Oil Spill Response Planning

Coastal and Marine Environmental Sensitivity Mapping

Simon Ross
Maarten Kuijper
24th July 2012
ESRI International User Conference

The world's leading sustainability consultancy

ERM

Overview

Understanding Environmental Sensitivities

- What are they?
- Why do we map them?

Environmental Sensitivity Mapping Process

- General Approach and Procedures
- Project Challenges

Lessons Learned and Future Developments

What Are Environmental Sensitivities?

IMO/IPIECA Definition

Resources, habitats, sites or activities are considered sensitive to oil spills because they are:

1. of environmental, economic, or cultural importance;
2. at risk of coming in contact with spilled oil; and
3. likely to be affected once oiled or affected by the oil even without direct contact.

(Michel, Christopherson and Whiple, 1994).

Why Map Environmental Sensitivities?

Sensitivity mapping enables:

- Most sensitive sites/resources to be identified
- Priorities for spill response and clean up to be defined

Successful sensitivity mapping informs the development of:

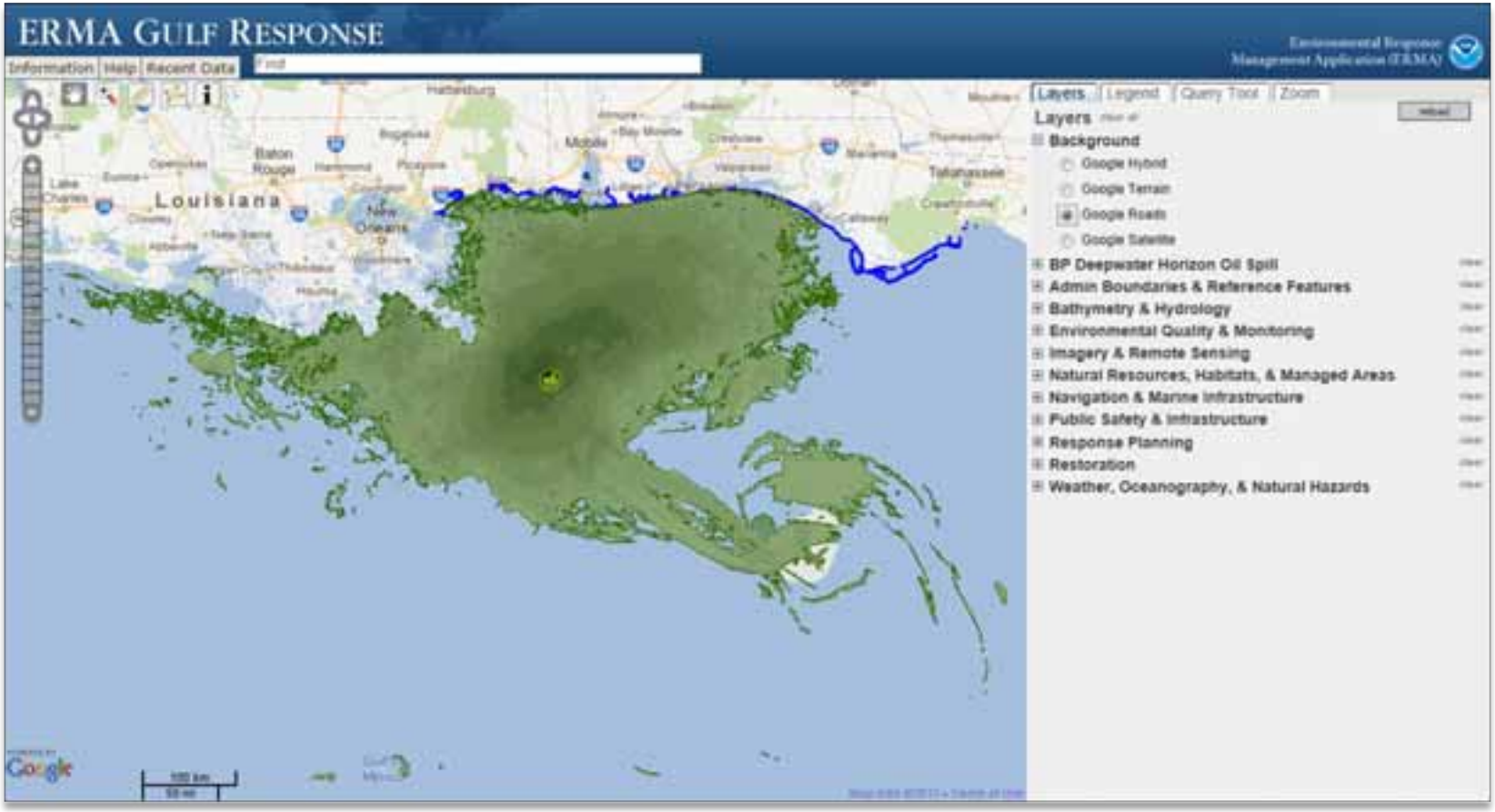
- Oil spill response strategy and contingency plans
- Waste management strategies
- Response equipment deployment
- Response maps and databases

ESM – A generalized approach

5 stages for creating sensitivity maps:

1. Define the Study Area
2. Identify potential sensitive resources and constraints
3. Acquire baseline data for analysis
4. Conduct sensitivity assessment
5. Share and apply results

ESM: 1. Define the Study Area



http://gomex.erma.noaa.gov/erma.html (Map Data © Google 2012)

ESM: 2. Identify resources and constraints

Characterize the Study Area

- General environmental characteristics
  - Identify key environments
  - Build appropriate assessment team
- Regulatory environment and stakeholders
  - International, National, Oil Company
- Project schedule and budget
  - Does schedule allow for field surveys, seasonality?
  - What type of data can be purchased (e.g. satellite imagery)?

ESM: 3. Acquire baseline data

Define the data model:

- GIS Data Management (formats, coordinate systems, quality control procedures)
- Document data procedures at project outset

Typical data categories:

- Shoreline Type
- Ecological/Biological Resources
- Social/Cultural Resources
- Marine Resources

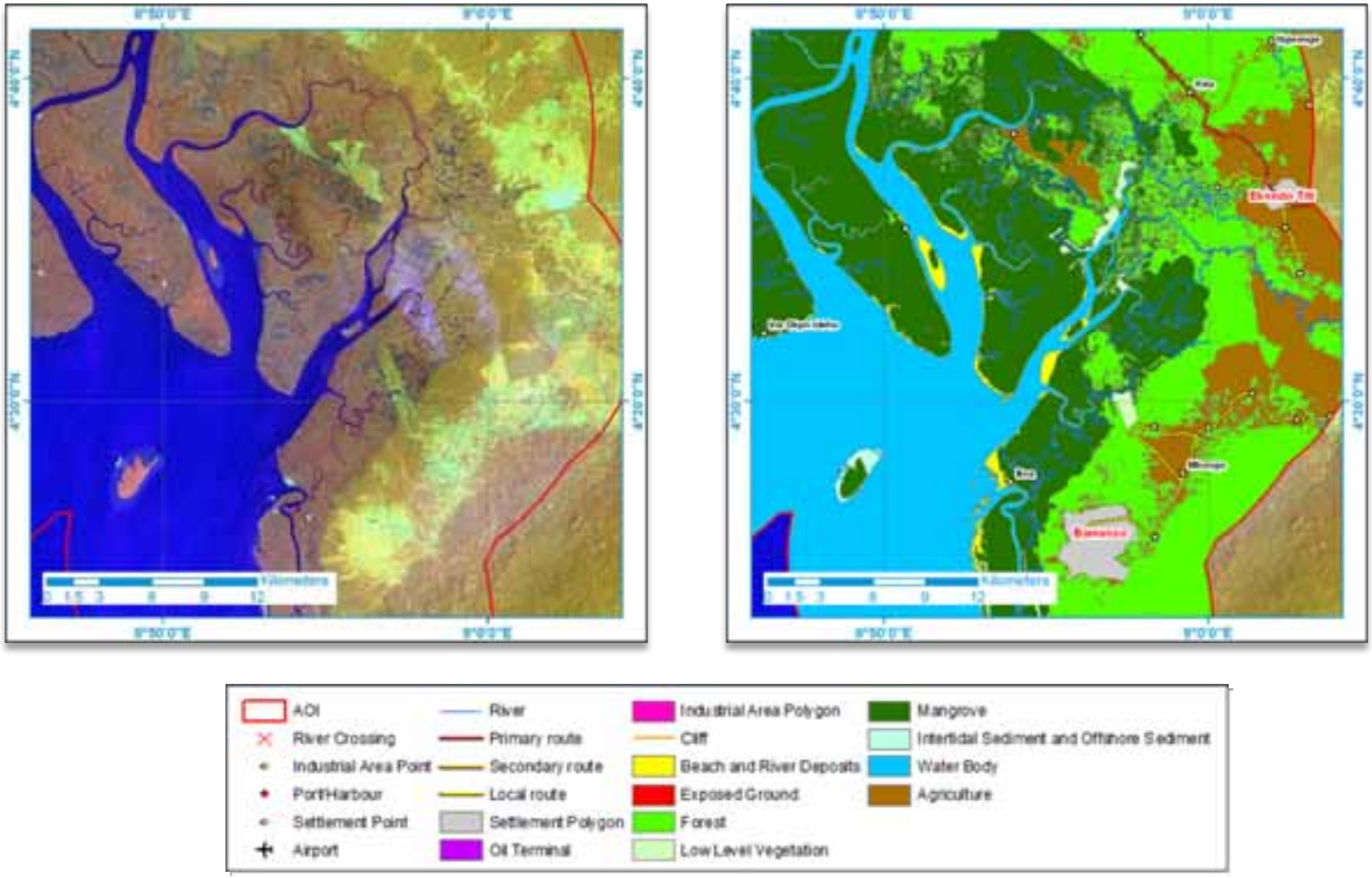
ESM: 3. Acquire baseline data

Typical Data Sources

- Existing ESMs – do they meet requirements (e.g. GIWACAF)
- Remote Sensing – satellite/aerials.
- National/International databases (e.g. UNEP, WCMC)
- Scientific literature and online databases (e.g. OBIS)
- Field survey

ESM: 3. Existing ESMs

ESM: 3. Remote Sensing: Regional



ESM: 3. Remote Sensing: Detailed

- http://gomex.erma.noaa.gov/erma.html (Map Data © Google 2012)

ESM: 4. Sensitivity Assessment

Map resources with respect to sensitivity to spill

- Sensitivity criteria will vary by location/environment/project
- Existing international guidelines define maps not methods
- Standard symbology
- Standardized terminology
- High/Medium/Low etc. requires definition

ESM: 4. Sensitivity Assessment - Shoreline

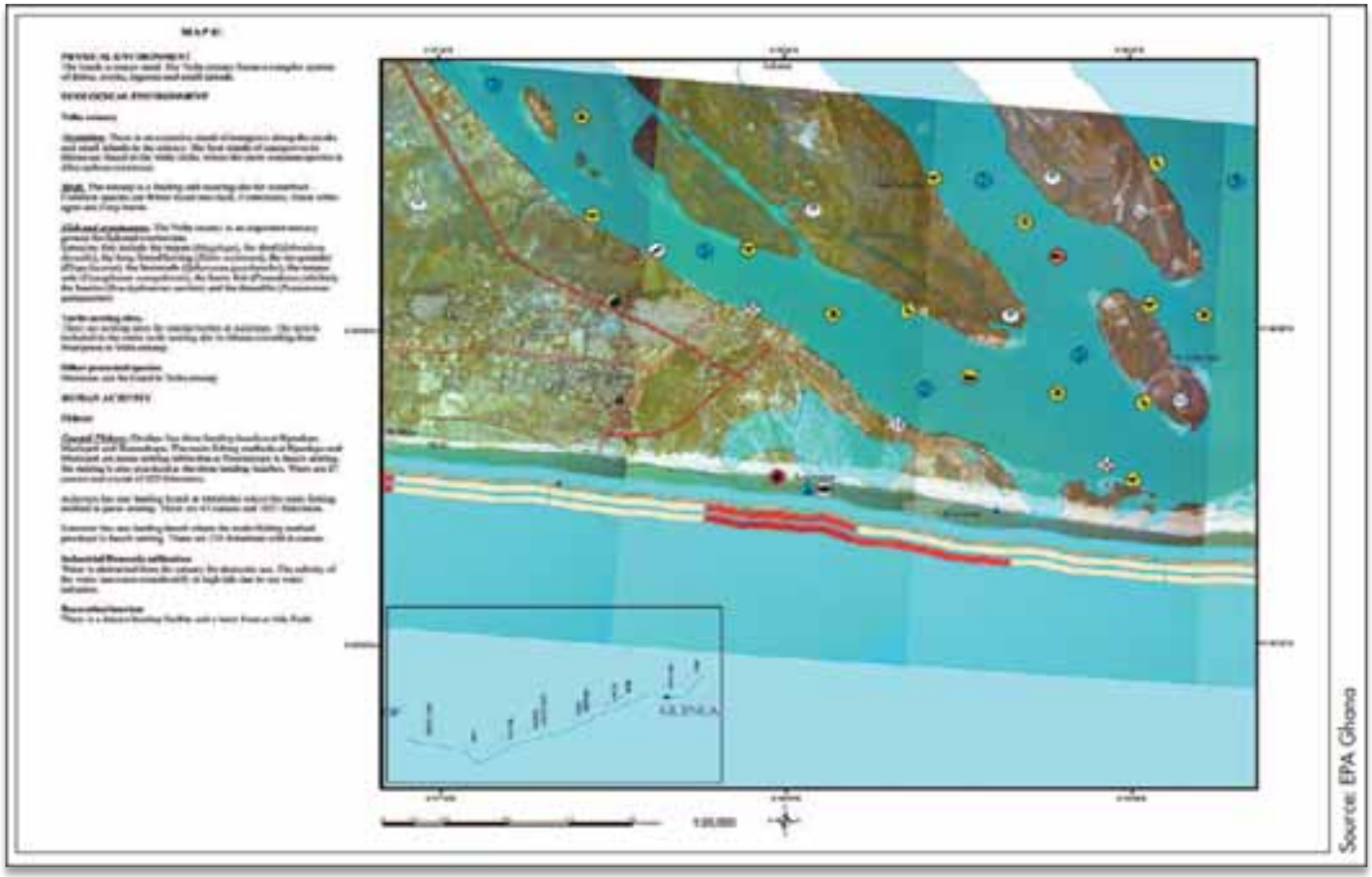
Well defined International Guidelines (IMO/IPIECA from NOAA)

- 1A Exposed rocky shore
- 1B Exposed, solid man-made structures
- 1C Exposed rocky cliffs with boulder talus base
- 2A Exposed wave-cut platforms in bedrock, mud or clay
- 2B Exposed scarps and steep slopes in clay
- 3A Fine- to medium-grained sand beaches
- 3B Scarps and steep slopes in sand
- 4 Coarse-grained sand beaches
- 5 Mixed sand and gravel beaches
- 6A Gravel beaches (granules and pebbles)
- 6B Riprap structures and gravel beaches (cobbles and boulders)
- 7 Exposed tidal flats
- 8A Sheltered scarps in bedrock, mud or clay and sheltered rocky shore
- 8B Sheltered, solid man-made structures
- 8C Sheltered riprap
- 8D Sheltered rocky rubble shores
- 8E Peat shorelines
- 9A Sheltered tidal flats
- 9B Vegetated low banks
- 9C Hypersaline tidal flats
- 10A Salt and brackish water marshes
- 10B Freshwater marshes
- 10C Swamps
- 10D Mangroves

Source: NOAA

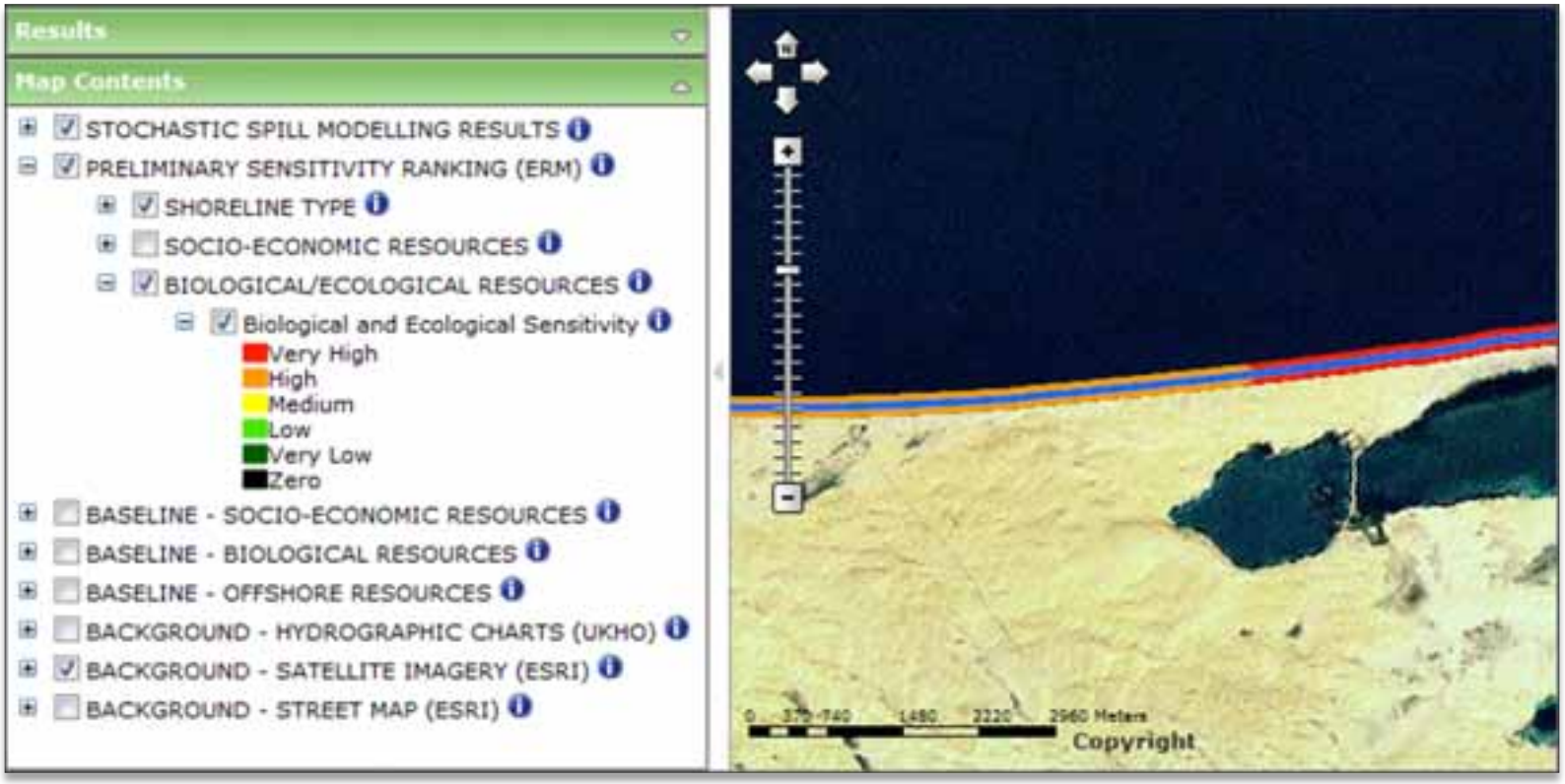
ESM: 4. Sensitivity Assessment

Example – Biological/Ecological Resources:

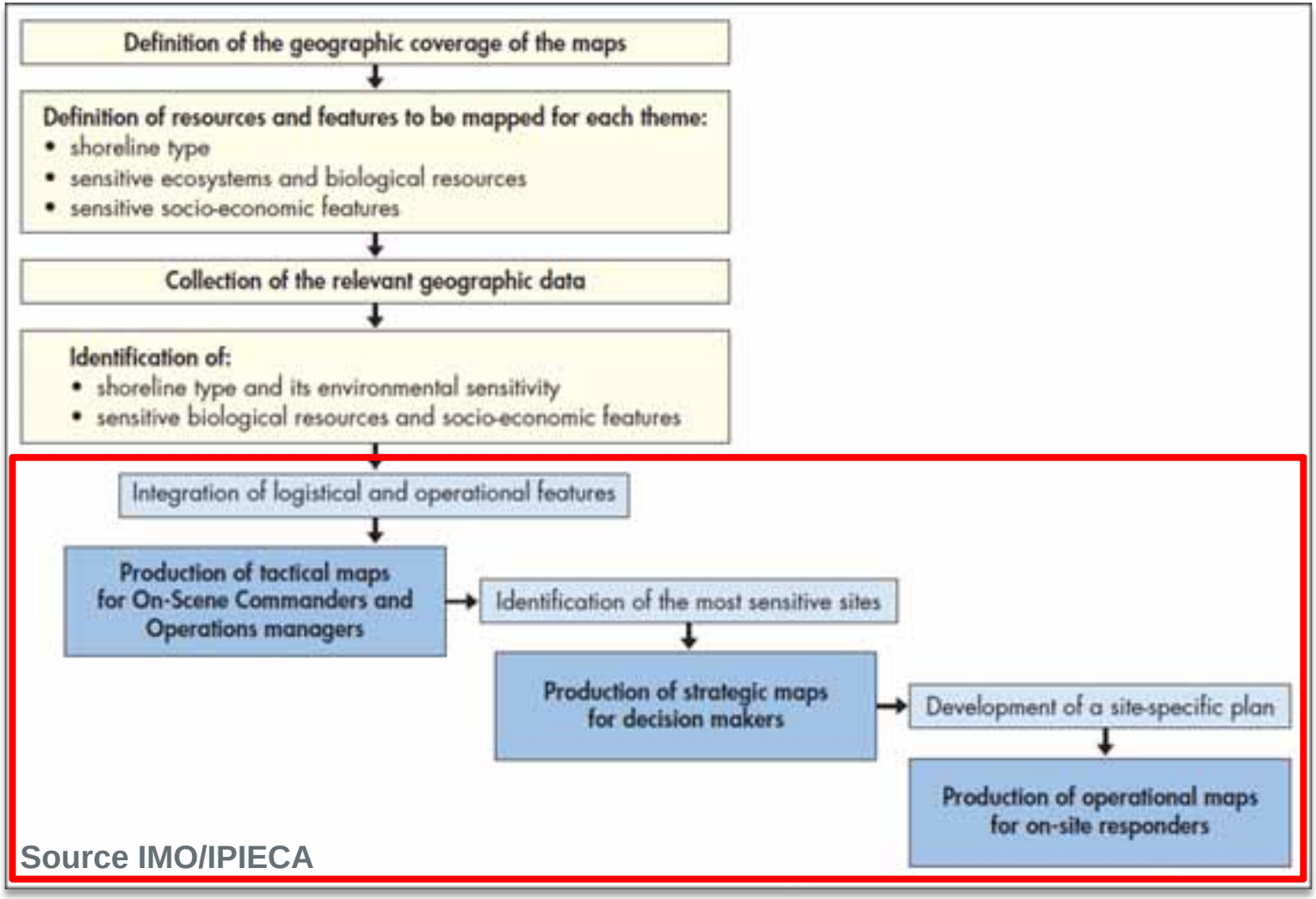


ESM: 4. Sensitivity Assessment

Example – Biological/Ecological Resources



ESM: 5. Share and Apply Results



Source IMO/IPIECA

ESM: 5. Intelligent Map Production

Potential map production at 1:50,000 scale

ERM

ESM: 5. GIS data Sharing

For the potential geographic scale the web is the best solution – particularly in planning stage:

- User defines area of interest
- Can zoom to any scale, produce maps on demand
- Integrated planning tools – online editing, data upload
- Automate common analysis
- Can link to existing databases directly (inc. base maps)
- Integrate with mobile devices
- Rapidly scalable to response situation
- Continuously updatable

Lessons learned and next developments

Defining GIS data standards, data models and workflows is critical for a successful ESM project

Use existing standards wherever possible

Identify potential project stakeholders early in the process (data providers, regulators, responders)

Maintain flexibility for different operating environments (countries, clients, new guidelines, new GIS platforms)