



**Building a Blue Economy: Strategy,
Opportunities and Partnerships in the
Seas of East Asia**
9-13 July

SPECIAL WORKSHOPS

**Subregional Inception Workshop on
Environmental Sensitivity Mapping for
the Gulf of Thailand**

CO-CONVENING AGENCIES:



The Yeosu Project and
Expo 2012 Yeosu Korea



International Maritime
Organization (IMO)



Partnerships in Environmental
Management for the
Seas of East Asia



The East Asian Seas Congress 2012
“Building a Blue Economy: Strategy, Opportunities
and Partnerships in the Seas of East Asia”
Changwon City, Republic of Korea, 9–13 July 2012

Subregional Inception Workshop
on Environmental Sensitivity Mapping in
the Gulf of Thailand

10 July 2012



Organized by the:

International Maritime Organization

PEMSEA Resource Facility

Yeosu Expo

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1.0 INTRODUCTION

- 1.1 Partnerships in Environmental Management for the Seas of East Asia (PEMSEA) entered into a Memorandum of Agreement with the International Maritime Organization (IMO) to manage and execute the project on Strengthening Oil Spill Preparedness and Response in a Subregional Sea Area: Environmental Sensitivity Mapping in the Gulf of Thailand. This project is funded by the Korean government through the Korea International Cooperation Agency (KOICA) under the Yeosu Project Fund.
- 1.2 The project will include Cambodia, Thailand and Vietnam and will be implemented under the Framework Programme on Partnerships in Joint Oil Spill Preparedness and Response in the Gulf of Thailand, which the three countries have adopted in January 2006. The overall goal of the project is to develop a decision support tool for use in planning and responding to oil spill incidents in the Gulf of Thailand.
- 1.3 A Subregional Inception Workshop on Environmental Sensitivity Mapping in the Gulf of Thailand was held on 10 July 2012, in parallel with various workshops of the East Asian Seas (EAS) Congress in Changwon City, RO Korea. The workshop was attended by representatives of the national contact points of the Gulf of Thailand Cooperation in Oil Spill Preparedness and Response and representatives of the national environmental sensitivity index (ESI) technical teams of Cambodia, Thailand and Vietnam. Resource persons from the Korea Institute of Ocean Science and Technology (KIOST [formerly known as KORDI]) and Korean Coast Guard provided technical support to the workshop. Representatives from the International Maritime Organization, Oil Spill Response Limited (OSRL) and PEMSEA were also in attendance. The list of participants is attached as **Annex 1**.
- 1.4 Ms. Diana Factuar, ESI Project Coordinator of PEMSEA, chaired the workshop. She provided a background of the project and introduced the workshop objectives.
- 1.5 The detailed workshop program is presented as **Annex 2**.

2.0 HIGHLIGHTS OF THE WORKSHOP

2.1 Introduction from the IMO

Ms. Brenda Pimentel, Regional Coordinator of the IMO Regional Presence Office for East Asia, welcomed the participants to the workshop. She underscored the IMO's thrust in building capacities of countries in oil spill preparedness and response by providing management tools to assist them in decisionmaking to ensure prompt and effective response to oil spills.

2.2 Introduction to the ESI Mapping Project in the Gulf of Thailand and the Workshop Objective

Ms. Factuar provided a background on the project. She emphasized that the main objective of the project is to reduce the impact of oil spills and clean up efforts to coastal and marine resources through the use of management tools that will assist policymakers and decisionmakers in three littoral states in planning and responding to oil spill incidents. She discussed the proposed implementing arrangements of the project as follows:

- A subregional project steering committee will be established composed of permanent representatives of the Gulf of Thailand national contact points of Cambodia, Thailand and Vietnam and has the overall responsibility for the successful implementation of the project, particularly in the integration of maps to produce a Gulf of Thailand (GOT) ESI Atlas.
- National ESI technical teams will be established and will be responsible for carrying out the project activities at the country level and in the production of ESI maps in each country.
- An international ESI specialist will be engaged to develop the guideline for developing ESI maps in the Gulf of Thailand and to provide technical support to the national ESI technical teams in the development of ESI maps in each country and in the production of the GOT ESI Atlas.

The project activities and expected outputs were explained which include the following:

- Establishment of the subregional ESI project steering committee
- Establishment of national ESI technical teams
- Conduct of subregional inception workshop
- Data gathering, validation, assessment and analysis
- Production of ESI maps for each country
- Conduct of national validation workshops
- Conduct of subregional integration workshop (integration of maps to produce a GOT ESI Atlas)
- Publication of the GOT ESI atlas
- Implementation of communication and advocacy plan

Ms. Factuar's presentation is attached as **Annex 3**.

2.3 Developing Environmental Sensitivity Maps: Experience from Korea

Mr. Changwoo Ha, Deputy Director of the Marine Pollution Planning Division, Korea Coast Guard, shared Korea's experience in developing ESI maps to support oil spill planning and

response. The process, difficulties and lessons learned, including some examples of maps, were presented. He indicated that in Korea, four types of maps were developed, namely (1) shoreline types; (2) biological resources; (3) tactical sensitivity map or strategic map; and (4) operational maps for the most sensitive sites. Tools used for mapping include geographic information system (GIS) and use of nautical charts with satellite images, among others. The total cost of the ESI mapping initiative in Korea was estimated at US\$ 800,000.

Lessons learned from the ESI mapping initiative in Korea are as follows:

- Careful selection of resources to be mapped
- Standardized format and consistency of people involved
- Good partnership between marine pollution responders, GIS specialists and stakeholders

Mr. Changwoo Ha presented key considerations in developing ESI maps as follows:

- Determine the type of information or resource to be mapped
- Determine the mapping tool to be used
- Agree on the appropriate scale of maps to be produced
- Focus on physical characteristics
- Translate maps into English

2.4 Inventory of Environmental Sensitivity Mapping Initiatives in the Gulf of Thailand

Representatives of the national ESI technical teams of Cambodia, Thailand and Vietnam presented their initial assessment of ESI mapping initiatives in respective countries focusing on availability of data, existing databases and information sources and data gaps and availability of maps including formats, standards and coverage. Methodology and tools used for ranking of shoreline, biological resources and human-use resources were presented. Highlights of presentations of the national ESI technical team representatives are presented below:

2.4.1 Cambodia

Mr. Meas Rithy of the Coastal Coordination Unit, Ministry of Environment, Cambodia, provided a background on the coastal zone of Cambodia emphasizing on various issues in the coastal zone. He stressed that data on coastal and marine biodiversity, economic activities and environmental management are available as a result of the survey conducted in the year 2002. In 2006, another survey was conducted by the Coastal Coordination Unit which covered mangroves, seagrass and corals, natural habitats, shoreline and beaches and other human-use resources. The presentation indicated that Cambodia has limited capacity in environmental sensitivity mapping.

Available maps include marine biological maps (seagrass, coral reef, dugong and dolphin sites), marine sanctuary/protected areas, coastal land use and cover, topography, a digital elevation model and basimetry and climate (temperature, rainfall, wind speed) and geology, hydrology, wetland, infrastructure and transport. Data are in ArcInfo and shapefile formats with a scale from 1:50,000 to 1:100,000. Data used in developing these maps are mostly from the survey conducted in 2002 and needs updating.

The tools used in developing the maps are Geographic Information System: ArcView and ArcGIS/Map. Remote sensing (Erdas Imagine) was also used. Mr. Rithy's presentation is attached as **Annex 4**.

2.4.2 Thailand

Ms. Chutamat Rattikansukha of the Thailand Pollution Control Department informed the workshop participants that ESI mapping initiatives in Thailand were initiated in 1997 through a grant from the Swedish International Development Agency (SIDA). The objective of the project was to develop maps for use on environmental quality monitoring and environmental emergency cases. The project included the creation of a GIS-based coastal zone database, the development of coastal environmental sensitivity index and the production of coastal maps for environmental sensitivity to oil. The project covered the Gulf of Thailand (1,660 km), Andaman (954 km) and Islands (500 km), 10-km inland, 20-km offshore. Equipment and software used include Esri software packages: ArcInfo and ArcView. Satellite images (through Landsat, SPOT and Ikonos), existing data, both digital and non-digital maps and field survey were applied in data collection.

It was learned that in the development of database, data was categorized into four features: (1) physical feature, (2) ecological feature, (3) human-use features and (4) contingency planning features.

Developing the environmental sensitivity index for Thailand involved four steps:

- Establishing the principle of ESI
- Establishing priorities for ESI
- Developing the environmental sensitivity index ranking
- ESI mapping

Available ESI maps are classified into coastal resource maps and environmental sensitivity maps with different scales and based on area usage, which is presented in **Table 1** below:

Table 1: Classification of ESI maps in Thailand

Map Theme	Scale	Area Usage
Coastal resource maps	1:100,000	National
Coastal resource maps	1:50,000	Provincial
Environmental sensitivity maps	1:100,000	National
Environmental sensitivity maps	1:50,000	Provincial

These maps are being used for coastal zone management, environmental impact assessment, marine environment surveillance and monitoring, contingency planning and response to oil spill and mapping of shoreline sensitivity to nutrients and suspended solids.

Ms. Rattikansukha stressed that there is a need to update the GIS database developed in 1997 and to develop a database on biological sensitivity. Hence, it was timely for the Yeosu project to address this need. Please refer to **Annex 5** for Ms. Rattikansukha's presentation.

2.4.3 Vietnam

Mr. Vu Cong Thang, of the Petrovietnam Center for Research and Development for Petroleum Safety and Environment, described ESI mapping initiatives specifically in the southern region of Vietnam. He outlined data sources for the ESI mapping initiatives as presented in **Table 2** below:

Table 2: Data sources for ESI mapping

No.	Documents	Sources	Use
1	Social and Economy Report of Province Ca Mau 2011	People's Committee of Province Ca Mau	Areas planned for aquaculture, tourism, industry, biosphere reserves, national parks, mangrove forests, etc. Preference areas
2	Social and Economy Report of Province Kien Giang 2011	People's Committee of Province Kien Giang	
3	Economy Development Plan of Province Ca Mau Period 2010–2015	People's Committee of Province Ca Mau	
4	Economy Development Plan of Province Kien Giang Period 2010–2015	People's Committee of Province Kien Giang	
5	Documents about World Biosphere Reserve of Dat Mui (2)	Management Board of World Biosphere Reserve of Dat Mui	Area (core and buffer), distribution of animals and plants, rare animals and rare plants
6	Documents about Sea Reserve of Phu Quoc Island	People's Committee of Phu Quoc District	
7	Land Usage Reports of Province Ca Mau 2010, Development Orientation up to 2015	People's Committee of Province Ca Mau	Statistical data about area, land type, their use (aquaculture, mangrove forests, tourism, industry, seaports, fish ports)
8	Land Usage Reports of Provinces Kien Giang 2010, Development Orientation up to 2015	People's Committee of Province Kien Giang	
9	Report of Aquatic Resources for Southern West Sea of Vietnam (3)	Consultative and Technology Transfer Centre of Aquatic Resources and Environment	Statistical data about fishing grounds, production (fish, shrimp, cuttlefish) for each fishing season (North, South)
10	Geomorphic Dynamics Report for Coastal Area of Southern West Sea of Vietnam and Phu Quoc Island	South Vietnam Union of Map and Geology	Shoreline types (NOAA) Topography versus height, areas affected by tide and sea dynamics

Available maps and their formats were also enumerated and presented. Please refer to **Annex 6**. Mr. Thang emphasized that available maps have certain limitations, such as:

- Difference in scale, coordinate system and detail
- Difference in issue time
- Difference in format
- Digital and hard copy

Furthermore, it was stressed that satellite images can be obtained from the Application and Development Center for Mapping and Geodetic Technology.

In Vietnam, environmental sensitivity index is classified into six levels with six different color symbols. Tools used for ESI mapping include ArcView and MapInfo. ESI maps are classified into three categories:

- a. ESI of shoreline
Shoreline classification is based on openness of shoreline and wave energy, topography and slope of beach, diversity and abundance of vegetational cover, risk of oil spill, cleanup methods and recovery of environment.
- b. ESI of onshore resources
Onshore resources are classified into natural resources and human-use resources.
- c. ESI of near-shore resources
Near-shore resources include corals, shrimps, bivalves, seagrass, fish and fish larva, grounds for fishes and production of aquatic living resources.

Mr. Thang offered the following recommendations in the development of ESI maps under the Yeosu project:

- Use of same ESI classification of six levels and color symbols; and
- Different ESI map types should be accepted in case there are differences among three GOT countries on the methodology and components of the ESI mapping.

Mr. Thang's presentation is attached as **Annex 7**.

2.5 Open Discussion

An open discussion followed after the presentations and was summarized as follows:

- a. Some of the data required for producing the ESI maps in each country are already available; however, there is a need to update and harmonize these;
- b. Where there are issues relating to boundary conflicts, areas involved are not to be included in the project;
- c. What is expected to be generated, paper or electronic maps;
- d. The remaining project time of 18 months will be a challenge considering the various activities to be undertaken;
- e. National focal points for the project should be identified and formalized, considering that the project would require more than one governmental agency in the implementation of the project.

There was an agreement to deal with the aforementioned issues and concerns in the course of the implementation of the project. The timetable of the project implementation was also adopted during the workshop, although there was concern on the remaining period up to the projected completion date of 31 December 2013. Nonetheless, the national ESI technical teams are confident the project will be completed within schedule.

2.6 Work Plan for Developing the ESI Maps in Each Country and GOT Atlas

Ms. Factuar emphasized that the duration of the project is 24 months. However, in view of the delay in commencing the project, the national ESI technical teams will be faced with a challenging task of completing the project in 16 months. Thus, it was recommended that the workshop will come up with a work plan to ensure that the project will be completed as planned. The agreed work plan and time frame for carrying out the project is presented as **Annex 8**.

3.0 VISIT TO KOEM OIL SPILL TRAINING FACILITY

The participants of the Subregional Inception Workshop and some delegates of the EAS Congress Maritime Transport Workshop visited the oil spill training facility of the Korean Marine Environment Management Corporation (KOEM) on July 12.

The visit provided the participants an opportunity to see the newly built training institution of Korea specializing on pollution response. It was learned that KOEM is offering oil spill training courses and has signed memoranda of understanding (MOUs) with various organizations including the IMO. The training facility is also used for environmental education activities and games for schoolchildren.

4.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the presentations and discussion, it was concluded that:

There are available data and information on coastal resources, shoreline classification and human-use resources. However, these are of different levels of details and sensitivity index ranking varies among the three GOT countries.

The workshop brought forward the following recommendations:

- a. Formulate a guideline for developing ESI maps in each country indicating the type of information to be collected, resources to be mapped and types of maps to be produced to ensure a common protocol for ESI mapping.
- b. Use the National Oceanic and Atmospheric Administration (NOAA) methodology for ESI ranking with some modifications as basis for the ESI ranking in the GOT.
- c. Organize a subregional meeting to review the progress of the project, back-to-back with the annual Gulf of Thailand national focal points meeting in November 2012.

ANNEX 1 LIST OF PARTICIPANTS

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ANNEX 2

Subregional Inception Workshop on Environmental Sensitivity Mapping for the Gulf of Thailand

Introduction

The significant increase in global trade and international seaborne transport experienced over the last decades entails negative consequences, as all human and industrial activities do, by increased risks for oil spills and increased emissions of air pollutants and greenhouse gases that contribute to global climate change. In the Gulf of Thailand, transportation of crude oil has increased because of augmented production in the Gulf Region and an ever-growing demand from neighboring countries.

Realizing the potential risks, which will certainly leave a tremendous impact on the natural and marine resources in the Gulf Region, it is important that management tools are developed to reduce the impact of marine pollution on coastal and marine resources. Environmental sensitivity index (ESI) maps, in particular, provide a comprehensive and accurate summary of coastal resources that are at risk if an oil spill occurs nearby.

In line with this, PEMSEA, in collaboration with the International Maritime Organization (IMO), is initiating a project on Strengthening Oil Spill Preparedness and Response in a Subregional Sea Area: Environmental Sensitivity Mapping in the Gulf of Thailand (GOT), with funding support from the Korean Government.

This subregional inception workshop is organized to discuss the implementation arrangements of the project and identify and agree on the protocols for developing correlated sensitivity maps for the Gulf of Thailand among the three national project task teams. In addition, an agreement will be reached on the methodology and process for integrating the maps from the three countries into a uniform format for the publication of a GOT Atlas covering marine and coastal resources, major economic activities, navigation routes, cultural sites, etc.

Program

July 10, 2012, 1400–1830		Speakers/Presenters
1400 – 1420	Introduction from IMO and PEMSEA	<p>Mrs. Brenda Pimentel Regional Coordinator, Regional Presence Office for East Asia, International Maritime Organization</p> <p>Mr. Stephen Adrian Ross Chief Technical Officer PEMSEA</p>
1420 – 1440	Introduction to the ESI Mapping Project in the Gulf of Thailand and the Workshop Objectives	Ms. Diana Factuar Training Specialist, PEMSEA
1440 – 1520	Developing Environmental Sensitivity Maps: Experience from Korea	Mr. Changwoo Ha Deputy Director, Marine Pollution Planning Division Korea Coast Guard
1520 – 1600	Inventory of Environmental Sensitivity Mapping Initiatives in the Gulf of Thailand <ul style="list-style-type: none"> • Availability of data and data sources • Methodology used for identification of the most sensitive sites • Availability maps and their formats • Tools used in developing the maps • Scope and coverage of ESI mapping initiatives 	<p>Mr. Meas Rithy Representative, ESI Technical Team of Cambodia</p> <p>Dr. Chutamat Rattikansukha Representative, ESI Technical Team of Thailand</p>
1600 – 1630	Coffee/Tea Break	
1630 – 1650	Inventory of Environmental Sensitivity Mapping Initiatives in the Gulf of Thailand (continued)	Dr. Vu Cong Thang Representative, ESI Technical Team of Vietnam
1650 – 1800	Open Discussion (Agreement on protocols for developing the ESI maps, scope and formats)	GOT ESI Project Steering Committee and ESI Technical Teams
1800 – 1830	Work Plan for Developing the Environmental Sensitivity Maps and GOT Atlas	GOT ESI Project Steering Committee and ESI Technical Teams
1830	End	

ANNEX 3
Overview of the Project on
Strengthening Oil Spill Preparedness and Response
in a Subregional Sea Area:
Environmental Sensitivity Mapping in the Gulf of Thailand

Strengthening Oil Spill Preparedness and Response in a Sub-regional Sea Area: Environmental Sensitivity Mapping in the Gulf of Thailand

Funding from Yeosu



Partnerships in Environmental Management for the Seas of East Asia

Project Proponents and Implementing Agencies

**International Maritime Organization
PEMSEA**

Project Duration : 24 months



Partnerships in Environmental Management for the Seas of East Asia

The Yeosu Project is part of a **multi-million-dollar aid package** that the RO Korean Government committed to fund for securing the bidding of the Yeosu EXPO 2012 in RO Korea.



Partnerships in Environmental Management for the Seas of East Asia

Overall Goal

- The main objective of the project is to reduce the environmental impact of oil spills and clean-up efforts to coastal and marine resources **with the use of management tools** that will assist policymakers and decision makers in the three littoral States in planning and responding to oil spill incidents.



Partnerships in Environmental Management for the Seas of East Asia

Specific Objectives

- a. To provide spill planners and responders with critical spill response information (e.g. sensitive locations, response/cleanup strategies, spill equipment locations) in an easily understood, graphical representation.
- b. To provide support information on biological, geomorphologic and human-use resources, as well as spill response and cleanup methods in an easily understood, graphical representation.
- c. To provide well-designed ESI maps in geographic information system (GIS) format that will facilitate the risk assessment and planning process during oil spill response.



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Project Components

- Component 1: Development/Enhancement of Environmental Sensitivity Maps in the Gulf of Thailand (country and sub-region)
- Component 2: Advocacy and Communication Plan (incl EAS Congress 2012)



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Advocacy and Communication Plan

- A technical workshop during the EAS Congress 2012 in Changwon, RO Korea.
- The workshop will bring together the project steering committee and technical support teams from the 3 countries, concerned stakeholders in the GOT area .



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Implementing Arrangements

Project Steering Committee

- Composed of GoT national contact points
- Organize national validation workshop to present the draft ESI maps to relevant agencies
- Over-all responsibility in the successful implementation of the project (coordinate the integration of maps to come up with the GOT Atlas)

ESI Technical Teams

- Serves as the national project task teams responsible for data gathering and production of ESI maps in respective countries

ESI Specialist

- Provide technical guidance to ESI Technical Teams
- Facilitate the sub-regional integration workshop
- Production of GOT Atlas



Partnerships in Environmental Management
for the Seas of East Asia

Project Workplan (June 2012 –Dec 2013)

- Establishment of the Project Steering Committee
- Establishment of the ESI Technical Teams
- Conduct of Sub-regional Inception Workshop
- Data gathering, validation, assessment and analysis
- Production of ESI Maps for each country
- National validation workshop
- Sub-regional Integration Workshop – integration of country maps to produce GOT Atlas
- Publication of Got ESI Atlas and Implementation of Communication and Advocacy Plan



Partnerships in Environmental Management
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Expected Outputs

- An assessment of existing data-bases and information sources including formats, standards and data gaps in 3 countries
- Final report on ESI Mapping with a scale of 1:50,000
- Set of ESI maps with scale of 1:50,000 for GOT Atlas
- Final assessment report of existing environment, socio-economic activities and natural resources in the GOT region
- Project proposal/action plan for the development of DSS for oil spill response in the GOT



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Guidelines (from IMO/IPIECA report series)

- Maps need to convey a clear message to spill responders, should not be necessary to have an expert to interpret them
- A distinction should be made between sensitive resource information and spill response and clean up information
- Scales should be marked in all maps using scale bars
- The most cost-effective maps are black and white and page-sized allowing easy copying and fax transmission. Reliance on colour alone is not recommended if it is likely that black and white photocopies of the map will be used during spill response operation
- Different coastal types should be indicated using symbols
- General purpose symbols are recommended for common resources such as birds, fish and amenity areas.



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Types of Information Included in Maps

Shoreline Types

- ▼ Classify shorelines using a vulnerability or ESI

Sub-tidal habitats

- ▼ Coral reefs
- ▼ Seagrass beds, etc

Wildlife and protected areas

- *feeding and breeding areas(seabird colonies)
- *threatened or endangered species should be highlighted
- *national parks or protected areas

Fish, fishing activities, shellfish and aquaculture

- *seaweed gathering
- *shellfish beds
- *fish and crustaceans nursery areas



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Types of Information Included in Maps

Socio-economic features

- ▼ Boat facilities
- ▼ Industrial facilities(water intakes)
- ▼ Recreational resources(beaches, water sport and game –fishing areas)

Oil spill response features

- ▼ Dispersants use zones, Coral reefs
- ▼ Areas where booms could be deployed
- ▼ Protection priorities



Action Needed from the Inception Workshop

- ▣ An assessment of ESI mapping initiatives in 3 countries
 - Availability of data and data sources
 - Methodology used for identification of sensitive sites/areas
 - Availability maps and their formats
 - Tools used in developing the maps
 - Scope and coverage of ESI mapping initiatives
 - Identify and agree on the protocols for developing correlated maps for the GoT among the 3 project teams.
 - Agree on the process for integrating the maps into unified format for the production of GoT Atlas
 - Agree on the timeframe of the project



ANNEX 4
Inventory of Environmental Sensitivity Mapping Initiatives in the
Gulf of Thailand

A Report from Cambodia

Availability of data and data sources

Coastal and marine biodiversity

- Dugong, Dolphin (CCU/MoE survey-2002)
- Coral Reefs (CCU/MoE survey-2002)
- Seagrass (CCU/MoE survey-2002)
- Coastal wetlands/mangrove(CCU/MoE survey-2002)

Availability of data and data sources

Economic Activities

- Marine aquaculture (CCU/MoE-2004)
- Recreational beaches / tourist sites(CCU/MoE-2004)
- Fishing activities/zones (CCU/MoE-2004)
- Coastal ports (MPWT)
- Coastal Urban (MLMUC)

Availability of data and data sources

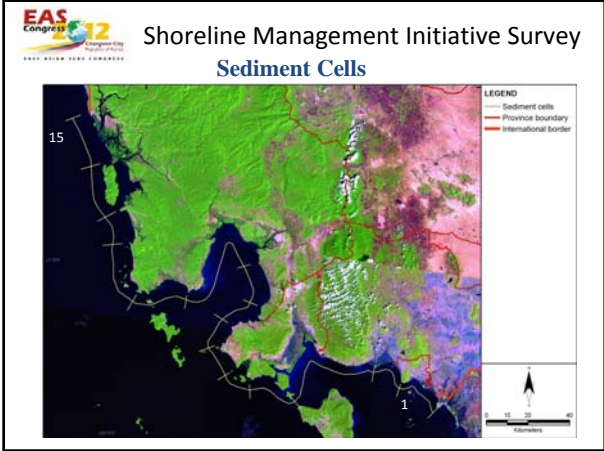
Environment management

- Solid Waste Management
- Water Quality observation(CCU/ MoE -2006)

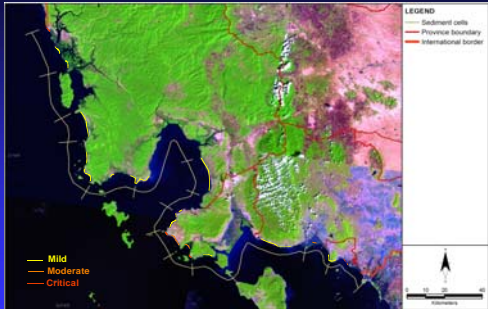
Availability of data and data sources

In 2006 the CCU team has been initiative surveyed to the coastal shoreline in Cambodia.

- The results of surveys and examples are show in the next slides:



Coastal erosion



Coastal erosion



Coastal Defense



Near shore coastal use





Land Reclamation



SHV



Newport



Land speculation and grabbing



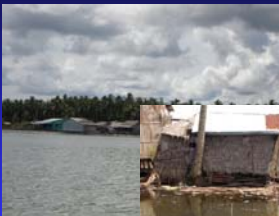
KK



SHV



Coastal Villages



Rubbish, Sanitation and Drinking water



Child Labour



1000 Riel per day.....School?

Salt Farms



Loss of mangroves, fishermen villages conflict

Illegal logging



Opportunities



Tourism and Development?

Aquaculture



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Republic of Korea
EAST ASIAN SEAS CONGRESS

Seaweed farming



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Changwon City
Republic of Korea
EAST ASIAN SEAS CONGRESS

Methodology used for identification of the most sensitive sites

Cambodia is still limited on environmental sensitive index mapping, however it is assumed to have such:

- Remote sensing data processed/generated
- Existing data and maps (need to observe)
- Share global/regional data on frequently sea flow direction and wind direction
- Information Tracking / Ground truthing

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Republic of Korea
EAST ASIAN SEAS CONGRESS

Availability maps and their formats

- Marine biological map (coral reef, sea-grass, dugong and dolphin sites) – *Arc-info and shapefile* (2002)
- Marine sanctuary/protected area– *Arc-info and shapefile; scale 1:50,000*
- Coastal land use and cover – *shapefile; scale 1:100,000* (1993-2002)
- Topography, digital elevation model and basimetry - *scale 1:100,000*
- Climate (temperature, rainfall, wind-speed) – *shapefile; scale 1:100,000* (2000)
- Geology, hydrology, wetland, infrastructure, transport... – *shapefile; scale 1:100,000* (2002)

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Republic of Korea
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Tools used in developing maps

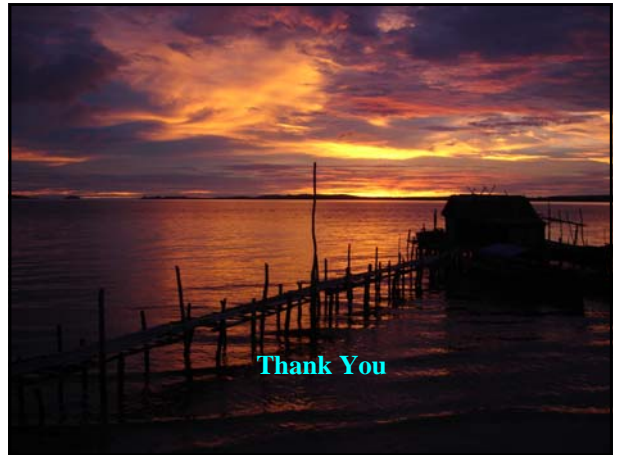
Cambodia has experience in developing maps by using the following tools:

- GIS: Arcview and ArcGIS/Map
- Remote Sensing: Erdas Imagine



Scope and coverage of ESI mapping initiatives

- Field survey/ground truthing
 - Additional data collection/generation
 - Identification/classification of sensitive sites
 - ESI mapping
- Capacity building
Coverage: Cambodia marine and coastal zone



Thank You

ANNEX 5
Inventory of Environmental Sensitivity Mapping Initiatives in the
Gulf of Thailand

A Report from Thailand

Environmental Sensitivity Index Initiatives in Thailand

Chuthamat Rattikansukha
Pollution Control Department

EAS Congress 2012
9 July 2012



Contents

- Background
- Objectives
- Project Areas
- Equipments and Software
- Methodology
- Outcomes
- Applications
- Future works



Background

- In 1997, Thai government represented by the Pollution Control Department was granted by Swedish International Development Cooperation Agency (Sida).
- The funding support a project to develop maps used for environmental quality monitoring and environmental emergency cases.



Objectives

- Create a GIS based coastal zone database
- Develop a coastal environmental sensitivity index
- Apply the database to produce coastal maps for environmental sensitivity to oil



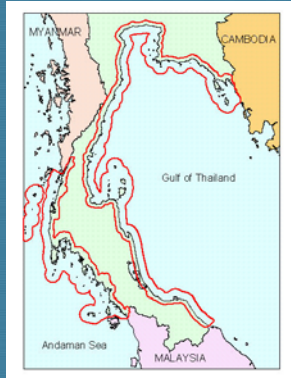
Project Areas

Length (2,614 km.)

- Andaman 954 km.
- Gulf of Thailand 1,660 km.
- Islands (~500 km.)

Areas

- 10 km. inland
- 20 km. offshore
- Islands



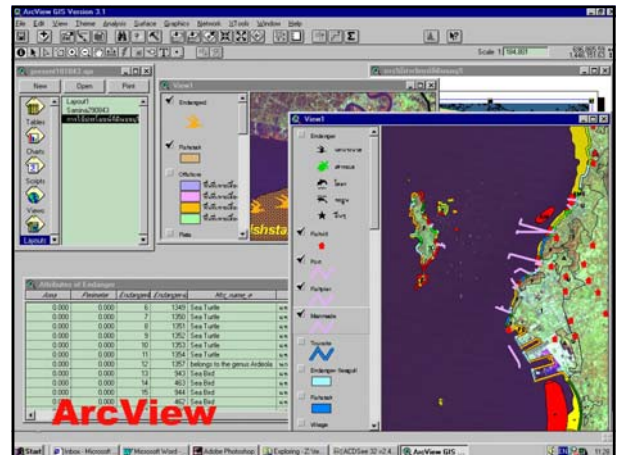
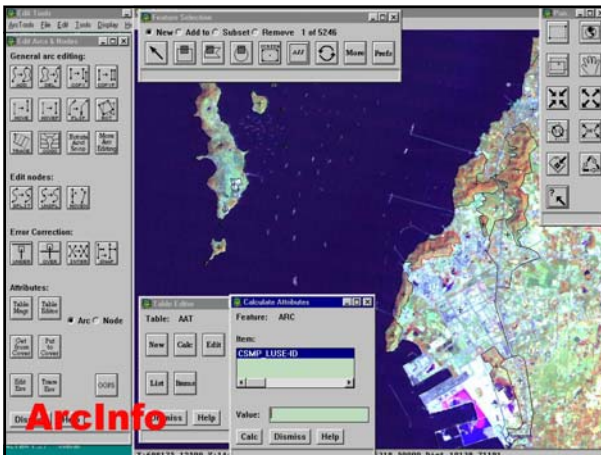
Equipments and Software

Equipments:

- ✓ Two computers
- ✓ A Plotter
- ✓ A Digitiser
- ✓ GPS
- ✓ Office accessories

Software:

- ✓ ESRI software packages: Arc/INFO, and ArcView
- ✓ Microsoft software packages: Word, Excel, PowerPoint and Access
- ✓ Adobe: Photoshop, Illustrator and PageMaker
- ✓ Antivirus software



Methodology:

1. Data collection
2. GIS and database development
3. ESI Mapping initiatives



Data collection



Methodology: Data collection

1. *Satellite images:*
Landsat, SPOT, IKONOS
2. *Existing data:*
Digital map database, Non-digital map
and table data
3. *Field survey*

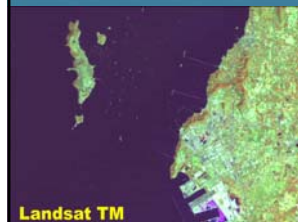


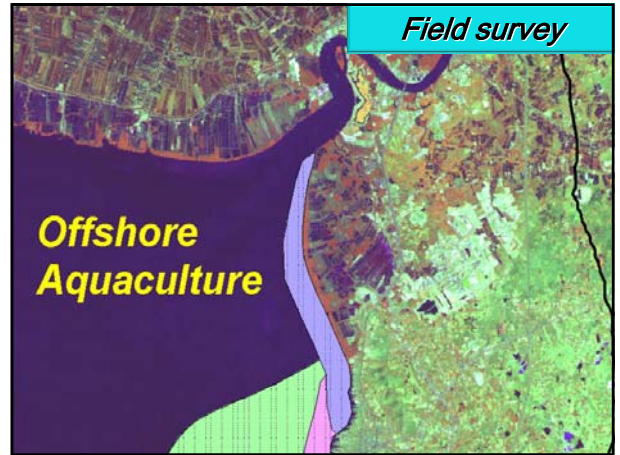
Satellite Images

Landsat 5 TM resolution 30x30 m.

Spot resolution 20x20 m.

IKONOS resolution 4x4 m.





GIS and database development

This slide has a dark blue background with a wavy cyan line at the top. A cyan rectangular box in the center contains the text 'GIS and database development' in white. A small logo is visible in the bottom right corner.

Methodology:
GIS and database development

- 1. Feature interpretation*
- 2. Adaptation of collected information to database feature list*
- 3. Database Verification*

This slide has a dark blue background with a wavy cyan line at the top. A cyan rectangular box at the top contains the text 'Methodology: GIS and database development'. Below it is a numbered list of three steps in white text. A small logo is visible in the bottom right corner.




Feature identification

- * Physical Features
- * Ecological Features
- * Human Features
- * Contingency Planning Features




Features List: Physical

Features	Coding	Object Type
P1 Mud Flat	FM	Polygon
P3 Sand Flat	FS	Polygon
P4 Sand and Gravel Flat	FSC	Polygon
P6 Sandy Beach		
P6.2 Sand Dune	SD	Polygon/Line
P6.3 Sand Beach	SB	Line
P13 River Mouth		Line
P18 Delta Formation	DF	Line



Features List: Ecological

Features	Coding	Object Type
E1 Mangrove	M	Polygon
E5 Lagoon (Songkhla Lake)	L	Polygon
E8 Peat Swamp Forest	FP	Polygon
E9 Marsh		
E9.1 Salt Marsh	MS	Polygon
E9.2 Fresh Water Marsh	MF	Polygon
E10 Estuary	E	Polygon
E11 Forest	F	Polygon



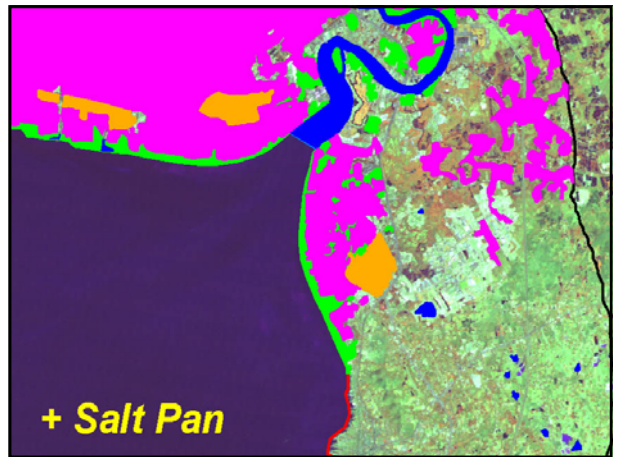
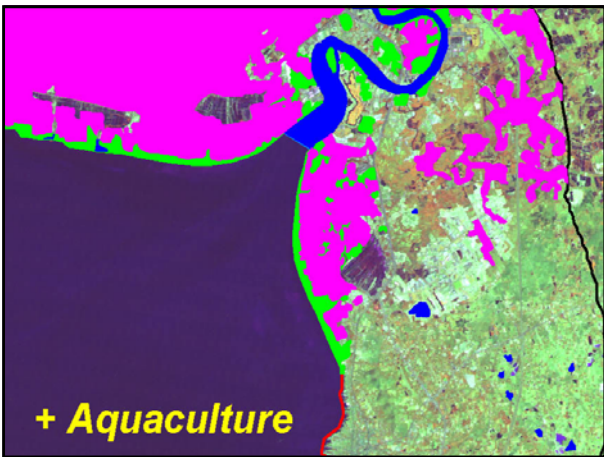
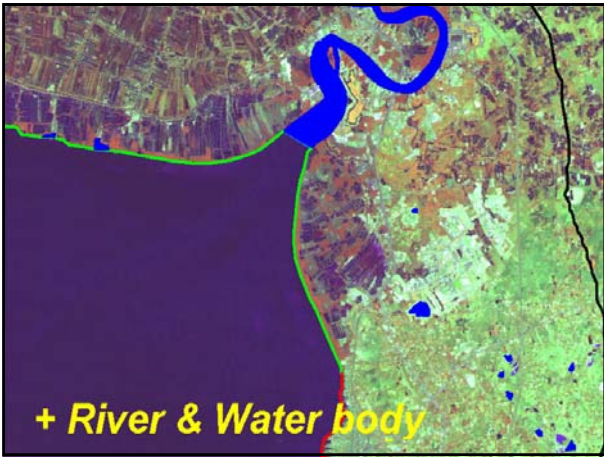
Features List: Human

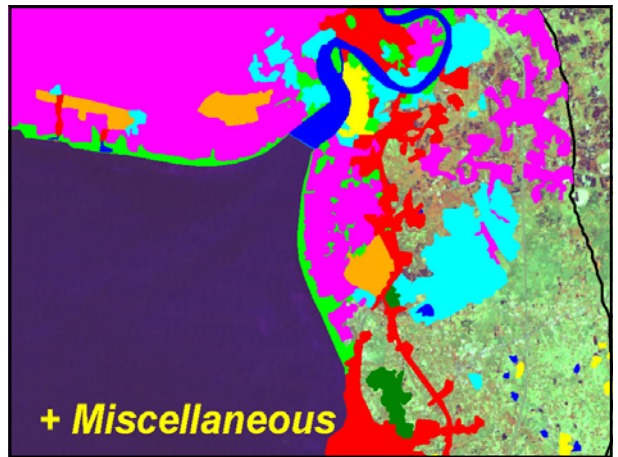
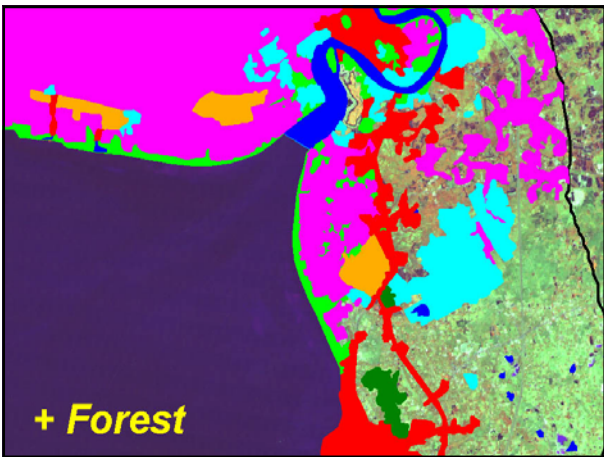
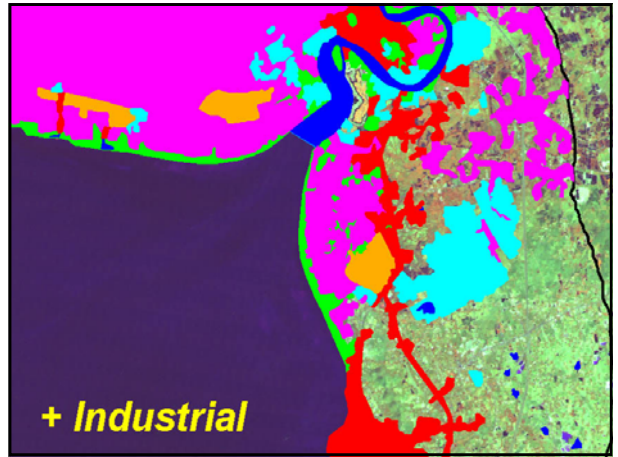
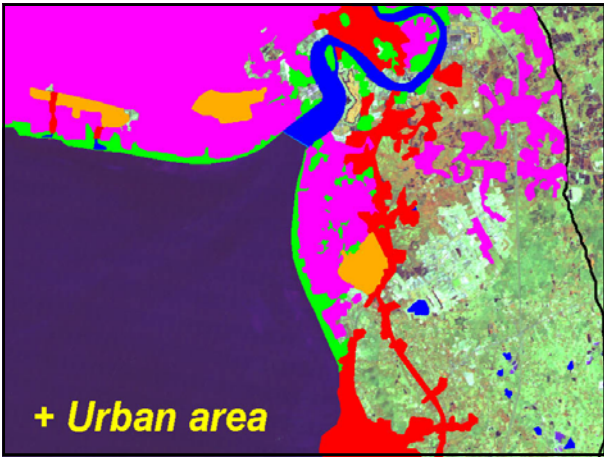
Features	Coding	Object Type
H3 Salt Pan	SP	Polygon
H4 Aquaculture	AQ	Polygon
H5 Intensive Fishing H5.1 Fishing Stakes	Fs	Polygon
H6 Agriculture	AC	Polygon
H7 Village	V	Point
H8 Urban Area	U	Polygon
H9 Industrial Area	I	Polygon

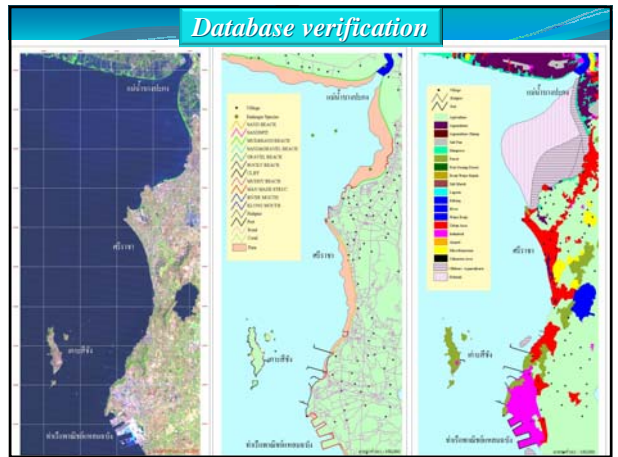
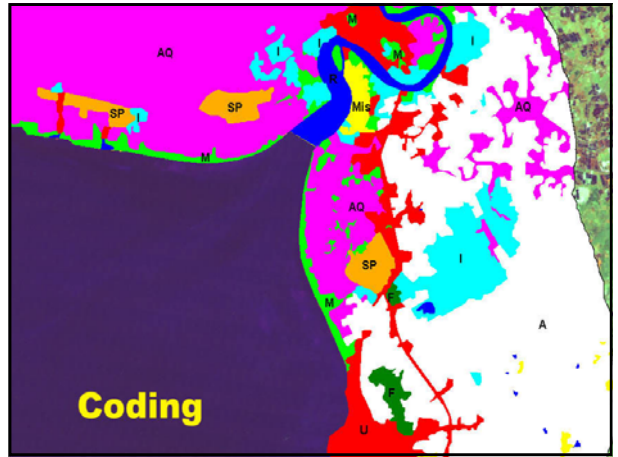
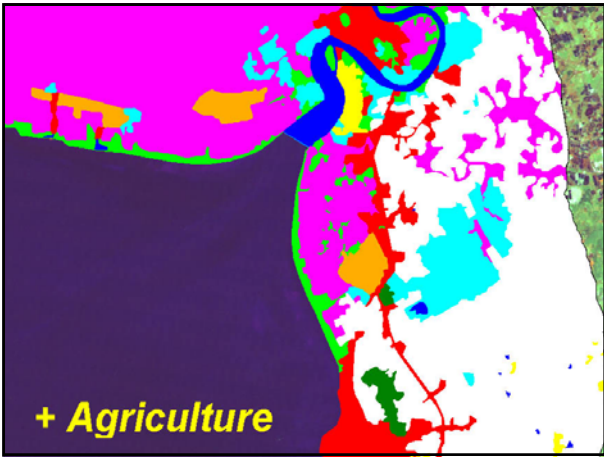
Features List: Contingency Planning

Features	Coding	Object Type
C1 River	R	Polygon/Line
C5 Road	Rd	Line
C7 Airport	AP	Polygon
C10 Lighthouse	LH	Point
C18 Oil Refinery	OR	Polygon/Point
C20 Oil Spill Equipment Stockpile	OE	Point









ESI Mapping initiatives



Methodology: Environmental Sensitivity Index (ESI)

- * *Principle of ESI*
- * *Priorities for ESI*
- * *Sensitivity Ranking System*
- * *ESI Mapping*



Principle of ESI

❖ Base Sensitivity Ranking

	1 - 4	Low impact
impact	5 - 7	Medium
	8 - 10	High impact

❖ Sensitivity Ranking Modifiers

	+	Low impact
++		Medium impact
equal or more than	+++	High impact



Priorities for ESI

- * Physical factors: the physical functions of oil penetration and residence time
- * Cleanup capability: relation to substrate type/grain size slope and exposure
- * Ecology factors: different types of flora/fauna communities, various ecosystem rates, rate of natural washing, slope and residence time
- * Socio-Economic factors: fishing, tourisms, industries



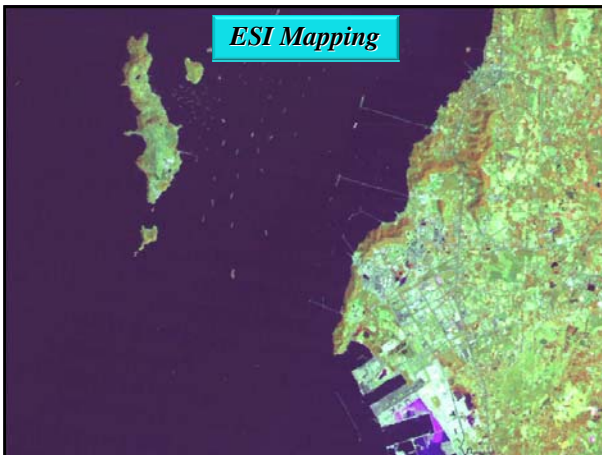
Sensitivity Ranking System: *Base*

Ranking level	Description
1	Exposed Cliff and Manmade Structure
2	Exposed Rocky Beach, Peat Swamp Forest
3	Exposed Sand Beach, Sand Spit & Sandy Gravel Beach
4	Sand Beach – sheltered, Gravel Beach – exposed
5	River/Cannel, Sandy Gravel Beach and Sand Spit
6	Muddy Sand Beach, Gravel Beach, Rip Rap, Seagrass
7	Lagoon, Sand Flat, Muddy Beach, Cliff and Manmade
8	Mud and Sand Flat, Rocky Beach, Seaweed
9	Mud Flat, Marsh, Seagrass-dense, Mangrove, Coral reef
10	Mangrove: Conservation area

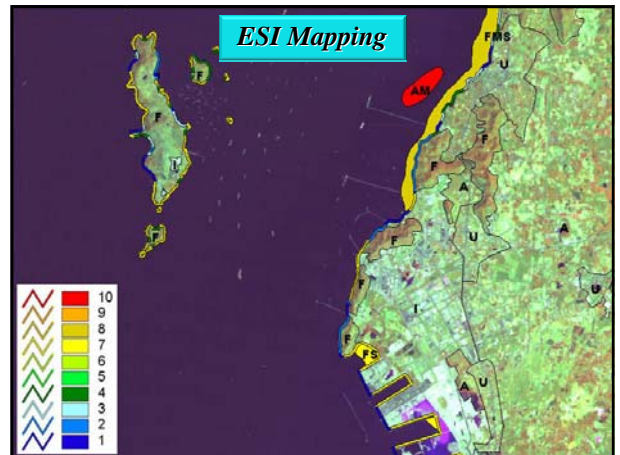
Sensitivity Ranking System: *Modifier*

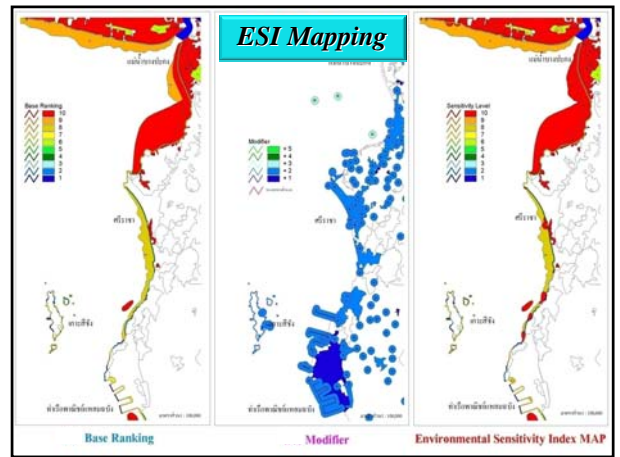
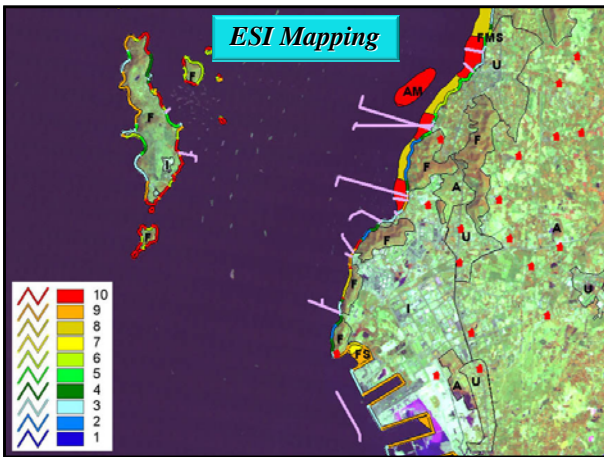
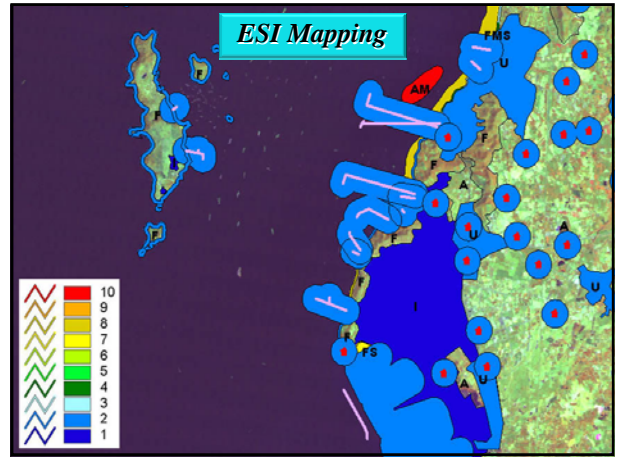
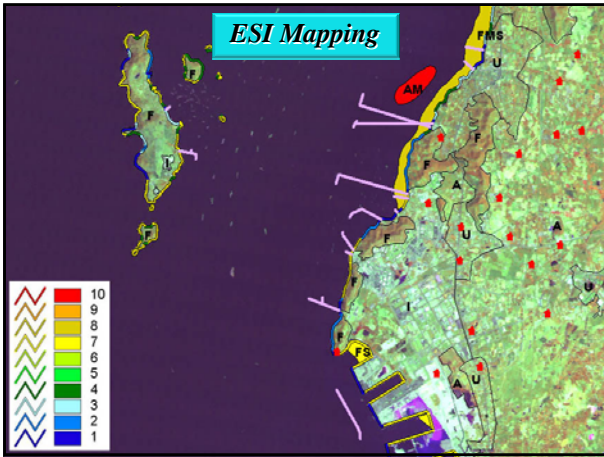
Upgrading level	Description
+ 1	Industrial, Deep Sea Port, Commercial Port Recreation Port, Non-fishing Village, Urban Areas
+ 2	Tourist/Recreation Site and Beach – Local Importance, Rare/Endangered Species Site – Offshore Whale Sacred/Historical Site, Intensive Fishing Ground, Fishing Village, Fishing Port River mouth, Cannel mouth, Fishing Stake
+ 3	Tourist/Recreation Site and Beach – National Importance, Protected area, Water intake – Open channel system, Aquaculture – Clam, Oyster, Mussel
+ 4	Tourist/Recreation Site and Beach – International Importance, Rare/Endangered Species Site – Near-shore Whale and Dolphin
+ 5	Rare/Endangered Species Site-Dugong, Rare/Endangered Species Site – Turtle, Coral Reef – excellent, Fish Spawning Ground

ESI Mapping



ESI Mapping





Outcomes

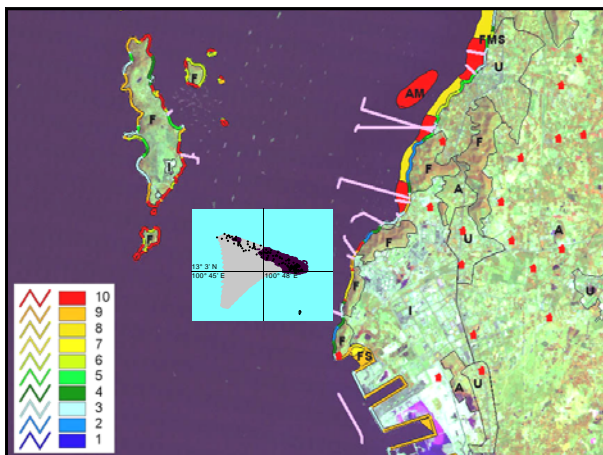
- ❑ Database arranged in GIS form
- ❑ Sensitivity index for natural resources vulnerable to oil
- ❑ Production for Sensitivity Maps

<i>Map Theme</i>	<i>Scale</i>	<i>Area usage</i>
Coastal Resource Maps	1:100,000	National
Coastal Resource Maps	1:50,000	Provincial
Environmental Sensitivity Maps	1:100,000	National
Environmental Sensitivity Maps	1:50,000	Provincial



Applications

- ❑ Contingency planning and response for oil spill prevention measures
- ❑ Marine environment surveillance and monitoring
- ❑ Coastal zone management
- ❑ Environmental impact assessment
- ❑ Mapping of shoreline sensitivity to nutrients and suspended solids

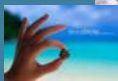


Future works

- ✧ Update GIS database
- ✧ Develop biological sensitivity database
- ✧ Review ESI
- ✧ Create networks or agreement with "data supplier" organizations



Thank you



ANNEX 6 AVAILABLE MAPS AND THEIR FORMATS

No.	Map Type	Source	Status and Use
1	Topographic map, scale 1/50,000 issued 2004 (4) <ul style="list-style-type: none"> - System VN2000, Central Longitude 105°, Time zone 6 - Format: MicroStation/MapInfo 	South Vietnam Union of Map and Geology	<ul style="list-style-type: none"> - Systems of roads, rail, rivers, resident areas, shoreline, height - Not yet updated.
2	Sketch maps of Phu Quoc Natural Reserve, World Biosphere Reserve of Dat Mui (5) Format: *.tif, *.bmp	<ul style="list-style-type: none"> - Management Board of World Biosphere Reserve of Dat Mui - People's Committee of Phu Quoc District 	<ul style="list-style-type: none"> - Determination of boundary for core area, buffer area of the natural reserves - Change with time
3	Land use maps of Ca Mau Provinces Ca Mau, Kien Giang, issued 2010 (6) <ul style="list-style-type: none"> - Scale 1/50,000 (or 1/100,000) - System: VN 2000, Central Longitude 105°, Time zone 6 - Format: MicroStation/MapInfo 	Departments of Agriculture and Rurality Development (Ca Mau and Kien Giang Provinces)	Status of land use, boundary of areas for rice, aquaculture, mangrove forest
4	Geomorphic dynamics maps for coastal area of Southern West Sea of Vietnam and Phu Quoc Island, issued 2010 (7) <ul style="list-style-type: none"> - Scale 1/50,000 (or 1/100,000) - System: VN 2000, Central Longitude 105°, Time zone 6 - Format: MicroStation/MapInfo 	South Vietnam Union of Map and Geology	<ul style="list-style-type: none"> - Shoreline types according to NOAA - Topography affected by tide and sea dynamics
5	Sketch maps of sea sources (grounds of fish, shrimp, cuttlefish, coral, seagrass, fishing areas) (8) <ul style="list-style-type: none"> • Format: *.tif, *.bmp 	Consultative and Technology Transfer Center of Aquatic Resources and Environment	<ul style="list-style-type: none"> - Identification by different colors - Low exact

ANNEX 7
Inventory of Environmental Sensitivity Mapping Initiatives in the
Gulf of Thailand

A Report from Vietnam

The background of the slide is a scenic photograph of a coastal area in Vietnam. It shows a wide, sandy beach curving along a bay with clear, turquoise water. The surrounding land is covered in dense green vegetation and trees. In the distance, there are rolling hills and a clear blue sky with a few wispy clouds.

ESI MAPPING OF GOT PART IN VIETNAM

Changwon City July 2012

CONTENT

- About CPSE ([1](#))
- Data for ESI Mapping and their sources
- Maps and their formats
- Satellite images
- Field trips
- Principle of ESI Mapping
- Tools used in ESI Mapping
- Scope and coverage of ESI map
- Recommendation

Data for ESI Mapping

No.	Documents	Sources	Use
1	Social and Economy Report of Province Ca Mau 2011	People's Committee of Province Ca Mau	Areas planned for aquaculture, Tourism, industry, biosphere reserves, National parks, mangrove forests, etc... Preference areas
2	Social and Economy Report of Province Kien Giang 2011	People's Committee of Province Kien Giang	
3	Economy Development Plan of Province Ca Mau Period 2010-2015	People's Committee of Province Ca Mau	
4	Economy Development Plan of Province Kien Giang Period 2010-2015	People's Committee of Province Kien Giang	

Data for ESI Mapping

No.	Documents	Sources	Use
5	Documents about World Biosphere Reserve of Dat Mui (2)	Management Board of World Biosphere Reserve of Dat Mui	Area (core and buffer), Distribution of animals and plants, rare animals and rare plants
6	Documents about Sea Reserve of Phú Quốc Island	People's Committee of Phu Quoc District	
7	Land Usage Reports of Province Ca Mau 2010, Development Orientation up to 2015	People's Committee of Province Ca Mau	Statistical data about area, land type, their use (aquaculture, Mangrove forests, tourism, industry, sea ports, fish ports...)
8	Land Usage Reports of Provinces Kien Giang 2010, Development Orientation up to 2015	People's Committee of Province Kien Giang	

Data for ESI Mapping

No.	Documents	Sources	Use
9	Report of Aquatic Resources for Southern West Sea of Vietnam (3)	Consultative and Technology Transfer Centre of Aquatic Resources and Environment	Statistical data about fishing grounds, production (fish, shrimp, cuttlefish...) for each fishing season (North, South)
10	Geomorphic dynamics report for Coastal area of Southern West Sea of Vietnam and Phu Quoc Island	South Vietnam Union of Map and Geology	<ul style="list-style-type: none"> - Shore line types (NOAA) - Topography versus height, areas affected by tide and sea dynamics...

Maps and their formats

No.	Map Type	Source	Status and Use
1	Topographic Map, scale 1/50,000 issued 2004 (4) –System VN2000, Central Longitude 105°, Time zone 6 –Format: Microtation/Mapinfo	South Vietnam Union of Map and Geology	<ul style="list-style-type: none"> - Systems of roads, rail, rivers, resident areas, shore line, height... - Not yet update.
2	Sketch maps of Phu Quoc Natural Reserve, World Biosphere Reserve of Dat Mui (5) Format: *.tif, *.bmp,...	<ul style="list-style-type: none"> - Management Board of World Biosphere Reserve of Dat Mui - People's Committee of Phu Quoc District 	<ul style="list-style-type: none"> - Determination of boundary for core area, buffer area of the natural reserves - Change with time

Maps and their formats

No.	Map Type	Source	Status and Use
3	Land Use Maps of Ca Mau Provinces Ca Mau, Kien Giang, issued 2010 (6) -Scale 1/50,000 (or 1/100,000) -System: VN 2000, Central Longitude 105°, Time zone 6 -Format: Microtation/Mapinfo	- Departments of Agriculture and Rurality Development (Ca Mau and Kien Giang Provinces)	Status of land use, boundary of areas for rice, aquaculture, mangrove forest ...
4	Geomorphic dynamics Maps for Coastal area of Southern West Sea of Vietnam and Phu Quoc Island, issued 2010 (7) -Scale 1/50,000 (or 1/100,000) -System: VN 2000, Central Longitude 105°, Time zone 6 -Format: Microtation/Mapinfo	South Vietnam Union of Map and Geology	- Shoreline types according to NOAA. - Topography affected by tide and sea dynamics

Maps and their formats

No.	Map Type	Source	Status and Use
5	<p>Sketch Maps of sea sources (grounds of fish, Shrimp, cuttlefish, Coral, sea grass, fishing areas) (8)</p> <p>•Format: *.tif, *.bmp...</p>	<p>Consultative and Technology Transfer Centre of Aquatic Resources and Environment</p>	<ul style="list-style-type: none"> – Identification by different colors – Low exact

Limitation of these maps

- Difference in scale, coordinate system and detail
- Difference in issue time
- Difference in format
- Digital and hard copy

Satellite Images

No.	Image Type	Source	Status and Use
	Spot 4 or Spot 5 (600 km ² / image; resolution of 5 m /pixel (max))	Application and Development Centre for Mapping and Geodesic Technology	<ul style="list-style-type: none"> - Correction for maps of land use, shoreline, river mouth - Classification of vegetational coverage (9)

Field Trips

Purpose

Surveying, checking and recording actual situation of ESI mapping area, comparing to collected data, maps and satellite images.

Means and instruments

- Transport: Motor boat, car
- Recording: Camera, video camera, notebooks
- Observation: Field-Glasses

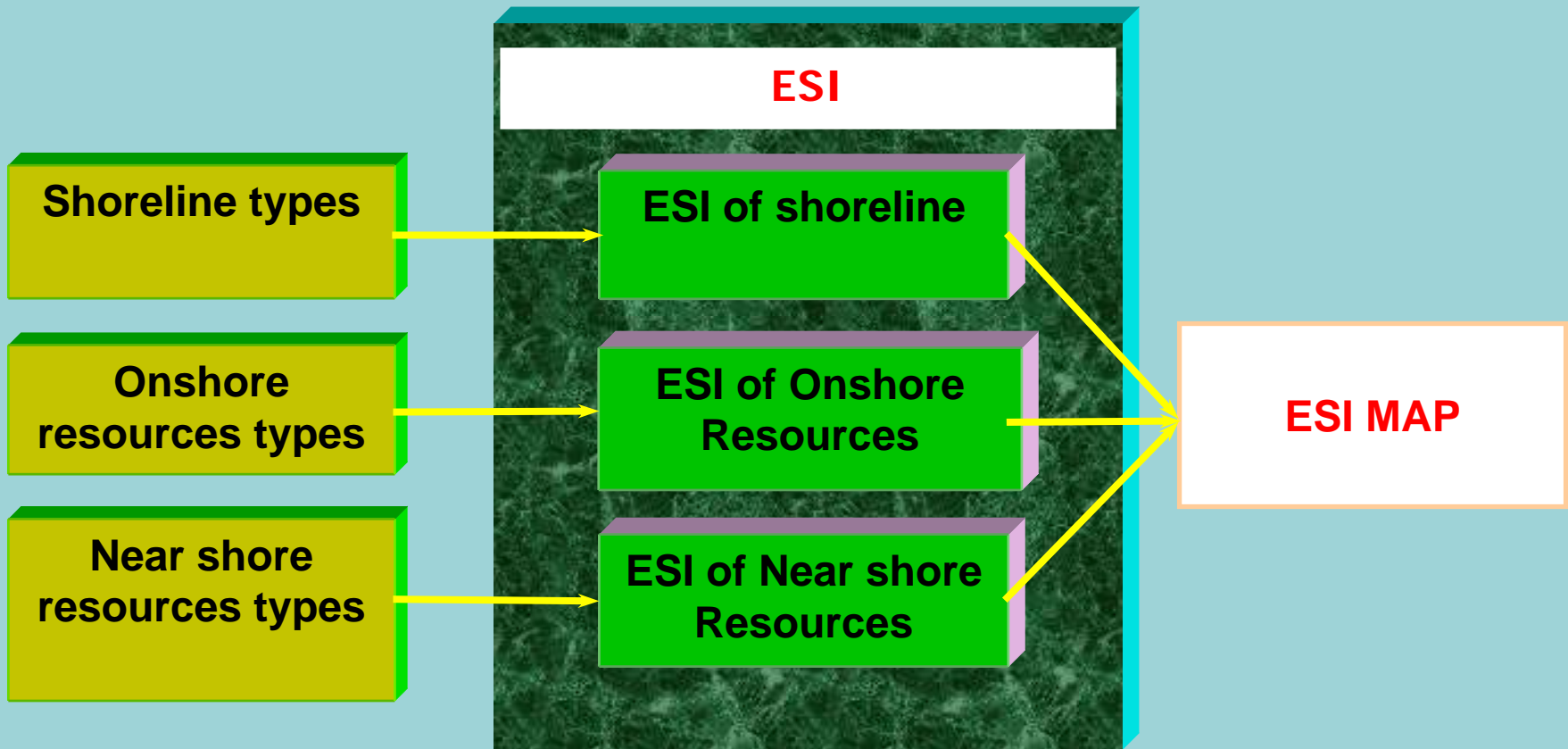
Principle of ESI Mapping

ESI classification

Environmental Sensitivity is classified by 6 levels with 6 different color symbols as following:

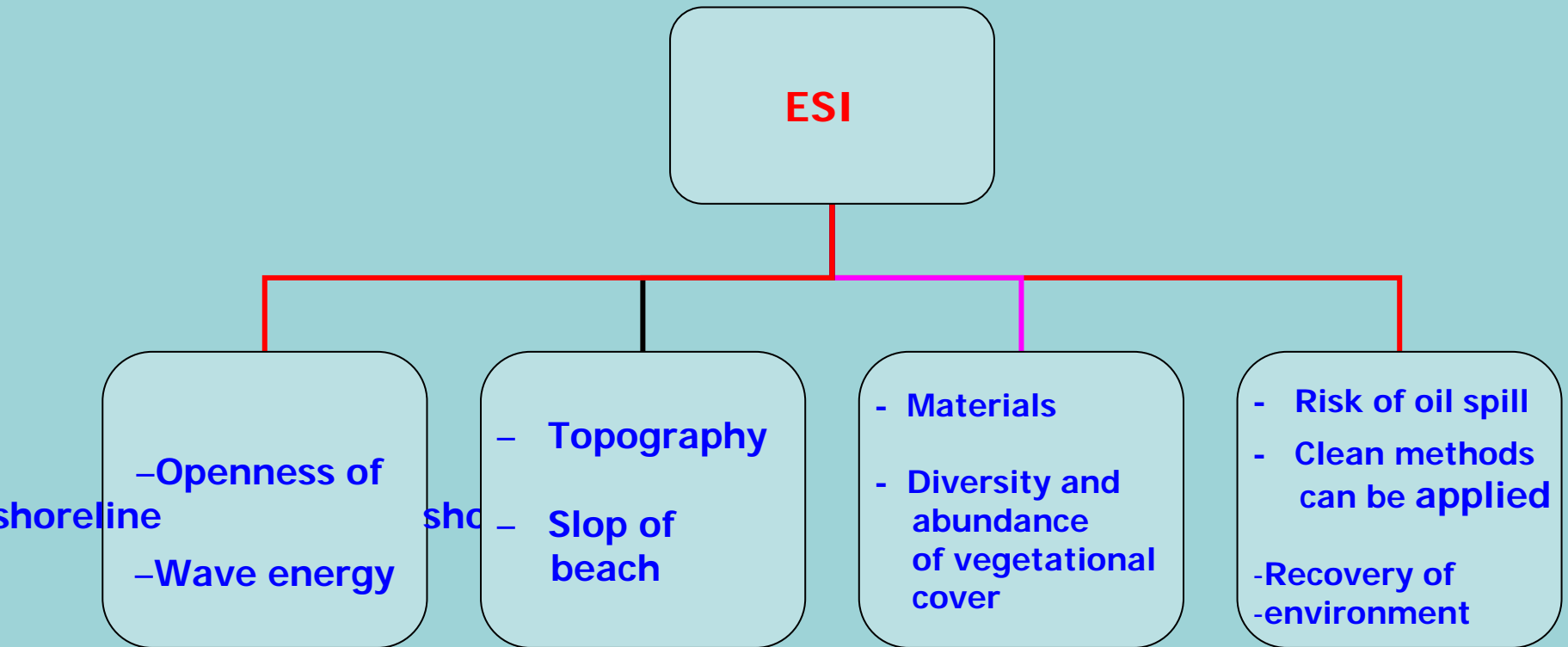
1	=	Low
2	=	Low average
3	=	Average
4	=	High average
5	=	High
6	=	Very high

Principle of ESI Mapping



Principle of ESI Mapping

ESI OF SHORELINE



Principle of ESI Mapping

ESI OF ONSHORE RESOURCES

ESI

NATURAL RESOURCES

Mangrove forests

Gulfs

Topography

Sweet / Brackish pools

River mouths

MAN USED RESOURCES

ROAD/SEA PORT/AIR PORT

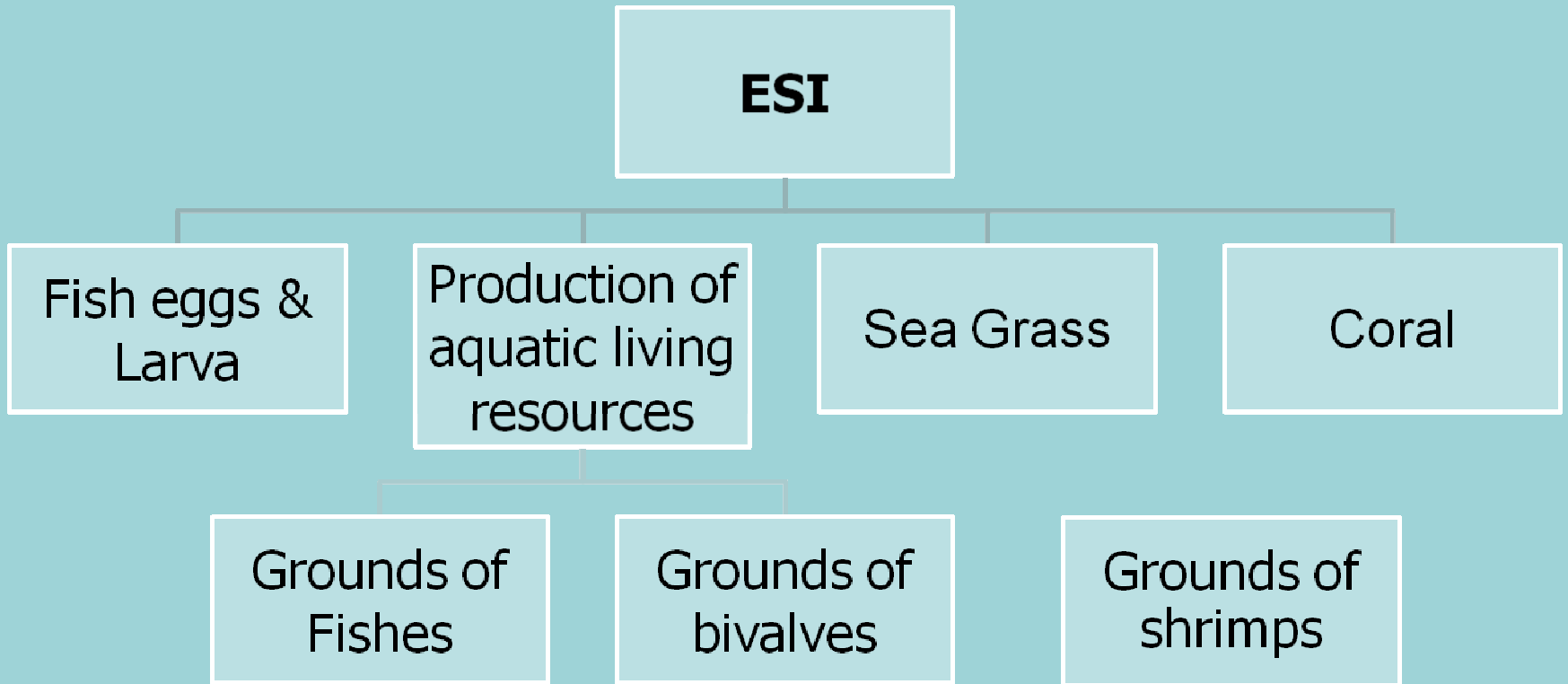
Industry/Tourism/urban areas

AQUACULTURE

His.Monument /Archaeological
areas

Principle of ESI Mapping

ESI of NEAR SHORE RESOURCES



Principle of ESI Mapping

INTEGRATION OF SPESIFIC ESI LAYERS

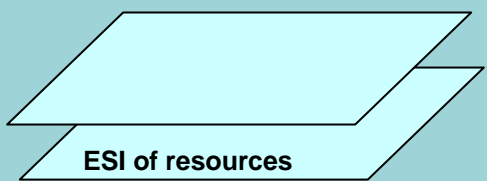
MAPINFOR

ARCVIEW

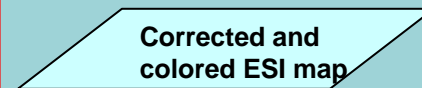
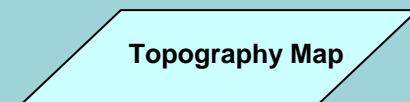
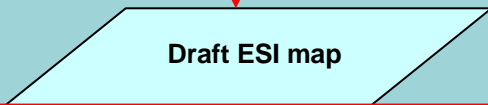
MAPINFOR

Including 5 layers:

1. layer of Shoreline
2. Layer of Onshore (natural, man used...)
3. Layer of geomorphic dynamics
4. Layer of aquatic resources (Coral, sea grass...)
5. Layer of Production of aquatic resources (Fish, shrimp...)



$$FSIV = \sum_{i=1}^x \frac{\sum_{j=1}^x \frac{ID_{ij}}{y(i)}}{x}$$



Print

ESI MAP

SPECIFIC ESI LAYERS

INTEGRATION

ESI MAP

Tools used for ESI Mapping

SOFTWARES

- Arcview 3.3
- MapInfor 8.0

OFFICE INSTRUMENTS

- PCs
- Printers
- Papers of size Ao, A1, A2, A3 and A4

MEANS AND INSTRUMENTS FOR FIELD TRIP

- Cars
- Motor boats
- Cameras
- Video cameras
- Notebooks
- Specific maps

Scope and coverage of ESI map

1. Coastal Area from Ca Mau Cap to Cambodia border, islands including Phu Quoc Island
2. Coastal band of onshore from 20 to 25 km depending on height of land and tide energy
3. Coastal band of near shore from 20 to 30 km depending on sea depth
4. General map of scale 1/250,000 for whole area (Provinces Ca Mau and Kien Giang)
5. Detail maps of scale 1/50,000 for local areas
6. Transferring to Coordinate system of WGS 84, central longitude 105° according to regulation of Vietnam government

Recommendation

1. Use of same ESI classification of 6 levels and color symbols should be done.
2. Different ESI map types should be accepted in case there are differences among 3 GOT countries on the methodology and components of the ESI mapping.

Thank you for your attention

ANNEX 8
PROPOSED WORK PLAN AND TIME FRAME

**ANNEX 8
PROPOSED WORKPLAN AND TIMEFRAME**

	Component/Actions	Schedule
1	Participate in the Sub-regional Inception Workshop	JuLY 9-14
2	Establish ESI project team/Engage ESI Specialist	July 16-30
3	Data gathering, validation and analysis	Aug 1 – Dec.30
4	Production of initial draft of maps	Jan 1- 30
5	Conduct National Validation Workshop	Feb 2013
5	Production of country ESI maps	March 2013
6	Sub-regional integration workshop	April 2013
7	Production of GoT Atlas	May –July 2013
8	Publication of GoT Atlas	August 2013