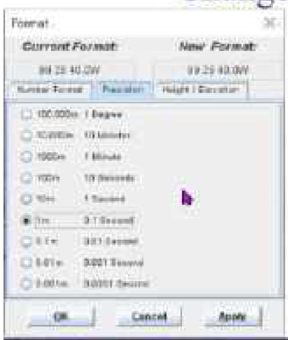
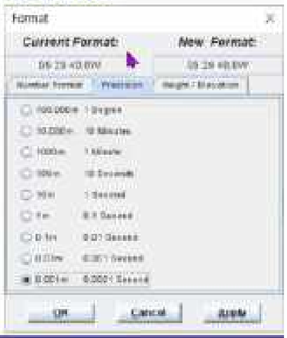
Change Precision





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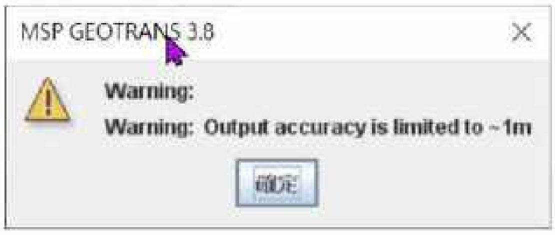
Limitation



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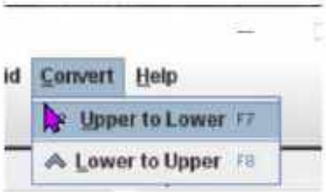
Convert → upper to Lower



國立陽明交通大學土木工程學系
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Result

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

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Check the consistency

- TNML (Original)
  X: -2982779.428
  Y: 4966662.497
  Z: 2658805.617
- TNML (Reversed)
  X: -2982779.428
  Y: 4966662.497
  Z: 2658805.617

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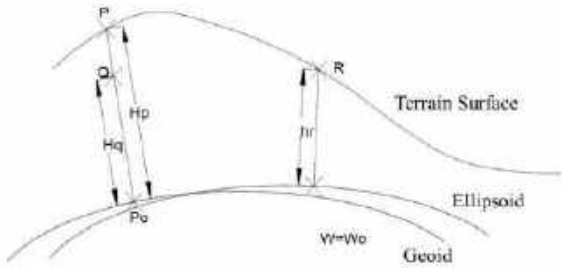
Height Systems



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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.

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Thank you all.

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

國立陽明交通大學土木工程學系
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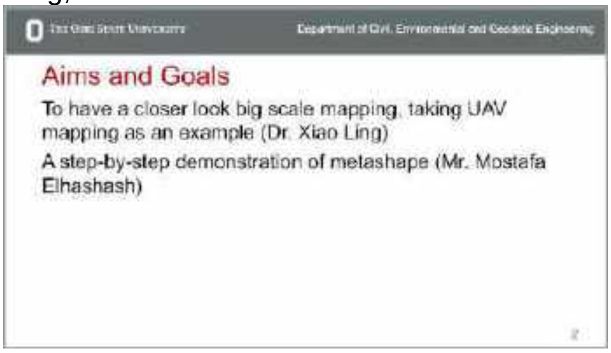
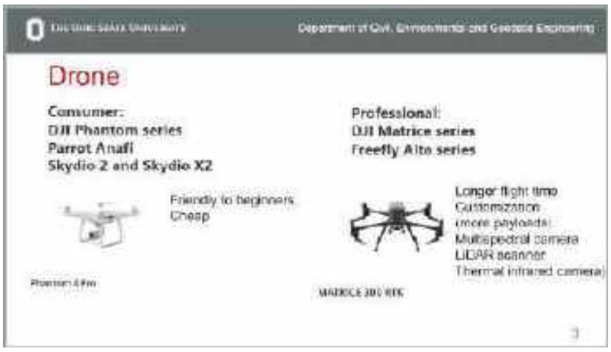
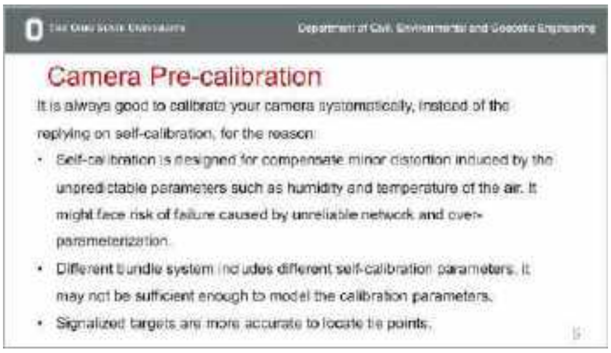
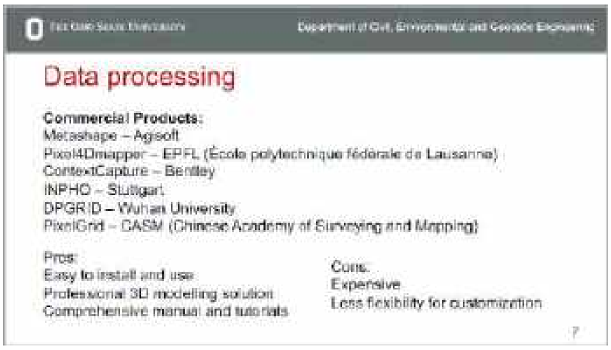
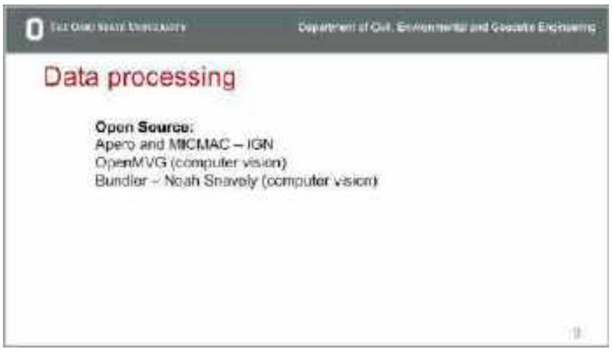
6.5. Day 3, Lecture 3: Prof. Rongjun Qin, Dr. Xiao Ling, Mr. Mostafa Elhashash

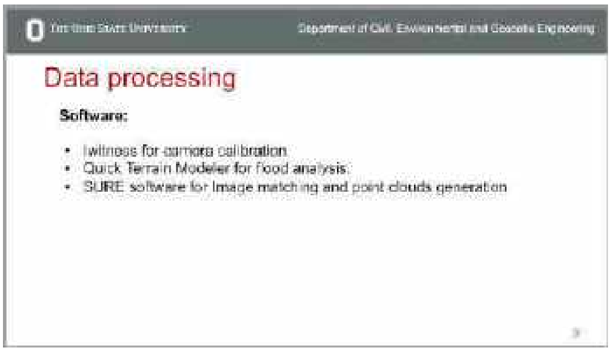


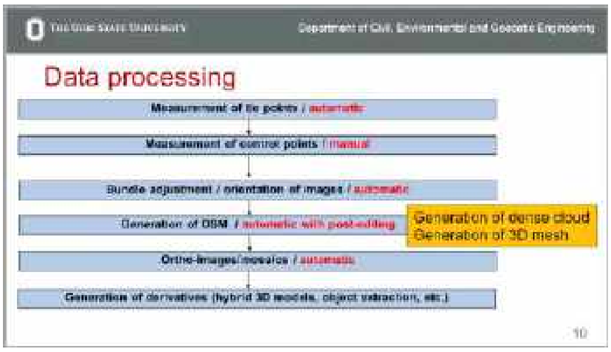


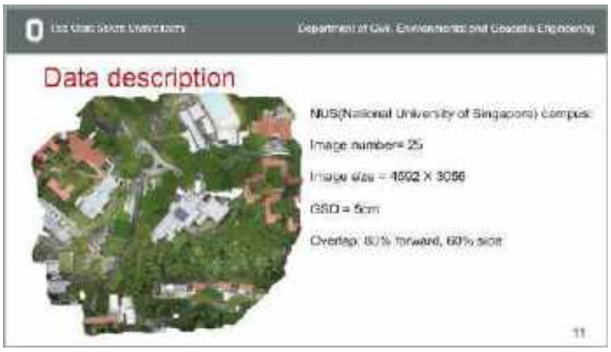








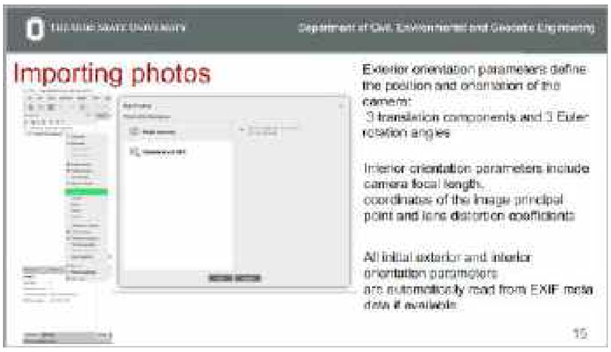



Department of Civil, Environmental and Geodetic Engineering
Data description
NUS(National University of Singapore) campus
Image number= 25
Image size = 4592 X 3056
GSD = 5cm
Overlap: 80% forward, 60% side
11

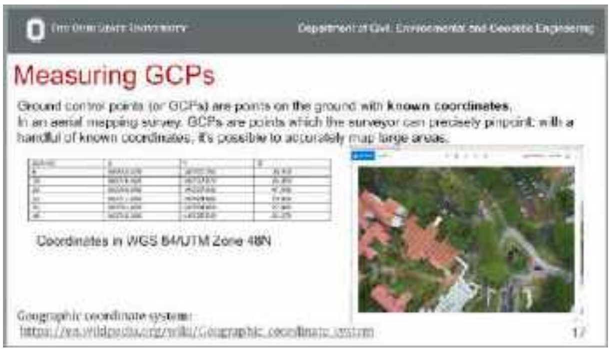

The Ohio State University
Demonstration of the metashape
Mr. Mostafa Elhashash


Department of Civil, Environmental and Geodetic Engineering
Metashape
Agisoft Metashape is a stand-alone software product that performs photogrammetric processing of digital images and generates 3D spatial data to be used in GIS applications, cultural heritage documentation, and visual effects production as well as for indirect measurements of objects of various scales.
Homepage https://www.agisoft.com
13

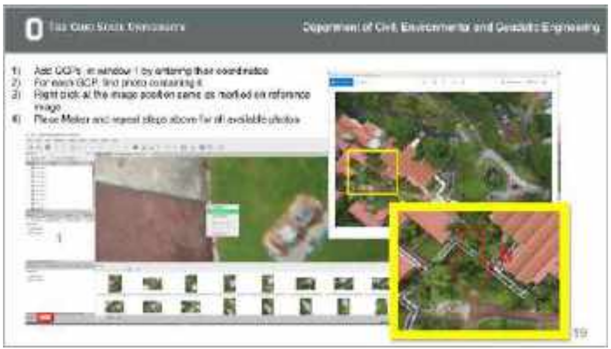

Department of Civil, Environmental and Geodetic Engineering
Contents
1. Importing photos
2. Measuring GCPs
3. Geo-referencing
4. Building dense cloud
5. Building mesh
6. Building DSM
7. Building orthophoto
14

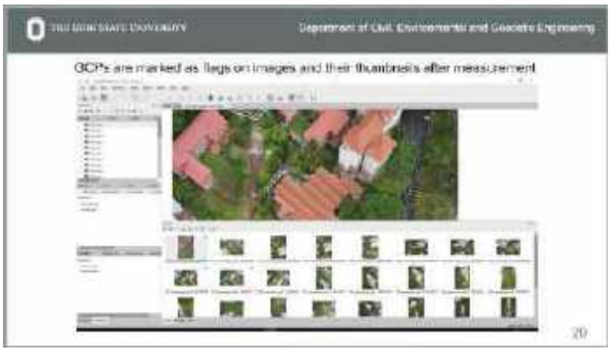

Department of Civil, Environmental and Geodetic Engineering
Importing photos
Exterior orientation parameters define the position and orientation of the camera:
3 translation components and 3 Euler rotation angles
Interior orientation parameters include camera focal length, coordinates of the image principal point and lens distortion coefficients
All initial exterior and interior orientation parameters are automatically read from EXIF meta data if available
15

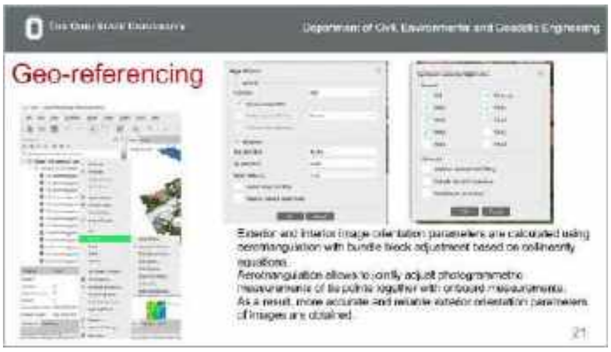

Department of Civil, Environmental and Geodetic Engineering
Importing photos
16

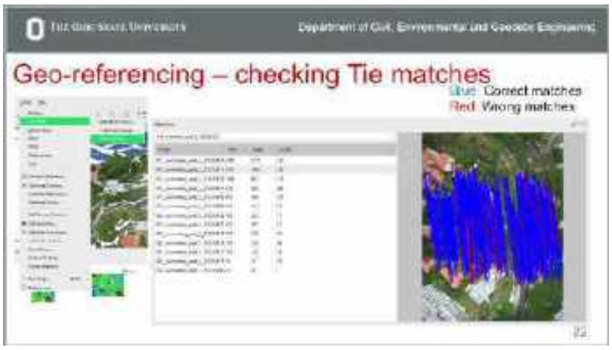

Department of Civil, Environmental and Geodetic Engineering
Measuring GCPs
Ground control points (or GCPs) are points on the ground with known coordinates.
In an aerial mapping survey, GCPs are points which the surveyor can precisely pinpoint: with a handful of known coordinates, it's possible to accurately map large areas.
Coordinates in WGS 84/UTM Zone 48N
Geographic coordinate system:
https://en.wikipedia.org/wiki/Geographic_coordinate_system
17


Department of Civil, Environmental and Geodetic Engineering
Measuring GCPs
Setting GCP coordinate system
18

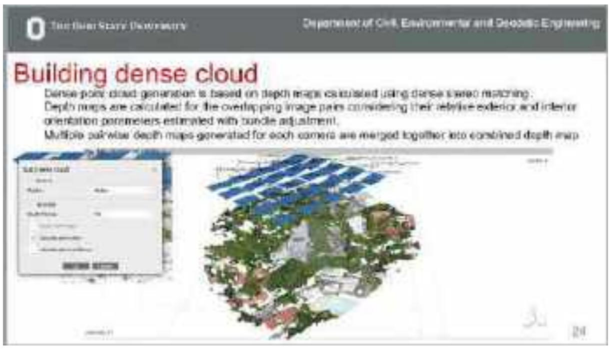

Department of Civil, Environmental and Geodetic Engineering
1) Add GCPs in window 1 by entering their coordinates
2) For each GCP, find photo containing it
3) Right click at the image position same as marked on reference image
4) Place Marker and repeat steps above for all available photos
1
19

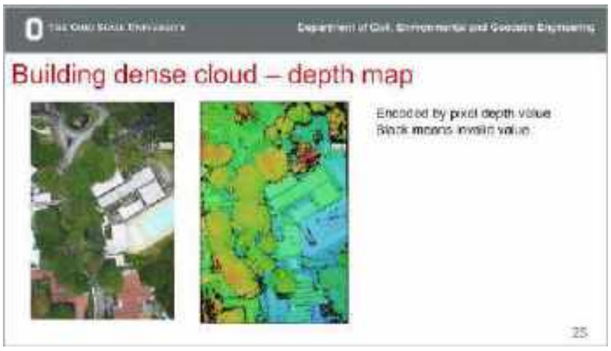

Department of Civil, Environmental and Geodetic Engineering
GCPs are marked as flags on images and their thumbnails after measurement
20


Department of Civil, Environmental and Geodetic Engineering
Geo-referencing
Exterior and interior image orientation parameters are calculated using aerotriangulation with bundle block adjustment based on collinearity equations.
Aerotriangulation allows to jointly adjust photogrammetric measurements of tie points together with onboard measurements.
As a result, more accurate and reliable exterior orientation parameters of images are obtained.
21

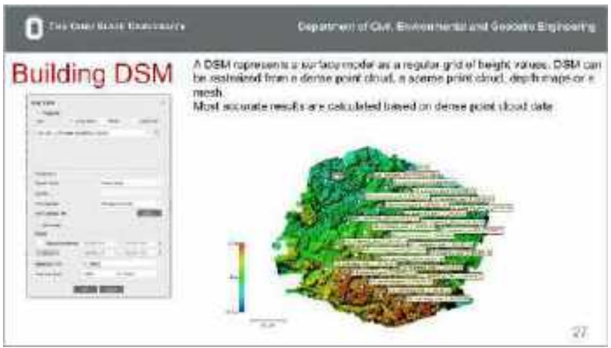

Department of Civil, Environmental and Geodetic Engineering
Geo-referencing – checking Tie matches
Blue: Correct matches
Red: Wrong matches
22


Department of Civil, Environmental and Geodetic Engineering
Geo-referencing – sparse cloud
23


Department of Civil, Environmental and Geodetic Engineering
Building dense cloud
Dense point cloud generation is based on depth maps calculated using dense stereo matching.
Depth maps are calculated for the overlapping image pairs considering their relative exterior and interior orientation parameters estimated with bundle adjustment.
Multiple pairwise depth maps generated for each camera are merged together into combined depth map
24


Department of Civil, Environmental and Geodetic Engineering
Building dense cloud – depth map
Encoded by pixel depth value
Black means invalid value
25


Department of Civil, Environmental and Geodetic Engineering
Building mesh
Polygonal mesh model is built based on the dense point cloud information
26


Department of Civil, Environmental and Geodetic Engineering
Building DSM
A DSM represents a surface model as a regular grid of height values. DSM can be rasterized from a dense point cloud, a sparse point cloud, depth maps or a mesh.
Most accurate results are calculated based on dense point cloud data
27


Department of Civil, Environmental and Geodetic Engineering
DSM as a gray scale image
28


Department of Civil, Environmental and Geodetic Engineering
Building orthophoto
Orthophoto is obtained by orthorectification and mosaic of the original images
29


Thank you for your time
30

6.5. Day 4, Lecture 1: Dr. Mulyanto Darmawan

TRAINING

Theory and concept of Integration Coastal and Land Spatial Planning

Mulyanto Darmawan

The practical Ways of Integrated Coastal SPDE, Semarang City

15-22 Februari 2021

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. Conclussion

Definition

Space means a site that consists of land space, oceanic space, and air space, including space within the earth as one united area, where humans and other creatures live, carry out activities and maintain a sustainable life. (Law no 26/2007 about spatial management)

Sea water (Ocean) is space on earth that connects the mainland to the mainland and other natural forms, which is the geographical and ecological unity and all its associated elements, and the limits and the system is determined by the legislation and international law (Law no 32/20114 about the sea)

Spatial is the space aspect of an object or event. Spatial use is the form of space structure and space pattern (Law no 26/2007 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)

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 stipulation and room pattern at area of planning which covers the activity which do and do not execute also the activity which is only shall be executed after getting the permit (law no 27/2007 about RZWP3K)

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

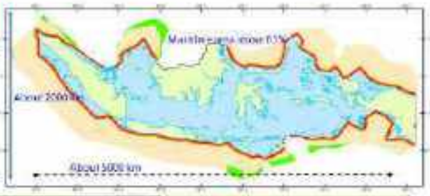
TRAINING

Role of IG for Regional Spatial Development

INDONESIA has vast territory and abundant land and marine resources

Maritime Continent of Indonesia

Geospatial Information is compulsory for supporting sustainable development of and managing its natural resources

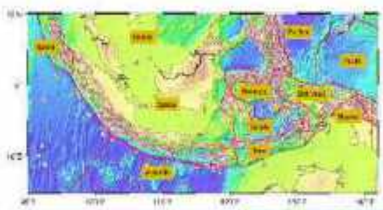


LAND AREA	1.900.000 Km²
MARITIME AREA : Sovereignty Territory	
• Internal and archipelagic waters	3.110.000 Km²
• Territorial Sea	290.000 Km²
MARITIME AREA : Sovereign Right Zone	
• Contiguous Zone	270.000 Km²
• Economic Exclusive Zone	3.000.000 Km²
• Continental Shelf	[illegible] Km²
MARITIME AREA OF INDONESIA	[illegible] Km²
TOTAL AREA OF INDONESIA (LAND & WATER)	[illegible] Km²

Coastline length	[illegible] Km
Number of Islands	17.504 islands - [illegible] islands has been verified and submitted to UN (2015)

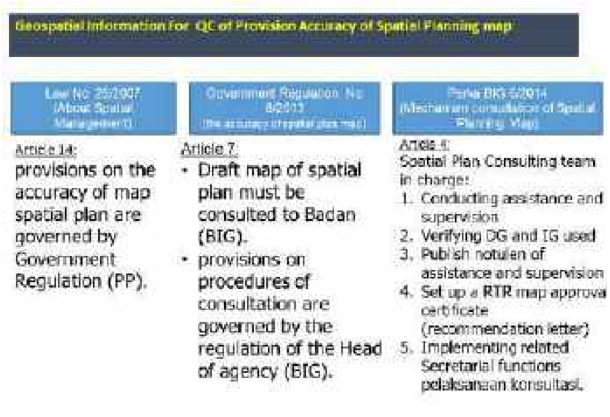
INDONESIA however is also prone to several natural disasters: earthquakes, tsunami, volcano eruption, flooding, landslide, etc.

INDONESIA
Home of Natural Hazards



Geospatial Information is compulsory for supporting Disaster Risk Reduction Management activities

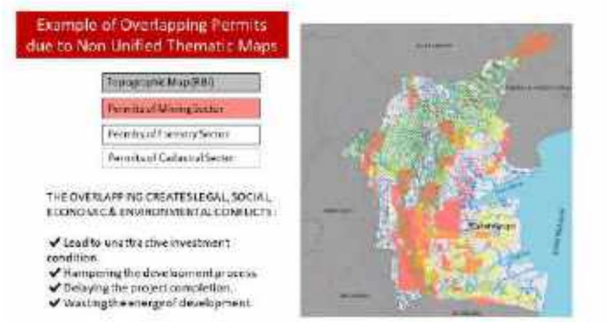
- Earthquakes
- Tsunami
- Volcano Eruption
- Flooding
- Landslide
- Land subsidence
- Drought
- Flooding
- Forest fire
- Windstorm


Geospatial Information For QC of Provision Accuracy of Spatial Planning map
Law No 26/2007 (About Spatial Management)
Government Regulation No 8/2013
Perka BIG 6/2014 (Mechanism consultation of Spatial Planning Map)
Article 14:
provisions on the accuracy of map spatial plan are governed by Government Regulation (PP).
Article 7:
• Draft map of spatial plan must be consulted to Badan (BIG).
• provisions on procedures of consultation are governed by the regulation of the Head of agency (BIG).
Article 4:
Spatial Plan Consulting team in charge:
1. Conducting assistance and supervision
2. Verifying DG and IG used
3. Publish notulen of assistance and supervision
4. Set up a RTR map approval certificate (recommendation letter)
5. Implementing related Secretarial functions pelaksanaan konsultasi.


TRAINING
Development and Future Application of Geospatial Information technology in Indonesia


Geospatial Information Management in Indonesia
Based on Law No. 4/2011
GEOSPATIAL INFORMATION
BASIC GEOSPATIAL INFORMATION
THEMATIC GEOSPATIAL INFORMATION
GEOSPATIAL INFORMATION INFRASTRUCTURE
Base Maps
Geodetic Control Network
Various Thematic Maps
Ministries Agencies Local Governments


1. One Map Policy
Indonesia
THEMATIC MAPPING:
THEMATIC DOMAIN:


Example of Overlapping Permits due to Non Unified Thematic Maps
Topographic Map (RBI)
Permits of Mining Sector
Permits of Forestry Sector
Permits of Cadastral Sector
THE OVERLAPPING CREATES LEGAL, SOCIAL, ECONOMIC & ENVIRONMENTAL CONFLICTS :
✔ Lead to unattractive investment condition.
✔ Hampering the development process.
✔ Delaying the project completion.
✔ Wasting the energy of development.


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

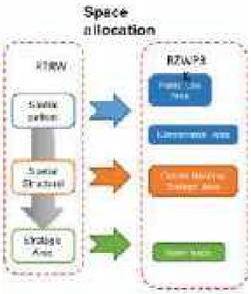

Ongoing & Incoming Geospatial Activities
Geodetic Reference Frames
• Densification of GNSS CORS and Tide Gauge Stations.
Basic Geospatial Information
• Acceleration of 1:5000 national topographic base map.
• Establishment of 1:1000 base map for metropolitan areas.
One Map Policy
• Synchronization of overlapping thematic maps.
• Inclusion of more thematic maps and map custodians.
• Going from 1:50.000 to 1:5.000 scales.
National Geospatial Information Network
• Increasing quantity and quality of information content.
• Increasing the network connection nodes to ministries, agencies, local government, and universities.
Geospatial Human Resources
• Increasing quantity and quality of the human resources.
• System for competence test, certification, and licensing.
Integration of Geospatial and Statistical Data
• Integration to support national development planning.
• Integration for achieving the SDGs.
Accelerating Detail Spatial Planning (RDTR)
• High resolution satellite data acquisition and orthorectification.
• Integration thematic map for spatial planning.


TRAINING
Status of Coastal (RZWP3K) and Land Spatial (RTRW) Planning in Indonesia

- Law No 26/2007 on spatial management and Law no 27/2007 amended by Law No 1/2014 on the management of Coastal areas and small islands.

Type of Management	Type of Area	
	Land	Coastal, Small Island
RUTR (General Spatial planning)	RTRW (National, Provincial, Regency/City)	RSWP3K, RZWP3K
RRTR (Detail Spatial Planning)	RTR (National Strategic area, Provincial Strategic area, regency strategic area, Detailed Spatial Planning)	RZWP3K

Space allocation



The disharmony between land and coastal – marine spatial planning has been threatening the sustainable coastal development

The disharmony between land and coastal – marine spatial planning has been threatening the sustainable coastal development

Status of RTRW and RZWP3k

Data Integration

The next important task is to integrate the Coastal Spatial Planning program with Land Spatial Planning to be ONE DATA INDONESIA

ONE DATA OF SPATIAL PLANNING

Methodology for Integration

Study area

GIS analysis

Geometric correction.
- all data have the same coordinate and projection systems

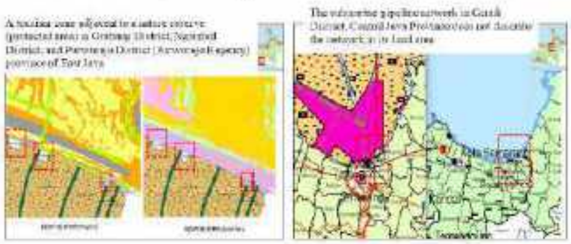
Topology check.
- So that all data do not have topology problems, such as undershoot, overshoot.

Check classification and toponomy.
- So that all data have the same classification

Seamless process
- Union, merge and dissolve

Synchronisation and harmonization between RTRW and RZWP3K to understand a connection between zonation

Tourist area and submarine pipe line intersect with protected area



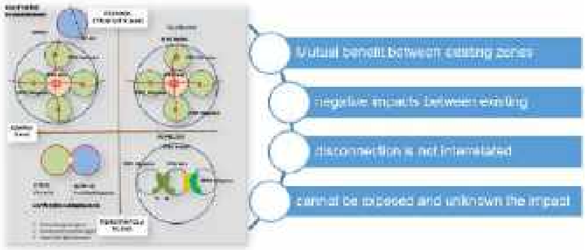
Mangrove area close to industrial area and Migration path of biota intersect by area of port

The mangrove forest type is adjacent to an industrial sector Demak Regency

The port intersects the migration path of the biota in Cilacap Regency

Integration status

Result



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.

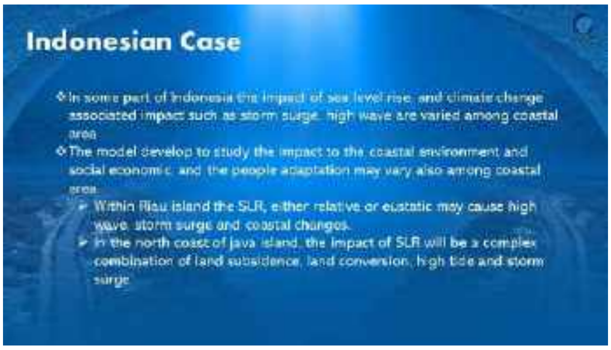
Conclusion

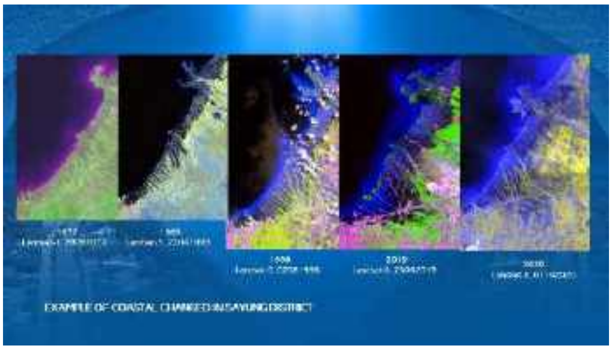
Base map is difference and affect to the difference on coastline boundary. The differences include in the geometric, attribute, and topological aspects of the dataset. As for geometric aspect, the land spatial planning (RTRW) adopts mean sea level as base map while coastal spatial plan (RZWP3K) uses the highest tidal

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

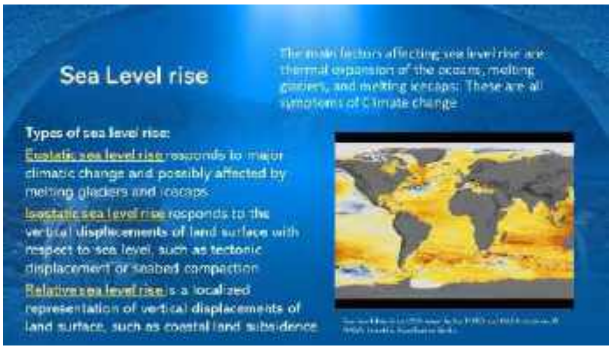
Inconsistencies zone found in adjacent zonation between coastal and land, therefore to achieve the Sustainable Coastal Area Development goal, harmonization between these spatial maps should needs to be done before implementing the national development program.

6.5. Day 4, Lecture 2: Prof. Dewayany Sutrisno

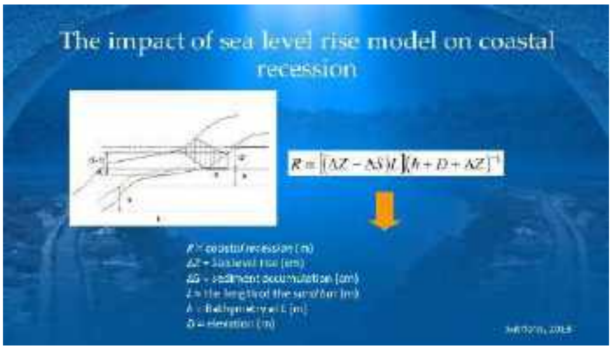


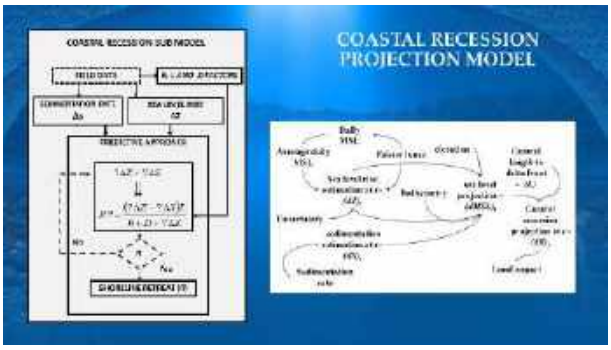



What has been occurred in this area?
Climate change
Sea level rise
Eustatic
Isostatic
Relative
Storm surge
High wave
High tide
Coastal erosion
Coastal inundation
Flooding
Land subsidence
Ground water discharge
Population growth
Physical development


Sea Level rise
The main factors affecting sea level rise are thermal expansion of the oceans, melting glaciers, and melting icecaps. These are all symptoms of Climate change
Types of sea level rise:
Eustatic sea level rise responds to major climatic change and possibly affected by melting glaciers and icecaps
Isostatic sea level rise responds to the vertical displacements of land surface with respect to sea level, such as tectonic displacement or seabed compaction
Relative sea level rise is a localized representation of vertical displacements of land surface, such as coastal land subsidence


RELATIVE SEALEVEL RISE ⟶ LAND SUBSIDENCE
Jakarta Tangerang Bekasi
Blanakan
Brebes
Pekalongan Pemalang
Semarang Demak
Gresik
Surabaya


The impact of sea level rise model on coastal recession
$R = [(\Delta Z - \Delta S)L]/(h + D + \Delta Z)$
R = coastal recession (m)
ΔZ = Sea level rise (cm)
ΔS = sediment accumulation (cm)
L = the length of the surf zone (m)
h = Bathymetry at L (m)
D = elevation (m)


COASTAL RECESSION SUB MODEL
SHORELINE RETREAT (R)
COASTAL RECESSION PROJECTION MODEL

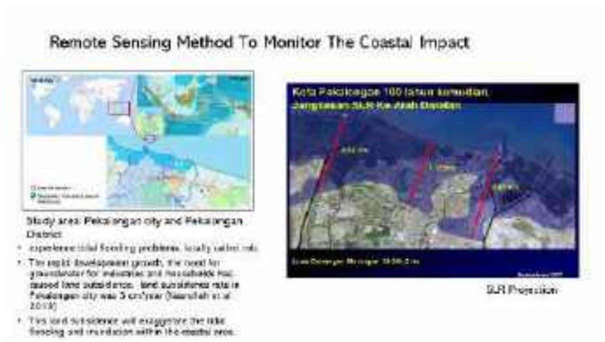
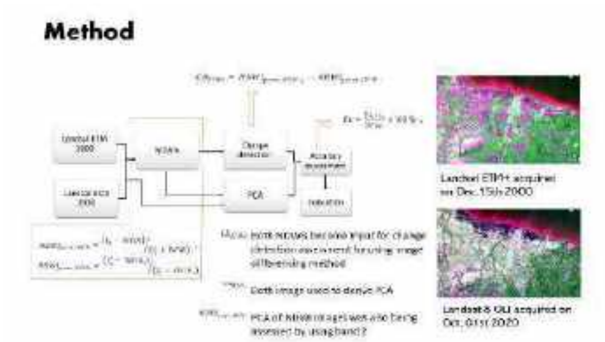
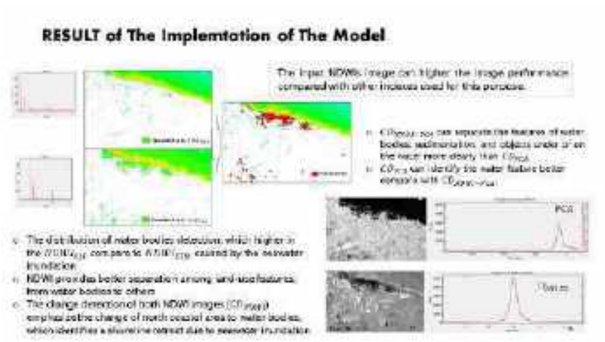
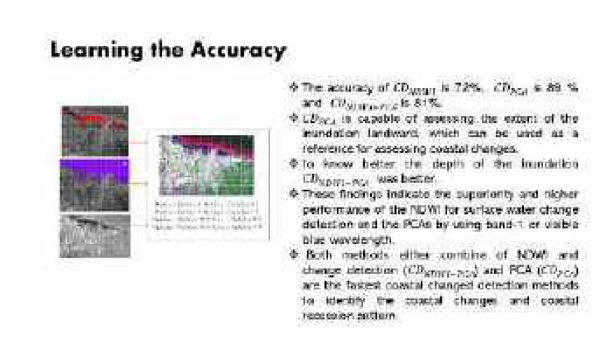
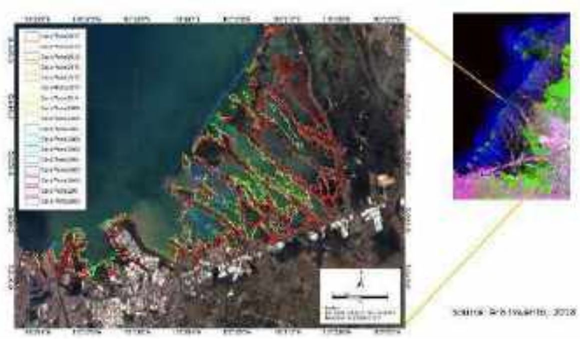

Remote Sensing Method To Monitor The Coastal Impact
Study area: Pekalongan city and Pekalongan District
SLR Projection

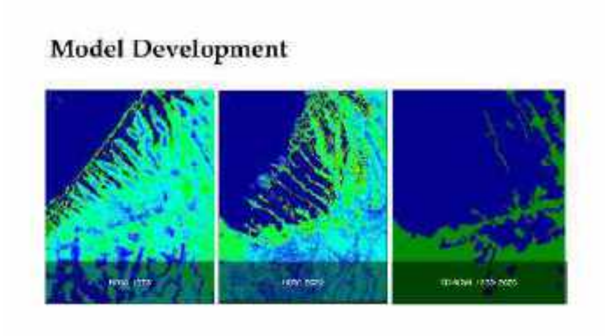

Image of the flooding

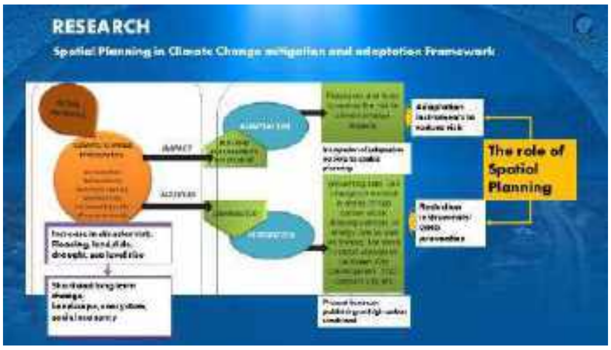

Method
NDWI
PCA
Landsat ETM+ acquired on Dec. 15th 2000
Landsat 8 OLI acquired on Oct. 01st 2020


RESULT of The Implemtation of The Model
PCA


Learning the Accuracy

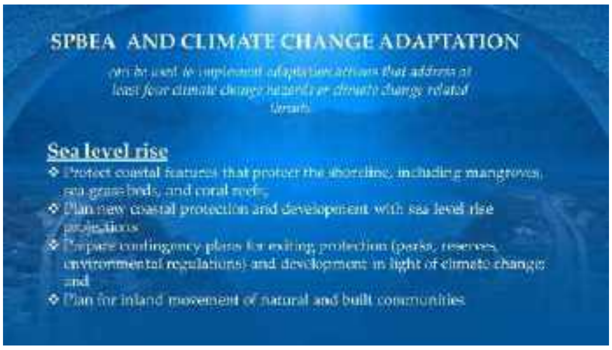

Source: Arie Yuwanto, 2018


Model Development

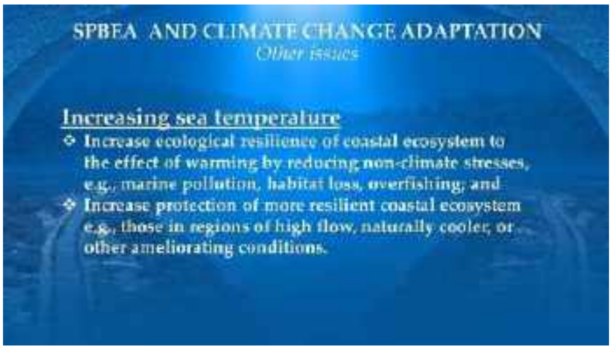

RESEARCH
Spatial Planning in Climate Change mitigation and adaptation Framework
IMPACT
Adaptation instruments to reduce risk
The role of Spatial Planning
Reduction instruments/ GHG prevention


How SPBEA can do?
Ecosystem-based management has been promoted internationally as the best way to ensure the sustainability of marine environments, since it is characterized by the sustainability, ecological health and human inclusion in the ecosystem
Science-based environmental factors, human wellbeing and sustainable development can be strengthened through developing the spatial-planning-based ecosystem adaptation (SPBEA)


Data collection
Analysis & planning
Implementation
Monitoring and evaluation
Integrated management plan
SPBEA SYSTEMATIC PROCESS
includes stakeholder involvement throughout the management process, management that is adaptive, and objectives that are broad in scope
would include areas of high biodiversity, high endemism, and high productivity, as well as spawning areas, nursery areas, migration corridors and stopover points
includes collecting information and mapping existing and future human activities in the marine and coastal area
involve broadening the scale of what is being managed
involve more attention to governing across scales


SPBEA AND CLIMATE CHANGE ADAPTATION
Sea level rise
Protect coastal features that protect the shoreline, including mangroves, sea grass beds, and coral reefs;
Plan new coastal protection and development with sea level rise projections
Prepare contingency plans for exiting protection (parks, reserves, environmental regulations) and development in light of climate change; and
Plan for inland movement of natural and built communities


SPBEA AND CLIMATE CHANGE ADAPTATION
Increasing storm surge, tidal wave frequency/intensity
Identify coastal areas subject to flooding, high winds, high waves, erosion
Use ecological buffer zones to provide habitat and connectivity, minimize erosion, providing flood storage and reducing flood velocities, and improve water quality through filtration of harmful sediments, pollutants and nutrients

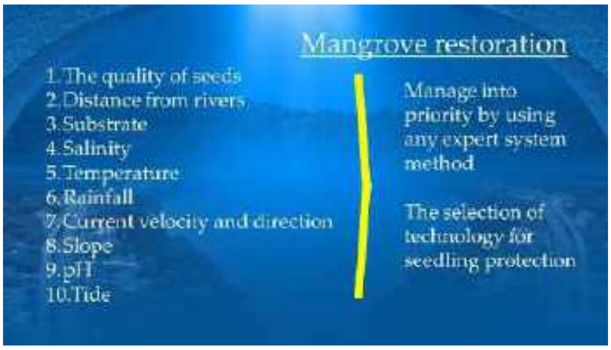

SPBEA AND CLIMATE CHANGE ADAPTATION
Other issues
Increasing sea temperature
Increase ecological resilience of coastal ecosystem to the effect of warming by reducing non-climate stresses, e.g., marine pollution, habitat loss, overfishing; and
Increase protection of more resilient coastal ecosystem e.g., those in regions of high flow, naturally cooler, or other ameliorating conditions.


SPBEA AND CLIMATE CHANGE ADAPTATION
Other issues
Ocean acidification
Reduce other non-climate stresses and ameliorate other climate stresses to increase resilience of coastal ecosystem to early pH shifts


The process
Identify the data for analysis and planning
Mangrove ecosystem area


The process
Identify the data for analysis and planning
Analysis & planning
Implementation
Monitoring and evaluation
Mangrove ecosystem area
ADAPTIVE TO MANGROVE ECOSYSTEM CHARACTERISTIC


Coastal zone protection


Mangrove restoration
1.The quality of seeds
2.Distance from rivers
3.Substrate
4.Salinity
5.Temperature
6.Rainfall
7.Current velocity and direction
8.Slope
9.pH
10.Tide
Manage into priority by using any expert system method
The selection of technology for seedling protection


Ponds culture
Slope
Soil type
Land use
Distance from rivers and coast
Rainfall
Geomorphology
Salinity
Dissolved oxygen
Nitrate
Environmental condition
Manage into priority by using any expert system method
The selection for technology practice


The process
Analysis & planning
Implementation
Monitoring and evaluation
First of all, more detailed spatial planning refers to the regional spatial plan that has been established by the government
For example: selection of the spatial plan of a village plan to be the rural settlement zone and the aquaculture zone
Selection of the spatial allocation
Analysis of the selected allocation:
Analysis of the site for detailed planning

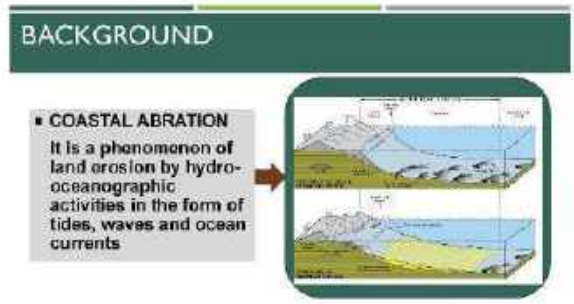

The process
Analysis of the site for detailed planning
Analysis in planning
Implementation
Monitoring and evaluation
Participatory spatial planning mapping:
is a mapping method that places the community as the actor of mapping their territory, as well as being the determinant of their own regional development planning
How is the village spatial planning mapping process carried out?

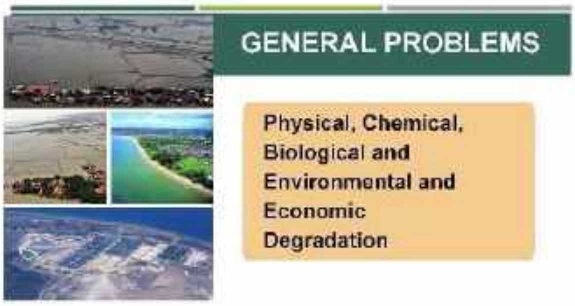

The process
The proposed allocation in site planning
Data collection
Analysis in planning
Implementation
Monitoring and evaluation
Accommodation & settlements

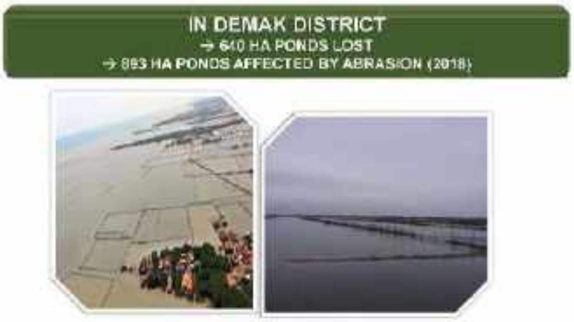

TRAINING
Thank You

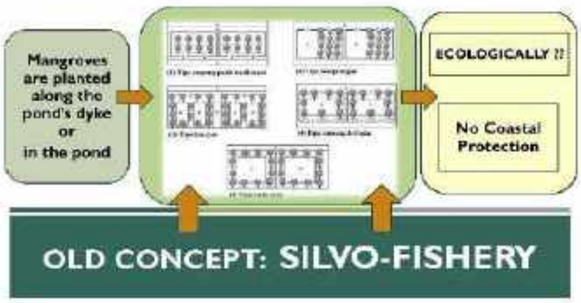

REFERENCES

6.5. Day 4, Lecture 3: Prof. Sri Rejeki










MANGROVE PLANTING ON THE POND'S DYKE OR INSIDE THE POND
Increase shading of the pond
In extensive ponds are shallow (40-50 cm water depth)
Stunted natural food growth
The water temperature drops

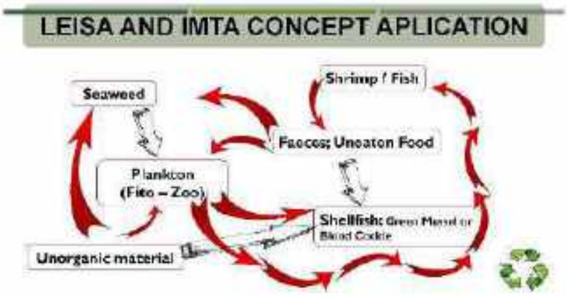

ASSOCIATED MANGROVE AQUACULTURE
Green belt space (Gov Rule No. 51 of 2016) Regarding coastal boundaries
Mangroves along the coastline 100-200 m from the lowest tide to the land
Mangroves 15-20 m from river embankment to land


WHY DO WE NEED ASSOCIATED MANGROVE AQUACULTURE ?
In terms of pond management
Protects pond dykes → reduces operational costs of pond maintanance
Pond management can be done more optimally
Water quality degradation is avoided / reduced


WHY DO WE NEED ASSOCIATED MANGROVE AQUACULTURE ?
From Ecosystem Point of view mangrove green belt provides
As a nursery and feeding grounds for economic important marine larvae
Leaves and fruit can be processed as food: api-api (Avicennia spp), tancang/lindur (Bruguiera spp); pedada (Sonneratia spp).
Mangrove leaves can be used to make compost for pond fertilizer.
Mangrove root can absorb pollutant


Asociated Mangrove Pond
The pond area for cultivation is reduced because part of the pond is for mangrove growth
however,
Pond productivity increases due to water quality improvement


LOW EXTERNAL INPUT SUSTAINABLE AQUACULTURE (LEISA)
INTEGRATED MULTI TROPHIC AQUACULTURE (IMTA)

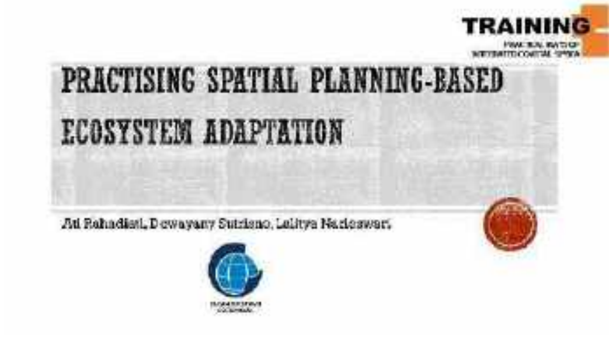

LEISA AND IMTA CONCEPT APLICATION
Seaweed
Shrimp / Fish
Faeces; Uneaten Food
Plankton (Fito – Zoo)
Shellfish: Green Mussel or Blood Cockle
Unorganic material

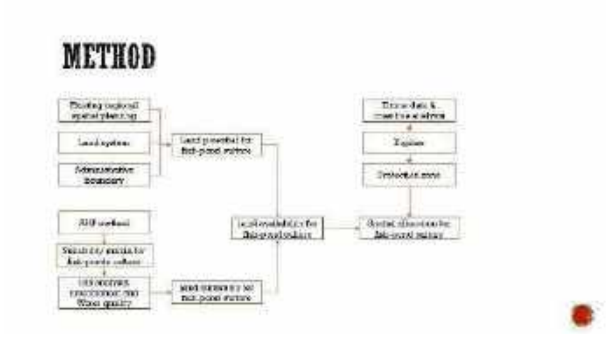

LEISA – IMTA APPLICATION ADVANTAGES
LEISA - IMTA
Traditional Ponds Affected by Abrasion
Improve the quality of the environment
Increase pond productivity
Increase revenue
Ensuring Sustainable Aquaculture

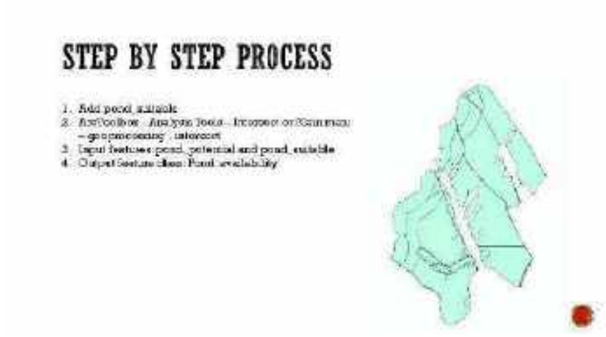

Associated Mangrove Pond Design
Water inlet
Cultured Pond
Shrimp; Milkfish
Shrimp; Milkfish
Biofilter Pond:
Tilapia
Milkfish
Green Mussel or Blood Cockle;
Seaweed Gracilaria


THANK YOU

6.5. Day 4, Lecture 4: Dr. Ati Rahadiati







STEP BY STEP PROCESS

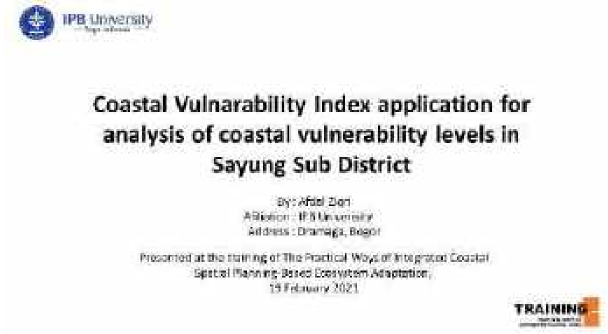
Digitize new shapefile (protection_zone)

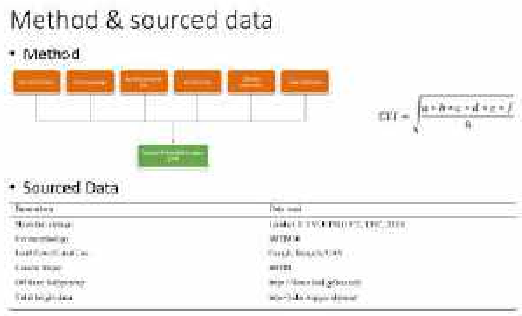
1. Add image/shapefile
2. Select Windows – catalog
3. Add new shapefile
4. Edit feature – Start editing

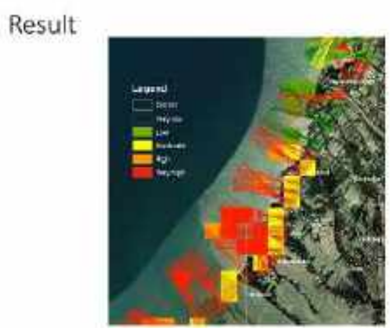
PRACTICE

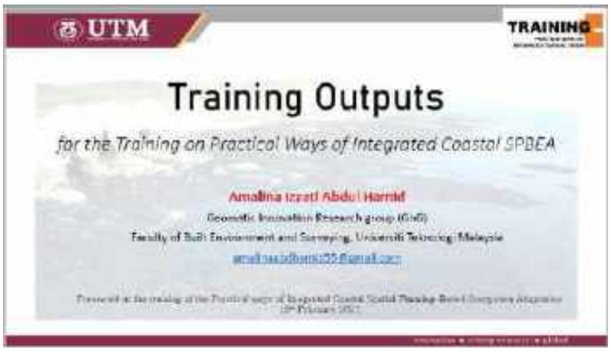
- Make spatial allocation for fish-pond culture in Surodadi village
- Calculate the area for fish-pond

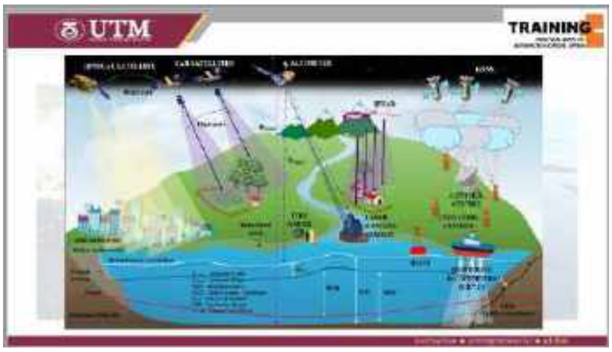
6.5. Day 5, Presentation from the trainees

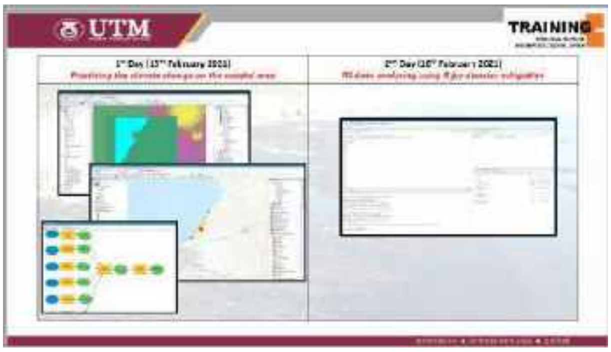







UTM
TRAINING
Training Outputs
for the Training on Practical Ways of Integrated Coastal SPBEA
Amalina Izzati Abdul Hamid
Geomatic Innovation Research group (GnG)
Faculty of Built Environment and Surveying, Universiti Teknologi Malaysia


UTM
TRAINING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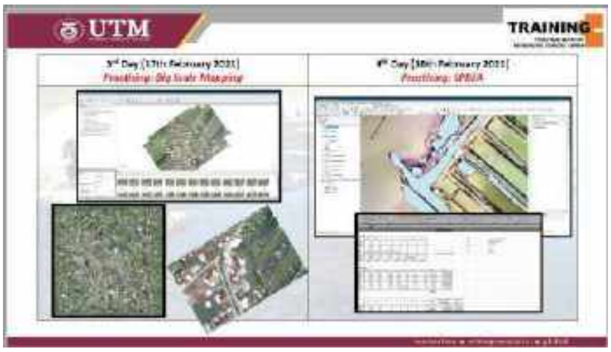
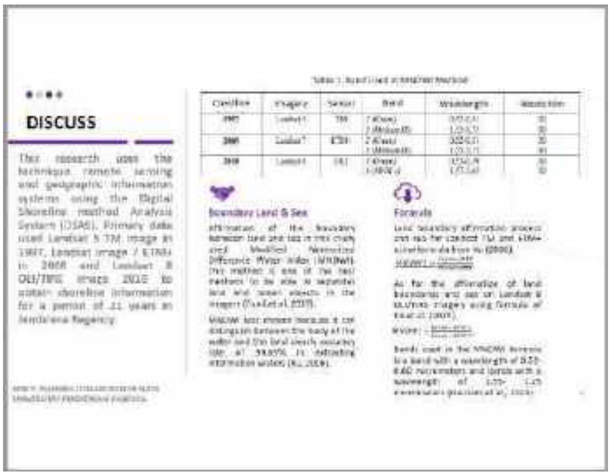
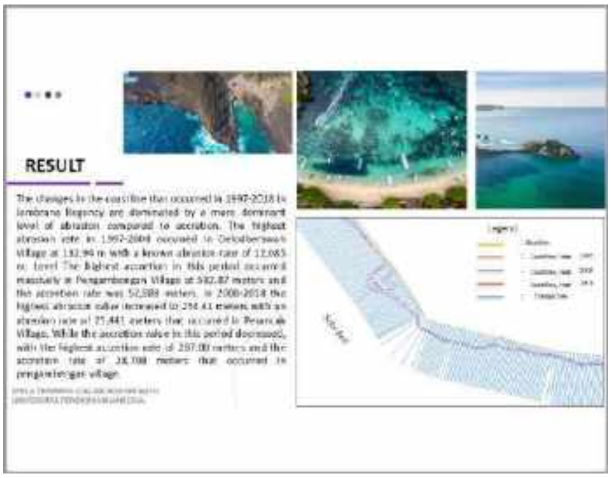
TRAINING

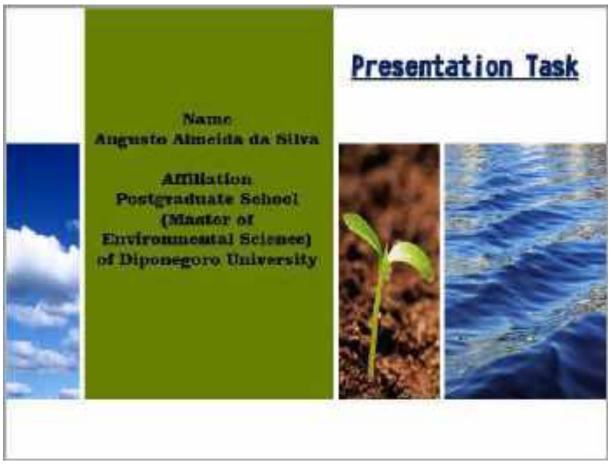

UTM
TRAINING

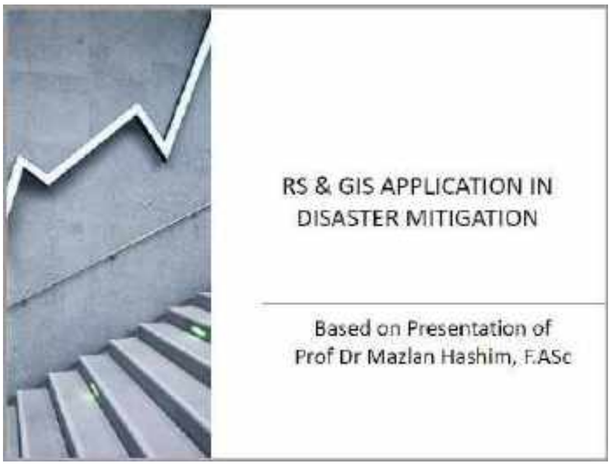

UTM
TRAINING
Thank you
Geomatic Innovation Research Group
(GnG)


TRAINING
DETECTION OF SHORELINE CHANGES
1997-2018 WITH DSSAS IN
JEMBRANA REGENCY
PRESENTED AT THE TRAINING OF THE
PRACTICAL WAYS OF INTEGRATED
COASTAL SPATIAL PLANNING-BASED
ECOSYSTEM ADAPTATION (SPBEA)
FEBRUARY 18, 2021


DISCUSS







RS & GIS are

1. An information technology effectively handle the management process natural disasters.
2. To Manage and first respond about natural disasters, at every stage. Information roads, population and circumstances topography of the earth can be made into clear map format before disaster natural.
3. Can make things easier some disastrous effects with incorporating information technology with emergency management knowledge.

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

RS 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 centre 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 organise 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

Babucarr Jassey
Diponegoro University

Main interest on climate change as it is one of the courses I am taking.

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.

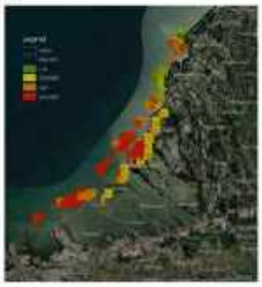
Biological impacts of climate change

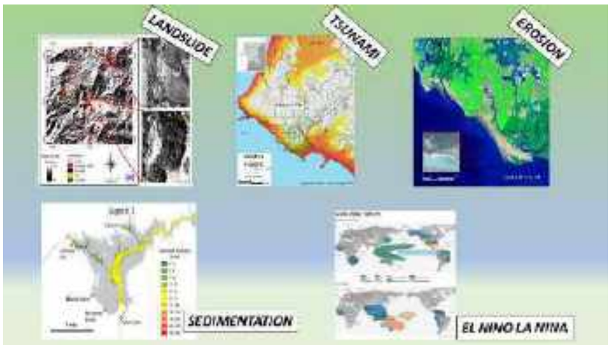
- Increased heat, drought and insect outbreaks, all linked to climate change, have increased wildfires.
- Additional concerns on the declining water supplies can:

1. reduced agricultural yields,
2. health impacts in cities due to heat
3. flooding and erosion in coastal areas

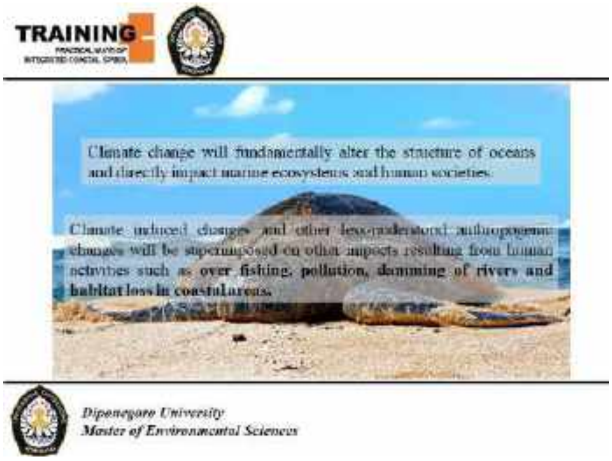
The use of Arc GIS was beneficial for the practical exercise

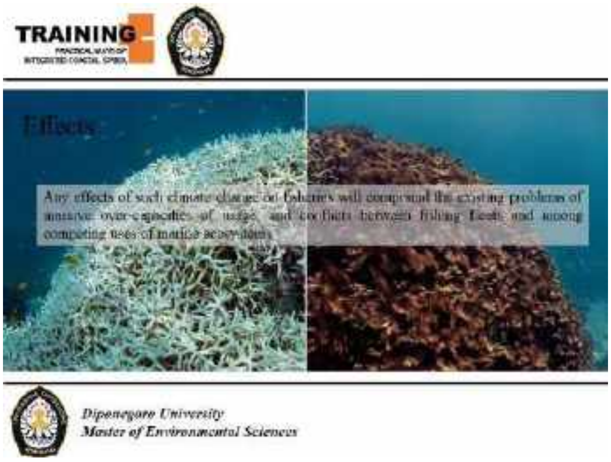
- The practical was on the sayung sub District and below is my end result.

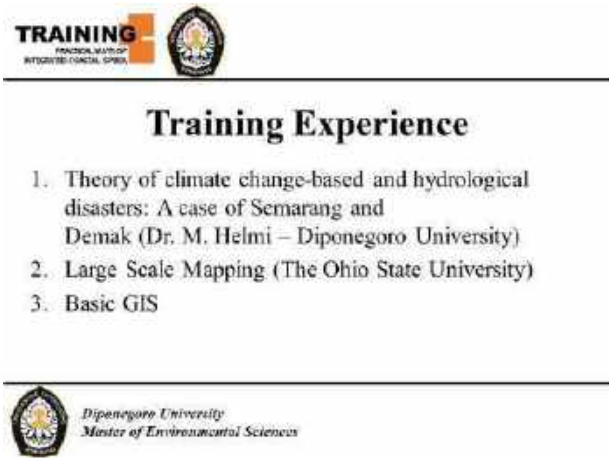



LANDSLIDE
TSUNAMI
EROSION
SEDIMENTATION
EL NINO LA NINA


TRAINING
DIPONEGORO UNIVERSITY
Delio Da Costa
Climate Change Impacts on Marine Ecosystems
Training Experience
Diponegoro University
Master of Environmental Sciences


TRAINING
Climate change will fundamentally alter the structure of oceans and directly impact marine ecosystems and human societies.
Climate induced changes and other less-understood anthropogenic changes will be superimposed on other impacts resulting from human activities such as over fishing, pollution, damming of rivers and habitat loss in coastal areas.
Diponegoro University
Master of Environmental Sciences


TRAINING
Effects
Any effects of such climate change on fisheries will compound the existing problems of massive over-capacities of usage and conflicts between fishing fleets and among competing uses of marine ecosystems.
Diponegoro University
Master of Environmental Sciences


TRAINING
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
Diponegoro University
Master of Environmental Sciences

THANK YOU…

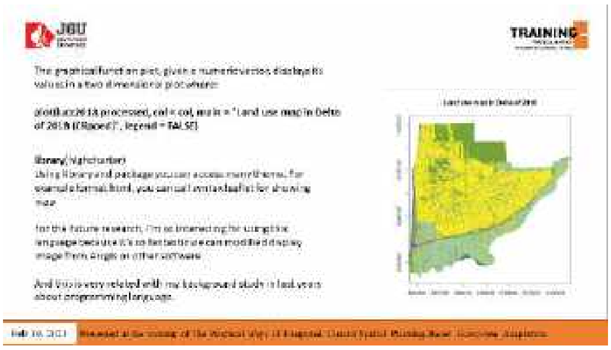

Konservasi
Alam Nusantara
TRAINING
POTENTIAL DESIGN RESTORATION MANGROVE AREA
MANGKANG WETAN VILLAGE, SEMARANG


Implementation :
- SPBEA solution
- Theory of Aquaculture AMA


POTENTIAL DESIGN RESTORATION MANGROVE AREA MAP
Legend
Mangrove
Fish Pond
Mangkang
Wetan


JGU
TRAINING
ANALYSIS R FOR LAND USE
FERI NUGROHO
Affiliation
E-mail


JGU
TRAINING

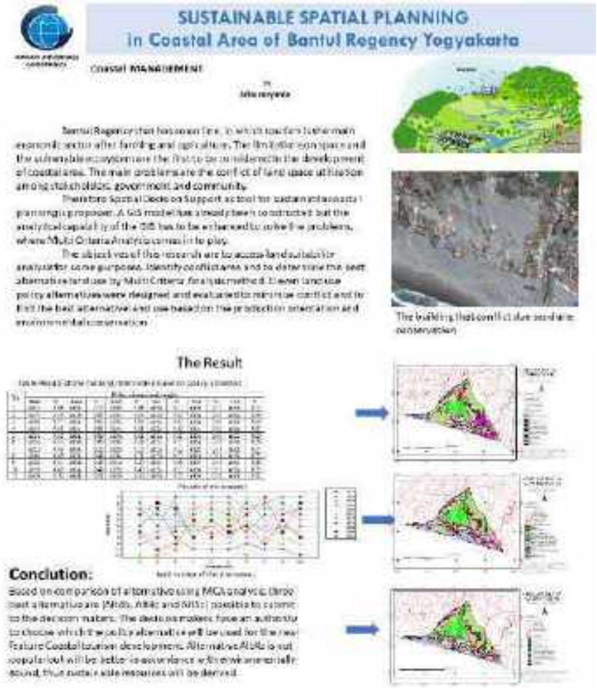

JGU
TRAINING

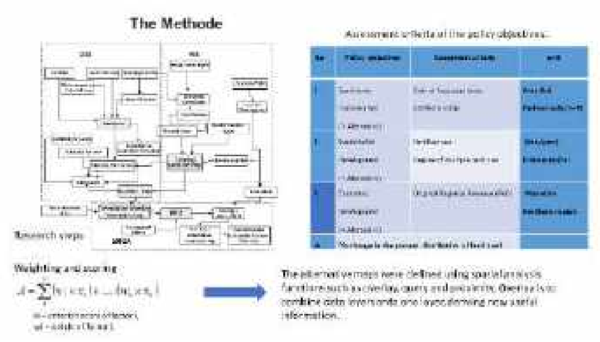
Condition of Coastal Alluvial Plains at Java Island

- Coastal alluvial plains
- Urban grew at young alluvial plains
- Dense population
- High urban growth
- Deforestation
- Medium to high rain intensity
- In shore area (risk of tidal flood, storm surge)

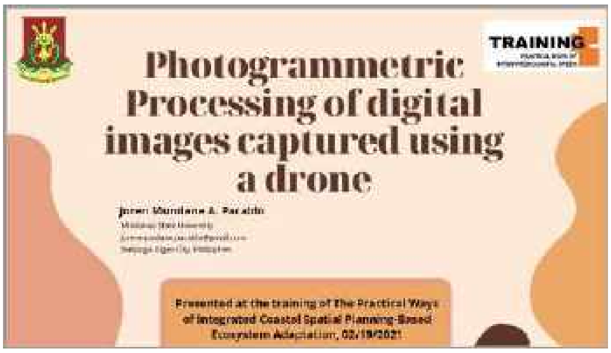
Condition of Coastal Alluvial Plains at Ayeyarwady Delta

- Lowest expanse of land in Myanmar that fans out from the limit of tidal influence at Myan Aung to the Bay of Bengal and Andaman Sea
- Densely populated
- Cultivation of rice
- High Urban Growth
- Deforestation (Mangroves or lamu and nipa palm)
- On May 2008, Delta suffered by Cyclone Nargis

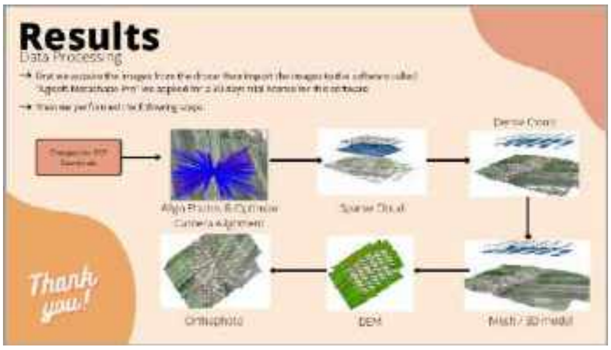

SUSTAINABLE SPATIAL PLANNING
in Coastal Area of Bantul Regency Yogyakarta
The Result
Conclution:


The Methode
Research steps
Weighting and scoring

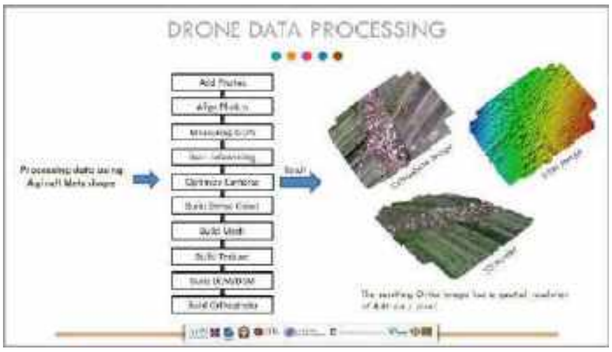

THANK YOU

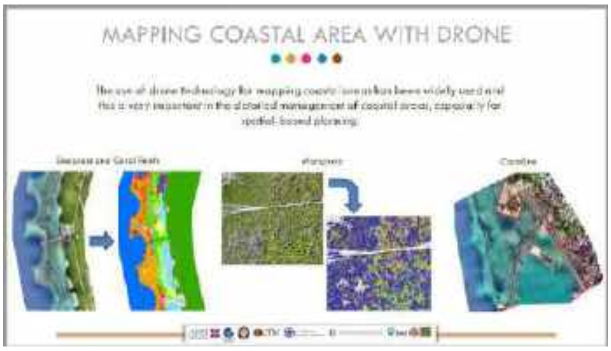

TRAINING
Photogrammetric Processing of digital images captured using a drone
Presented at the training of the Practical Ways of Integrated Coastal Spatial Planning-Based Ecosystem Adaptation, 02/19/2021


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


Results
Data Processing
Align Photos & Optimize Camera Alignment
Sparse Cloud
Dense Cloud
Orthophoto
DEM
Mesh / 3D model
Thank you!

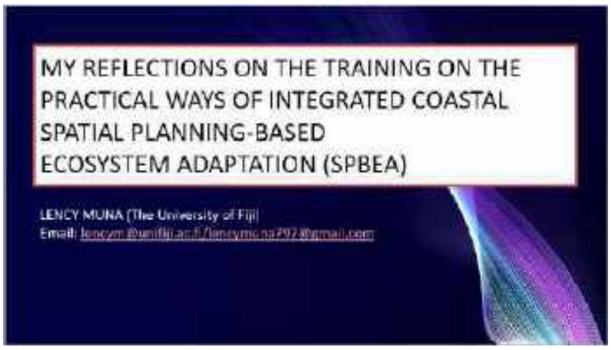

DRONE TECHNOLOGY FOR MAPPING COASTAL AREA
LA ODE KHAIRUM MASTU


DRONE DATA PROCESSING
Add Photos
Align Photos
Build Mesh



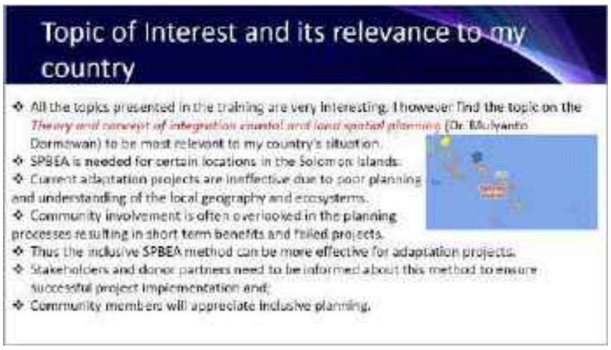
MAPPING COASTAL AREA WITH DRONE

THANKS

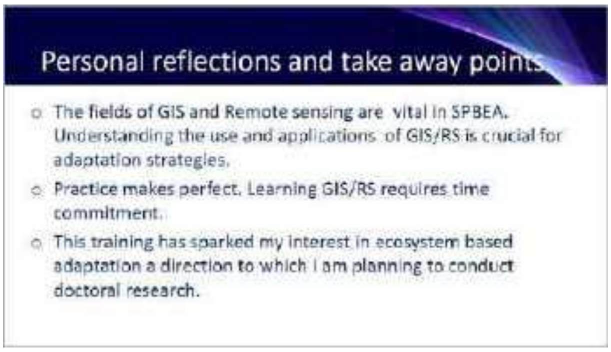


MY REFLECTIONS ON THE TRAINING ON THE PRACTICAL WAYS OF INTEGRATED COASTAL SPATIAL PLANNING-BASED ECOSYSTEM ADAPTATION (SPBEA)
LENCY MUNA (The University of Fiji)

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



Topic of Interest and its relevance to my country
❖ 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 (Dr. Mulyanto Darmawan) to be most relevant to my country's situation.
❖ SPBEA is needed for certain locations in the Solomon Islands:
❖ Current adaptation projects are ineffective due to poor planning and understanding of the local geography and ecosystems.
❖ Community involvement is often overlooked in the planning processes resulting in short term benefits and failed projects.
❖ Thus the inclusive SPBEA method can be more effective for adaptation projects.
❖ Stakeholders and donor partners need to be informed about this method to ensure successful project implementation and;
❖ Community members will appreciate inclusive planning.

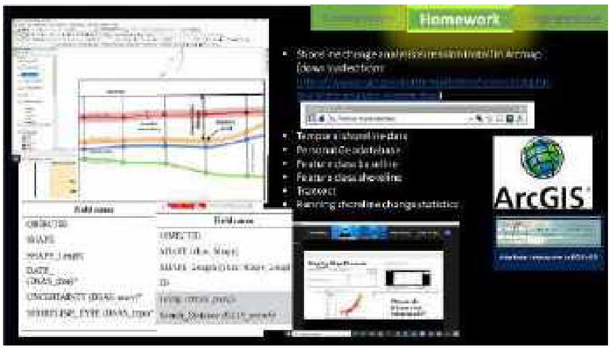


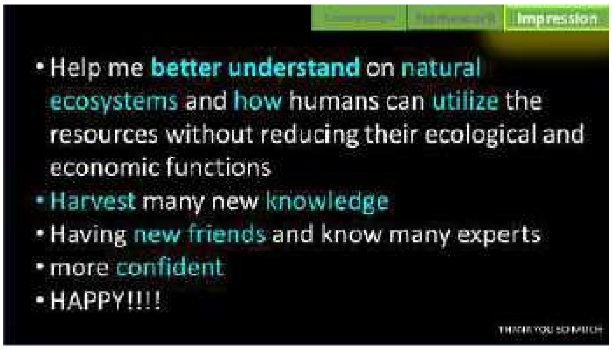
Personal reflections and take away points
○ The fields of GIS and Remote sensing are vital in SPBEA. Understanding the use and applications of GIS/RS is crucial for adaptation strategies.
○ Practice makes perfect. Learning GIS/RS requires time commitment.
○ This training has sparked my interest in ecosystem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

• My sincere thanks to the organizers, the Lecturers and fellow participants.
Best wishes to all!

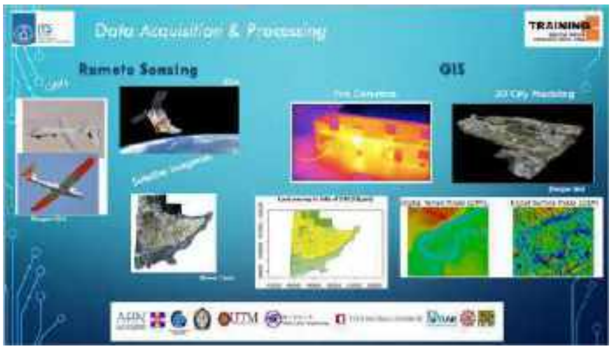
TRAINING

First Day
Second Day
Third Day
Fourth Day
ArcGIS

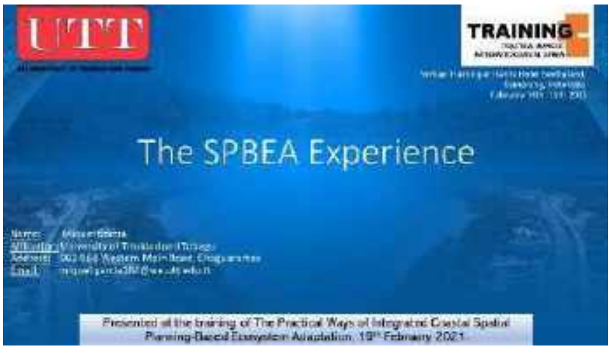

Homework
ArcGIS


Impression
• Help me better understand on natural ecosystems and how humans can utilize the resources without reducing their ecological and economic functions
• Harvest many new knowledge
• Having new friends and know many experts
• more confident
• HAPPY!!!!

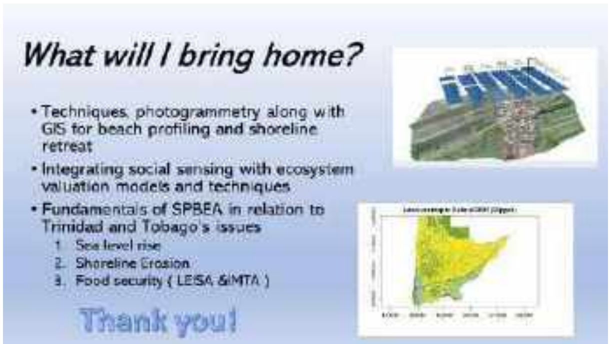

TRAINING
Integrated Coastal Spatial Planning-Based Ecosystem Adaptation : Data, Methods, and Applications


Data Acquisition & Processing
Remote Sensing
GIS

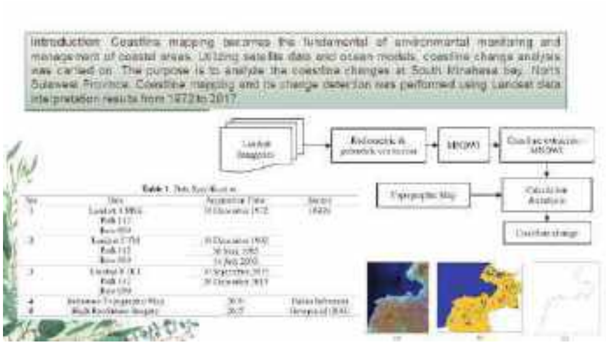

Methods & Applications

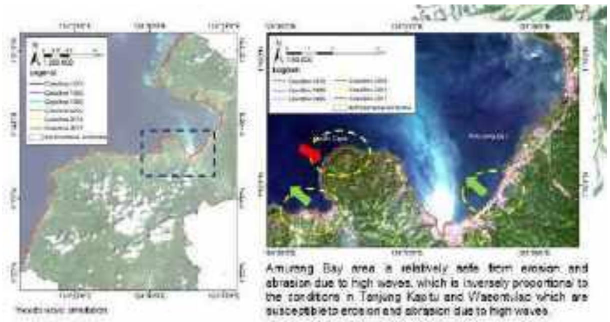

UTT
TRAINING
The SPBEA Experience
Presented at the training of The Practical Ways of Integrated Coastal Spatial Planning-Based Ecosystem Adaptation, 19th February 2021


Remote sensing training
R- training
GIS Training
Spatial Planning-Based


What will I bring home?
• Techniques, photogrammetry along with GIS for beach profiling and shoreline retreat
• Integrating social sensing with ecosystem valuation models and techniques
• Fundamentals of SPBEA in relation to Trinidad and Tobago's issues
1. Sea level rise
2. Shoreline Erosion
3. Food security (LEISA &IMTA)
Thank you!

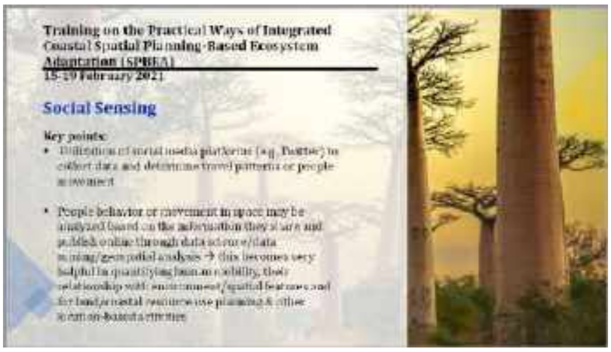

TRAINING
LANDSAT DATA FOR COASTLINE CHANGES DETECTION IN SOUTH MINAHASA REGENCY
Muniwaroh, S.Si

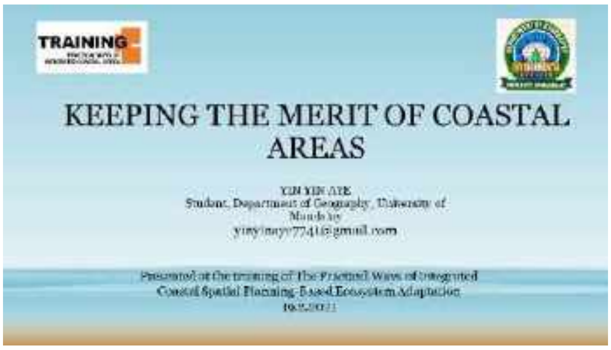

Introduction: Coastline mapping becomes the fundamental of environmental monitoring and management of coastal areas. Utilizing satellite data and ocean models, coastline change analysis was carried on. The purpose is to analyze the coastline changes at South Minahasa bay, North Sulawesi Province. Coastline mapping and its change detection was performed using Landsat data interpretation results from 1972 to 2017.

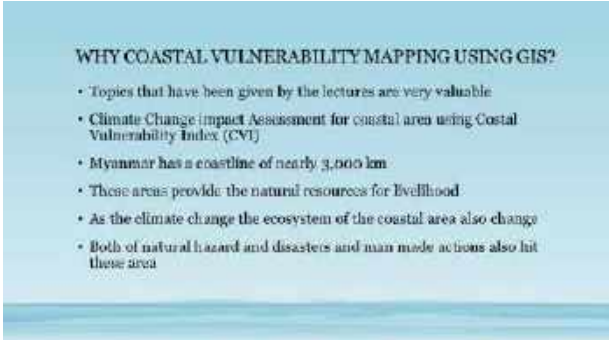

Legend
Amurang Bay area is relatively safe from erosion and abrasion due to high waves, which is inversely proportional to the conditions in Tanjung Kaptu and Waeonilao which are susceptible to erosion and abrasion due to high waves.

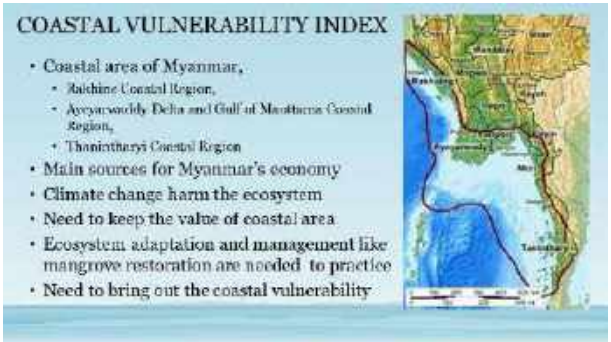

Training on the Practical Ways of Integrated Coastal Spatial Planning-Based Ecosystem Adaptation (SPBEA)
Training Highlights [Personal Preference]


Training on the Practical Ways of Integrated Coastal Spatial Planning-Based Ecosystem Adaptation (SPBEA)
Case studies by Dr. Muhammad Helmi
Key points:


Training on the Practical Ways of Integrated Coastal Spatial Planning-Based Ecosystem Adaptation (SPBEA)
15-19 February 2021
Social Sensing
Key points:


TRAINING
KEEPING THE MERIT OF COASTAL AREAS
YIN YIN AYE
Student, Department of Geography, University of
Presented at the training of The Practical Ways of Integrated
Coastal Spatial Planning-Based Ecosystem Adaptation


WHY COASTAL VULNERABILITY MAPPING USING GIS?
• Topics that have been given by the lectures are very valuable
• Climate Change impact Assessment for coastal area using Costal Vulnerability Index (CVI)
• Myanmar has a coastline of nearly 3,000 km
• These areas provide the 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 actions also hit these area


COASTAL VULNERABILITY INDEX
• Coastal area of Myanmar,
• Rakhine Coastal Region,
• Ayeyarwaddy Delta and Gulf of Mottama Coastal Region,
• Thanintharyi Coastal Region
• Main sources for Myanmar's economy
• Climate change harm the ecosystem
• Need to keep the value of coastal area
• Ecosystem adaptation and management like mangrove restoration are needed to practice
• Need to bring out the coastal vulnerability