

## **Mapping for Coastal Pollution Response and GIS Application**

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### ***Abstract***

Geographic Information Systems (GIS) have been making important contributions to oil spill response and preparedness. GIS application using an Environmental Sensitivity Index (ESI), is used by pollution planner emergency responders. In this study, we have built ESI classification for Korean coastal environment and have included Hazardous and Noxious Substances (HNS) information in ESI Map. And we have constructed spatial database and implemented GIS application for managing and using ESI and response information. This application provides coastal pollution responders and planners with the functions for identifying information and supports their making the decision. ArcInfo has been used in building database and the application has been developed with Visual C++ and MapObjects.

### **Introduction**

It is important to response pollution not only at the shoreline but also on the sea when pollution accident occurs at sea. Coastal area includes many complex things, so the whole response information should be required in order to establish the response plan. The response information about the coastal pollution is consisted of shoreline sensitivity, distribution of coastal sensitive facility and resources, distribution of response resources and etc.

ESI (Environmental Sensitivity Index) map is an information map which represents coastal resources and response information on the spatial map. ESI map represents sensitivity of shoreline, coastal biological resources distributions, and sensitive facilities to oil. This paper introduces how to map coastal environment sensitivity information for pollution response and how to apply ESI Map with its own application.

### **ESI Classification**

Environmental Sensitivity Index (ESI) maps have been developed to map coastal spatial information to prepare and respond the pollutant spills. The

ESI datasets have represented the geomorphologic features, the wildlife and habitats which are sensitive to spilled oil. ESI map consists of shoreline, biological resources and human-use resources and Korea Coast Guard has classified these items by the pollution sensitivity to oil. Korean coastal areas have used intensively with aquaculture, fishing, leisure and so on. And also, there are important habitats and wide mud flats.

Shorelines have been sorted by the geographic features relating to pollution vulnerability in the coastal area. Sensitivity to oil is related to wave, sediment, biological productivity and geomorphology. Index is higher, sensitivity is higher and the priority of response is higher, too.



**Fig. 1 Korean Shoreline Classifications**

Some subtidal habitats or particular species are sensitive to pollutant spills and then types of the sensitive biological resources consist of birds, fishery, mammals, mollusks, algae, salt plants and others which are weak at the coastal pollution in Korea.

Korean coastal areas are used intensively, so there are many coastal facilities such like harbors, fisheries, industrial complexes, oil reservoirs, HNS (Hazardous and Noxious Substances) facilities and so on. And locations and attributes of coast guards, response organizations and response agencies are good information for planning the response strategy and acting response plan. They should be included in ESI map. Response support datasets are composed of oil fence, oil adsorbent, dispersant, storage tool, oil cleaner, spray tool, high pressure cleaner, car for response, crane, transfer pump, oil collection, etc. In this project, location and attribute of these materials have been able to be collected with cooperation of Korea Coast Guards.

### **ESI Mapping**

This project has built shoreline, various resources, response information and others. These datasets are mostly point types, but shoreline datasets are line types they have possibilities to have various topology errors. So validating topology and editing shoreline should be done following rules.

- Must Not Overlap
- Must Not Intersect
- Must Not Self-Overlap

In order to apply topology functions of ArcInfo, datasets have been edited as (GDB) Geodatabase format and finally have reconverted shapefile format because of ESI application developed using MapObjects.

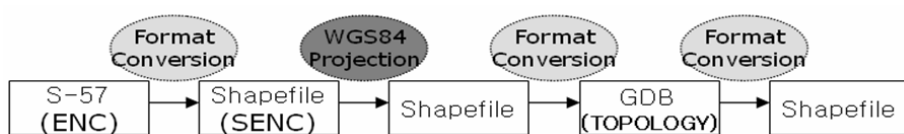


Fig. 2 Conversion process

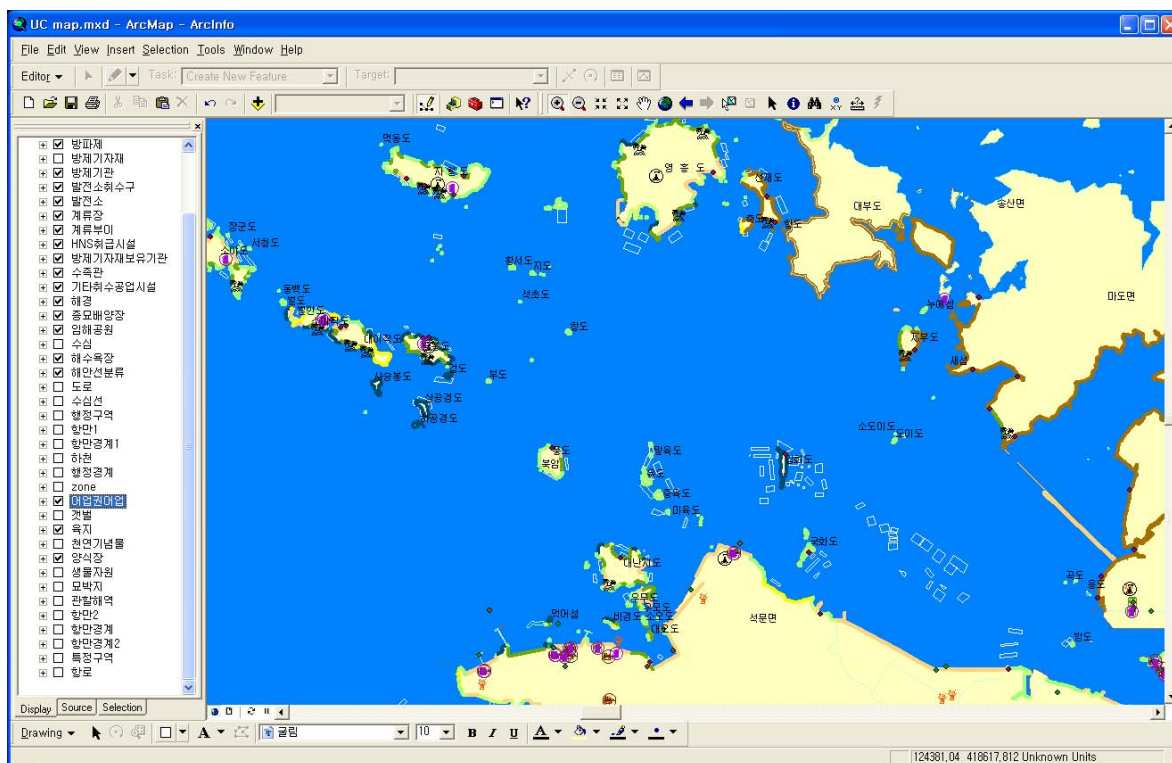


Fig. 3 Mapping of shorelines, fishery and so on.

Satellite images are useful to build the database in editing phase and also understand the coastal area rapidly in utilization phase. So this project has used coastal images in these phases. These images are corrected geographically referring ESI Map in ArcMap.

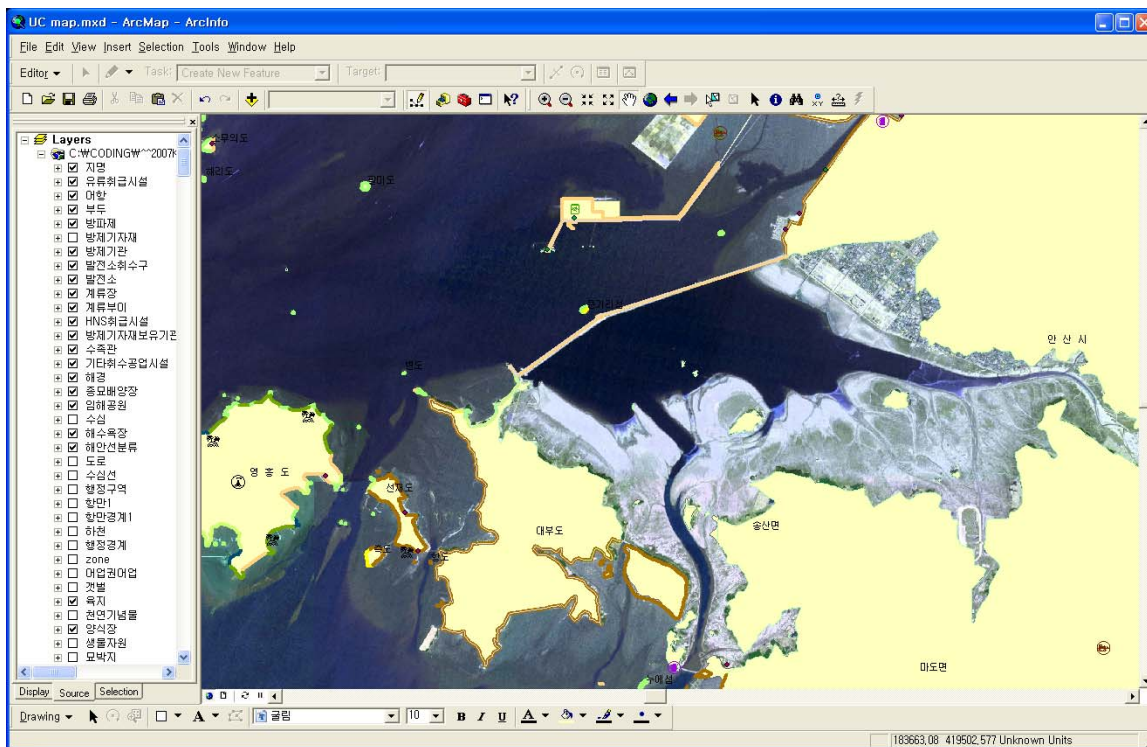


Fig. 4 Satellite image for ESI map

### ESI Map Application

There are lots of information in ESI map including spatial information and attributes. Response planners should understand the accident area wholly and make a decision to respond rapidly. So the exclusive application of ESI map is necessary for planners. This project has developed a program for utilizing ESI map using MapObjects Windows. This application has been implemented to display, query and analyze the variety of the related spatial information and ESI.

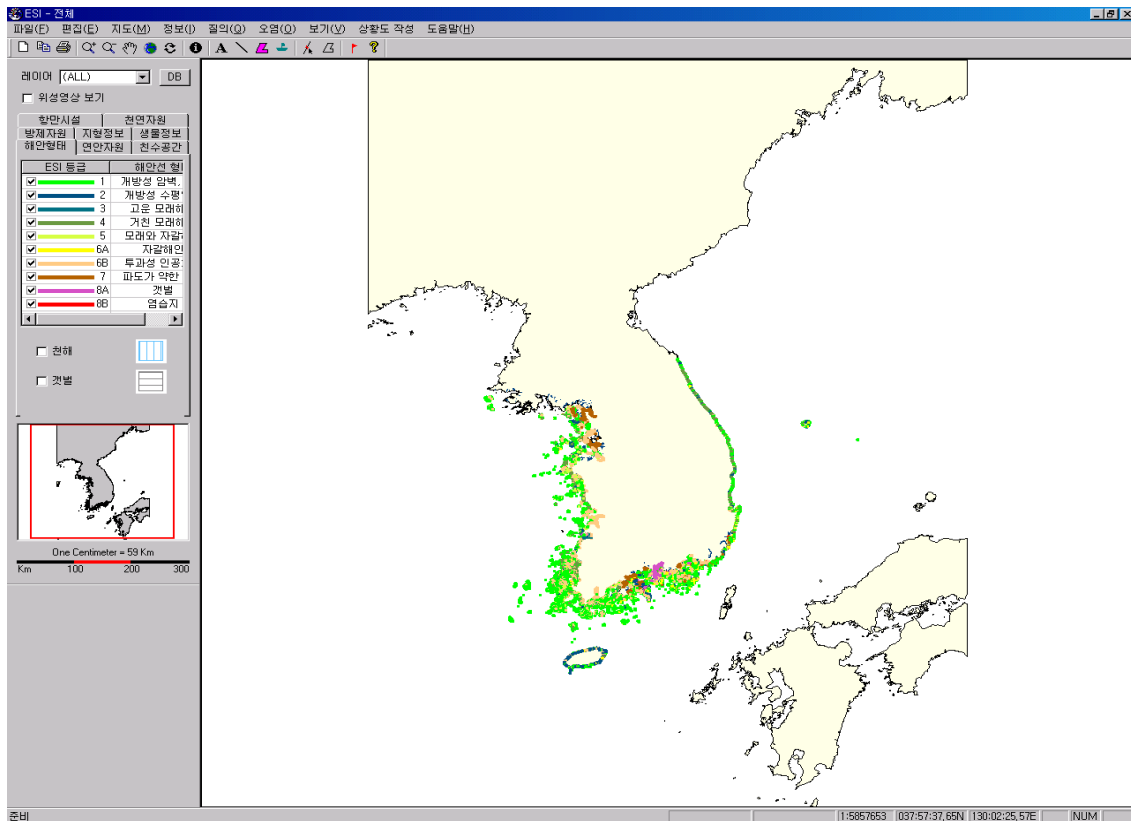


Fig. 5 Application for South Korea ESI Map

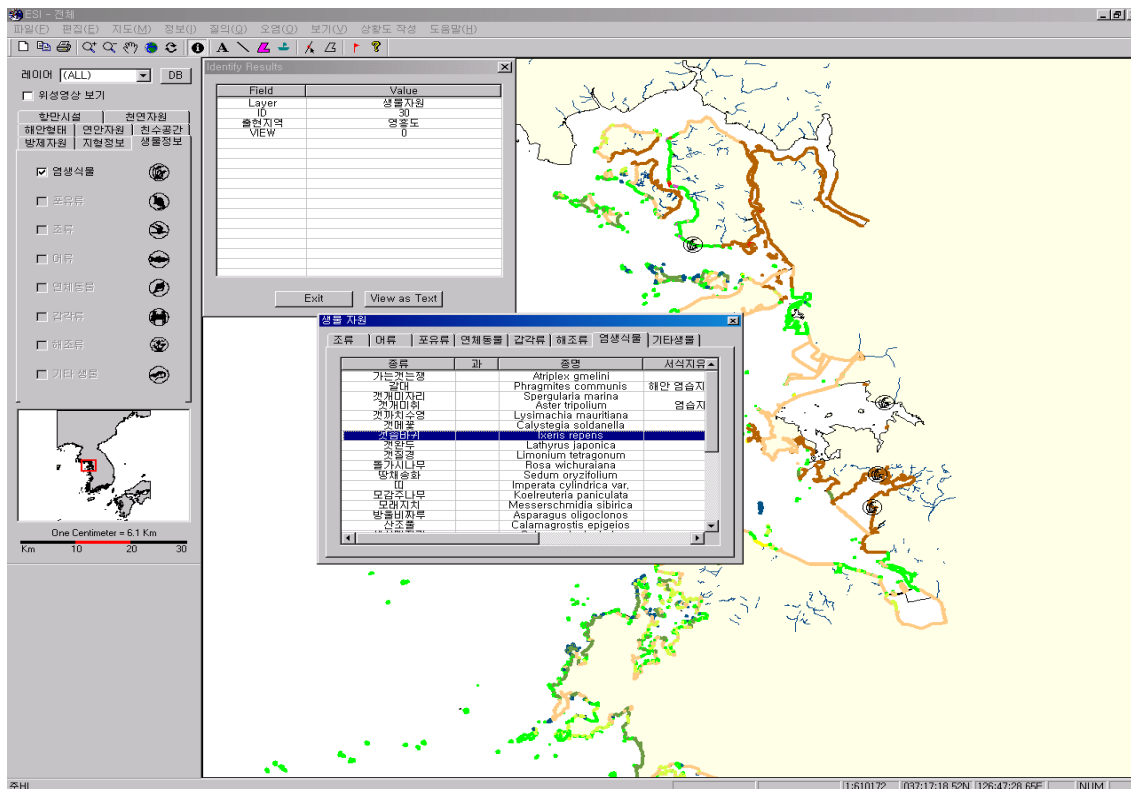


Fig. 6 Identification of ESI Information

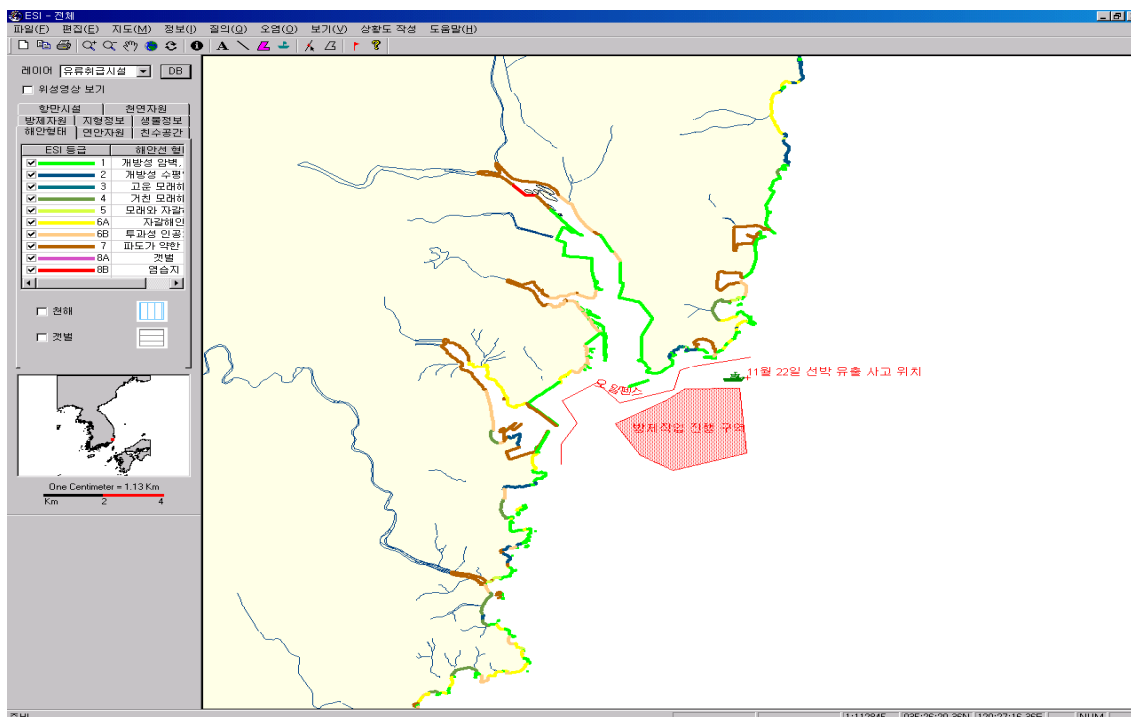


Fig. 7 Drawing some notes

### Conclusion

ESI map have been developed to map coastal areas to prepare and respond pollution accidents. These ESI datasets represent the biological habitats and shoreline index sensitive to spilled oil. And also ESI map includes information which supports establishing the response strategy. In order to use ESI map, ESI map application has been developed. Responders are able to recognize the feature of pollution area and the distribution of response resources and also make decision to response efficiently.

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