# 1 INTRODUCTION

Environmental Sensitivity Index (ESI) maps have been an integral component of oil-spill contingency planning and response since 1979, when the first ESI maps were prepared days in advance of the arrival of the oil slicks from the IXTOC 1 well blowout in the Gulf of Mexico. Since that time, ESI atlases have been prepared for most of the U.S. shoreline, including Alaska and the Great Lakes (Table 1). Nearly all of the maps of the lower 48 states have been compiled at a scale of 1:24,000, using U.S. Geological Survey (USGS) 7.5-minute quadrangles as the base map. For work in Alaska, 15-minute USGS topographic quadrangles at a scale of 1:63,360 and 2-degree sheets at a scale of 1:250,000 have been used as base maps.

Before 1989, traditional sensitivity maps were produced as color paper maps, with limited distribution (because of the cost of reproduction), and without a means for ready updating. However, since 1989, ESI atlases have been generated from digital databases using Geographic Information System (GIS) techniques. As the oil-spill response community moves towards development of automated sensitivity maps, it is important to define what comprises the ESI mapping system and how this information is being developed and distributed using GIS technology.

The primary objectives of this report are to outline the basic elements of a sensitivity mapping system, guide the collection and synthesis of data, and define the data structure for a digital ESI application using GIS technology. There are many aspects of a fully functional application that are still under development, such as pre-set queries and integration with other spill response systems (e.g., trajectories and equipment inventories), or are specific to the type of software being used (e.g., the user interface), that are not addressed at this time. However, we recommend standard output formats and symbology for maps to be shown on the screen or printed out in hard copy. Hard copy products are as important as developing the on-screen user interface. The printed map is still a major product for spill response applications.

## The Need for Standardization

The spill contingency planning requirements of the Oil Pollution Act of 1990 (OPA 90) and similar legislation passed by many states require information on the location of sensitive resources to be used as the basis for establishing protection priorities.

**Table 1.** Environmental Sensitivity Index (ESI) atlases published for the U.S. (Bold names indicate atlases produced in digital format.)

| Name | Year Published | No. of Maps |
|---|---|---|
| **Alabama** | 1981/**1996** | 20/**29** |
| Alaska (5 atlases) | 1982-1986 | 329 |
| **Alaska (Aleutians East Borough)** | **2001** | **13** |
| **Alaska (Aleutians West Coastal Resources Area)** | **2001** | **9** |
| **Alaska (Northwest Arctic)** | **2002** | **33** |
| **Alaska (Prince William Sound)** | 1983/**2000** | 42/**46** |
| **Alaska (Southeast 4 volumes)** | **1992-2001** | **199** |
| **California (Central)** | **1994** | **49** |
| **California (Northern)** | **1994** | **39** |
| **California (Southern)** | 1980/**1995** | 52/**51** |
| **California (San Francisco Bay)** | 1986/**1999** | 23/**27** |
| **Connecticut** | 1984/**2001** | 17/**25** |
| **Delaware/New Jersey/Pennsylvania** | 1985/**1996** | 59/**64** |
| **Florida** (7 atlases/**6 atlases**) | 1981-1984/**1995-1997** | 246/**296** |
| **Georgia** | 1985/**1997** | 29/**39** |
| Guam | 1993 | 15 |
| **Hawaii** | 1986/**2001** | 86/**96** |
| Lake Erie System | 1985 | 66 |
| **Lake Huron (Michigan)** | **1994** | **69** |
| Lake Michigan (Eastern Shore) | 1986 | 23 |
| **Northern Lake Michigan** | **1994** | **70** |
| **Southern Lake Michigan** | **1994** | **11** |
| **Western Lake Michigan** | **1993** | **54** |
| **Lake Ontario (New York)** | **1993** | **34** |
| **Lake Superior (3 volumes)** | **1993** | **133** |
| **Louisiana** | **1989** | **98** |
| Maine (Downeast) | 1985 | 42 |
| Maine (Mid-Coast) | 1985 | 35 |
| Maine (Southern/New Hampshire) | 1983 | 25 |
| Maryland (2 volumes) | 1983 | 119 |
| Massachusetts | 1980/**1999** | 51/**55** |
| **Mississippi** | **1996** | **29** |
| New York (Harbor/Hudson River) | 1985 | 37 |
| New York (Long Island) | 1985 | 41 |
| **New York/New Jersey Metropolitan Region** | **2001** | **23** |
| North Carolina (2 volumes/**3 volumes**) | 1983/**1996** | 113/**135** |
| Oregon/Washington (Outer Coast) | 1989 | 55 |

**Table 1.** Continued.

| Name | Year Published | No. of Maps |
|---|---|---|
| **Oregon/Washington, Columbia River** | **1989** | **26** |
| Puerto Rico (ESI/**ESI-RSI**) | 1984/**2000** | 35/**68** |
| Rhode Island/Massachusetts | 1983 | 18 |
| **Rhode Island** | **2001** | **16** |
| St. Lawrence River | 1985 | 17 |
| St. Marys River | 1986 | 15 |
| **South Carolina** | 1982/**1996** | 50/**63** |
| Texas (Galveston Bay) | 1979 | 19 |
| Texas (South) | 1980 | 15 |
| **Texas (Upper Coast)** | **1995** | **51** |
| U.S. Virgin Islands/**U.S.-British Virgin Islands** | 1986/**2001** | 8/**14** |
| Virginia (2 volumes) | 1983 | 104 |
| Washington (Strait of Juan de Fuca/ | 1984 | 36 |
| Northern Puget Sound Washington (Central/Southern Puget Sound) | 1985 | 44 |

Digital databases being developed to support oil-spill planning and response functions are a subset of those needed for a wide range of natural resource management applications. Standardizing the basic elements for a spill application speeds the development of systems and facilitates their use by national response teams and organizations, such as the U.S. Coast Guard, industry response staff, and spill cooperatives. Data sharing and updates are greatly facilitated by a uniform data structure.

## Report Outline

This report is divided into six chapters, with the following content and intended users:

Chapter 1-Introduction to Environmental Sensitivity Index mapping

Chapter 2—The basic components of sensitivity mapping, data layers and how they are defined, for the resource manager developing sensitivity data.

Chapter 3—Detailed guidelines for geologists responsible for the shoreline classification.

Chapter 4-Detailed guidelines for resource managers on how to collect and compile the biological and human-use resource information on hard copy maps and data tables.

Chapter 5—Guidelines on how the data are digitized, stored, and delivered as a GIS product, for all users but especially for the GIS manager.

Chapter 6—Description of the map product, for all users.