Latin America and the Caribbean

Building IABIN (Inter-American Biodiversity Network) Project

Trust Fund #TF-030388

Recommended Standards and Practices for sharing GIS-based Information

(Document 4: Supplementary case studies)

July 2004

NIPPON KOEI

UNEP WCMC

Building IABIN (Inter-American Biodiversity Network) Project

Review of the Use of Biodiversity Information

in the Decision-Making Process in Japan

Project Background

The World Bank has financed this work under a trust fund from the Government of Japan. The objective is to assist the World Bank in the completion of project preparation for the project 'Building Inter-American Biodiversity Information Network (IABIN)' and for assistance in supervision of the project. The work undertaken covers three areas: background studies on key aspects of biodiversity informatics; direct assistance to the World Bank in project preparation; and assistance to the World Bank in project supervision. The current document is one of the background studies.

The work has been carried out by Nippon Koei UK, in association with the UNEP World Conservation Monitoring Centre.

Table of Contents

Table of Tables

Table of Figures

Report Summary

Spatial information is one of the indispensable aspects of biodiversity information. This report is a collection of case studies on how spatial information, as well as GIS, is used in a biodiversity sector in Japan, together with some examples of international collaboration in the field of environmental management. Several examples of information systems were targeted for reviewing from the technical viewpoint (such as system structure, data format, and metadata), and to some extent, an institutional viewpoint. These case studies are:

(a) JIBIS (Japan Integrated Biodiversity Information System)

(b) DNLIS (Digital National Land Information System)

(c) Inter-ministerial Clearinghouse Gateway for Spatial Data

(d) Tokyo-BEIS (Bay-area Environmental Information System)

(e) Clearing-house for Water-related Information

(f) NOWPAP (Northwest Pacific Ocean Action Program)

(g) PEMSEA (Partnership for Environmental Management in the Sea of East Asia)

CHAPTER 1 CASE STUDIES IN JAPAN

1.1 JIBIS (Japan Integrated Biodiversity Information System)

1.1.1 Background

In 1993, Japan ratified the Convention of Biological Diversity (CBD). The Japanese government was obligated to establish a clearing-house for this convention. In 1994, the Japanese government established the Biodiversity Centre of Japan, immediately after the ratification of the CBD. They began to design the Information System in 1994, and operation commenced in 1998.

1.1.2 Overview

Since the late 70's, the Ministry of Environment in Japan has collected several types of biodiversity information in accordance with article 4 of the Nature Conservation Law of 1972. The surveys were carried out according to several types of ecosystem, such as terrestrial ecosystem (plant, animal distribution), aquatic ecosystem (river, estuary, lakes), and coastal and marine ecosystem (coral reef, sea grass bed, submarine forest, tidal flat, etc) Originally these data were collected by a separate survey in a paper map form, but are latterly in digital form, in accordance with the advancement of Information Technology, especially GIS.

Currently, JIBIS is composed of several databases, each focused on a key biodiversity area: (a) National Survey on the Natural Environment, (b) List of Threatened Species, (c) Profile database of National Park, (d) Laws and treaties for Nature Conservation, and (e) Biodiversity Related Agencies and information. GIS is currently used mainly for the National Surveys on the Natural Environment.

1.1.3 Data Source: Key Surveys on National Survey on Natural Environment

The National Survey on Natural Environment is comprised of the surveys detailed in Table 2.1. These surveys are designed to correspond to the three broad categories of ecosystem: (a) terrestrial ecosystem, (b) aquatic ecosystem, and (c) coastal and marine ecosystem. From the viewpoint of GIS, the surveys are categorized as having a spatial element and an a-spatial element.

Table 1.1 Survey List on National Survey on Natural Environment

Types of Survey	1st Survey	2nd survey	3rd Survey	4th Survey	5th Survey
1. The Land Surveys					
[Flora]					
1.1 Vegetation Naturalness Survey/ Vegetation Survey	Yes	Yes	Yes	Yes	Yes
1.2 Specific Plant Community Surve	No	Yes	Yes	No	Yes
1.3 Big Tree Survey	No	No	No	Yes	No
[Flora & Fauna]					
1.4 Animal Distribution Survey	No	Yes	No	No	No
1.5 Animal Distribution Survey (All-species survey)	No	No	Yes	Yes	Yes
1.6 Environmental Indicator Species Survey (Survey of Common Wildlife)	No	No	Yes	Yes	Yes
[Topography and Geology, Historic and Scenic Environment]					
1.7 Survey of Valuable Natural Areas (Plants, animals, Landscape, geology, Natural Phenomena, Historic Natural Environment)	Yes	No	No	No	No
1.8 Survey of Surface Ground Alterations	No	Yes	No	No	No
1.9 Natural Landscape Resource Survey	No	No	Yes	No	No
2. The Surface Water Survey					
2.1 Surface Water Naturaliness Survey	Yes	No	No	No	No
2.2 Lake and Marsh Survey	No	Yes	Yes	Yes	No
2.3 River Survey	No	Yes	Yes	Yes	Yes
2.4 Wetland Survey	No	No	No	No	Yes
3. Coastal Area Surveys					
3.1 Coastal Area Survey	Yes	No	No	No	No
3.2 Survey of Valuable Natural Areas (Marine Environment)	Yes	No	No	No	No
3.3 Coastline Survey	No	Yes	Yes	Yes	No
3.4 Survey of Tidal flats, seaweed Beds, and Coral Reefs Distribution/ Maarine Organisme Biological Environment Survey	No	Yes	No	Yes	Yes
3.5 Marine Environment Survey	No	Yes	No	No	No

3.6 Marine Organismes Survey/ Marine Organismes Biological Environment Survey	No	No	No	Yes	No
3.7 Life in the Coastal Area Survey	No	No	No	No	Yes
4. The Ecosystem Surveys					
4.1 Ecosystem Survey	No	No	No	No	Yes
4.2 Typical Ecosystem Survey	No	No	No	No	Yes
5. Others					
5.1 Past Bird and Animal Distribution Survey	No	No	Yes	No	No
5.2 Inventory of Flora	No	No	Yes	No	No

(Source): Translated from http://www.biodic.go.jp/kiso/fnd_list_h.html

English page available http://www.biodic.go.jp/english/kiso/top_list.html

(Note):

1st Survey (1973)

2nd Survey (1978-79)

3rd Survey (1983-87)

4th Survey (1988-1992)

5 th Survey (1993-1998)

(1) Vegetation Naturalness Survey

This survey was carried out throughout Japan, in four time slices: 1973, 1979, 1983-86, and 1989-92. The objective of this survey is to identify current vegetation cover, with a focus on evidence of human modification or disturbance. Through an aerial photo interpretation and on-site survey, each prefectural (regional) government (i.e. 2nd tier local government) prepares a vegetation map at a scale of 1:50,000. The prepared map is re-compiled to another map of 1:200,000 on a prefectural basis. Onto this map, a National Grid System (i.e. Standard Area Grid) which is standardised to JIS-C6304-1979, was overlaid. The degree of wilderness is evaluated for each cell, according to the criteria defined from the viewpoint of human disturbance. The details of the classification scheme for this standard is shown in Table 1.2

Since the 4th survey in 1992, satellite imagery has been adopted as the original source data, to detect the change in land cover as well as to prepare the land cover change map.

Table 1.2 Classification Scheme for Widerness

Code	Description
10	Natural vegetation of grassland and moorland
9	Natural vegetation of forest
8	Substitutional vegetation close to natural vegetation of forest
7	Substitutional vegetation of secondary forest
6	Planted forest
5	substitutional vegetation of high profile grassland
4	substitutional vegetation of low profile grassland
3	Fruit orchard, mulberry plantations, tea gardens, and other horticulture
2	Paddies, fields, and other arble land, residential area with abundant trees
1	Urban land, developed racts, and other zoneswhere plant live is virtually non-existent

(source): http://www.biodic.go.jp/english/kiso/vg/vg_kiso_e.html

(2) Plant Community Survey

This survey has been carried out throughout the whole country: in 1978 and 1984-86. The objective of this survey is to define the current situation on plant communities: to be an input for policy formulation on the protection and restoration of plant communities.

Prefecture government established an evaluation committee to formulate criteria for selecting target plant communities, taking into account the features of the ecosystem in their prefecture. For target communities, tracking and status surveys were carried out. These surveys contain a record of the location of plant communities, re-complied with a National Grid System.

(3) Big Tree Survey

It is an ancient Japanese belief that large trees are home to spiritual beings. These trees are therefore regarded as a target of conservation. This survey aims to grasp the current status of these trees. Target trees are those with a girth of more than 300 centimetres at breast height (120 centimetres). Location data of these trees are collected, together with physical parameters such as tree age, height, and girth, as well as its ecological health. It is notable that the surveyor also collects an anecdote on these trees, such as the religious beliefs of local people, their traditions and legends.

(4) Animal Distribution Survey

This survey focuses on the distribution of animals in Japan. The survey was carried out in 1978, 1984, 1990-92, and 1993. Target groups for this survey are: (a) 8 mammal species whose habitation overlaps areas of human habitation, (b) 257 bird species that breed in Japan, (c) 34 amphibians and reptile species with limited distribution, or species which are threatened by extinction due to human disturbance, or species that are scientifically important, (d) 34 freshwater fish, and (e) 10 insect species selected by the Ministry of Environment (MOE), as well as the 50-100 species selected by the prefectural council that meets their selection standard.

A document review combined with a site-survey was adopted for the survey method. It should be noted that during the mammalian survey, forest workers and wildlife specialists interviewed hunters who have had the chance to encounter the target species. In the case of the insect survey, members of the Entomological Society of Japan undertook the data collection activities. The results of each survey were summarized in a grid map with a spacing of 5 kilometres.

(5) Environmental Indicator Species Survey

The Environmental Indicator Species survey focuses on a more narrow geographical area in terms of spatial resolution. This survey aims to record the current status of the natural environment located adjacent to areas of human habitation. The survey was carried out in 1984, 1990, and 1995-97.

Since the beginning of the first survey in 1984, the survey has focused on the aspect of the environmental awareness of the citizens, since this survey was carried out in the 'backyard' of the people. As a result of this connection, volunteers were requested to participate in the data gathering activities for this survey. In order to ensure the reliability of the data, participants were requested to collect the data on the distribution of species, with verified evidence, such as collected specimens or photographs, in addition to the name of the place gathered, Experts in each prefecture carry out species identification based on these evidence.

(6) Lake and Marsh Survey

The objective of this survey is to assess the change of lakeshore line. Through a high economic growth period in 1960's, lake and marshes were reclaimed for agricultural production or other reasons. The Lake and Marsh survey was initially carried out in 1975. 487 lakes and marshes were targeted in the first survey in

1997, but it decreased to 483 in the second survey in 1985, and 480 in the third survey in 1991. This decrease was triggered by the human disturbance, since the survey was carried out only in the lake and marshes with respect to an original shape.

Surveyed parameters are categorised into five types; (a) physical dimensions of the lake and marsh (superficial area, depth), (b) degree of alternation of the lake shoreline, (c) transparency and water quality (transparency, water temperature, pH, and Dissolved Oxygen), (d) fish species, (e) plankton survey both phytoplankton and zooplankton. The fish species survey targeted 61 species, and the amount of each catch was recorded.

The results from the above survey provide a valuable source of information when evaluating a species invasion of species like the black bass. Black bass were introduced to Japan in the 1990s, as a fish species for sports fishing. These fish were released into the lakes, and it is reported that this fish triggers a disturbance of the original aquatic ecosystem of the lake and marsh, especially on the endemic fish species in Japan.

The collected data is expected to be attribute data of spatial boundary for lakes and marshes to be provided by the Digital National Land Information (DNLI).

(7) River Survey

This survey aims to assess the river habitats. Three surveys were carried out in 1979, 1985, and 1992. River reach was targeted from 109 first-class rivers in the survey in 1979 and in 1985. During the survey of 1992, an additional 153 second-class rivers were added to the target list. The survey parameters were (a) stream flow rate, (b) fish survey of species name and amount of catch, and (c) land use or riparian forest with an aerial photo. This survey provides attribute data for the reach segment, data of which was provided by the Digital National Land Information, which will be described in the subsequent section 1.3. Spatial data is not provided by the JIBIS for this survey.

(8) Coastal Line Survey

During a high economic period in 1960s, the coastline in Japan was significantly affected by human alteration. This survey was initiated in 1973, in order to monitor the current situation of the coastline. Originally this survey was carried out in 1975, under the direction of the former Ministry of Construction, the

ministry responsible for the management of all coastlines except those in port areas.

The Coastline was categorised into six types: (a) natural, (b) semi-natural, (c) artificial, (d) agriculture, (e) urban-industrial and (f) estuary. These data were utilised as attribute data for spatial data at coastal line.

The coastline database was established as an output for this survey. In connection with the spatial aspect of data, this data is expected to be an attribute for the spatial data on coastlines to be provided by the DNLI. Currently, JIBIS does not provide the spatial data set corresponding to this survey.

(9) Survey on Tidal Flats, Seaweed Beds, and Coral Reefs Distribution

Tidal flats, seaweed beds and coral reefs are important habitats in coastal and marine ecosystems. Tidal flats are home to fish and shellfish, as well as migratory birds like Sandpipers and Plovers. The Seaweed bed is important not only from the viewpoint of habitat conservation, but also from the fishery resources.

Tidal flats are threatened by human disturbance. This survey was firstly conducted in 1978, and subsequently in 1989-92, to monitor the disappearance of the tidal flats. During a survey in 1979, location, area extent and the current status was recorded for tidal flats with an area extent of more than 1 hectare in 1945. A topographical map together with an aerial photo were utilised to measure the area extent and to confirm the current situation.

The first survey on coral reef communities was carried out in 1978 with a focus on the distribution of coral reefs, collecting indicators such as area extent, location, and the current status of the coral reef community. Aerial photos were fully utilized for this survey. The second survey, carried out during 1989-92, aims to grasp the area extent of disappearance of coral reef, especially on the community distribution of hermatypic coral reef.

(10) Life in the Coastal Area Survey

This survey was carried out in 1990, targeting an area of diving spots throughout the country. The scuba divers and snorkellers are requested to participate in the survey as volunteers. The Ministry of Environment selected 43 species to be identified through this survey, and they prepared a handbook for the surveyors.

The surveyors recorded a location and the species code, which had been pre-defined within the handbook. The results of each survey were summarized in a grid map with a spacing of 1 kilometres.

(11) Past Bird and Animal Distributional Data

This activity was attempted in 1985-86. There are several extinct species in Japan, such as the Japanese wolf, or the Japanese Ibis. To restore a past distribution map on these species and draw a factor or drivers that leads to the extinction or shrinkage of these species, it would be valuable information when considering a conservation policy and management of other wildlife.

This data was prepared with an aim to re-construct a past environment in terms of bird and animal distribution, by examining a relationship between change of the habitat condition and species distribution.

As an output of this study, distribution maps were prepared on 17 animal species and 13 bird species at the time of 1730's. The historical document collection that described the flora and fauna of that time also included. the historical document called 'Kyoho-Genbun Registry of Productions of Provinces.' It is a good source of information in this regard. This document was compiled during a period of 1735 and 1738 by Mr. Shokaku Niwa, a medical officer at Shogunate government (Bakufu). He ordered every province to investigate and report on the production of agriculture. This document is a reliable source of information, since he prepared a form of data collection and manual for recording information, together with a follow-up checks when unclear points are observed.

1.1.4 Technical Aspect of the System

(1) System Structure

In order to visualise a spatial component of the surveyed data, a Web-GIS technology was used for this database, especially for displaying the spatial data for the National Survey on Natural Environment, such as the distribution of species or land cover. Figure 1.1 illustrates a screenshot of Web-GIS in JIBIS.

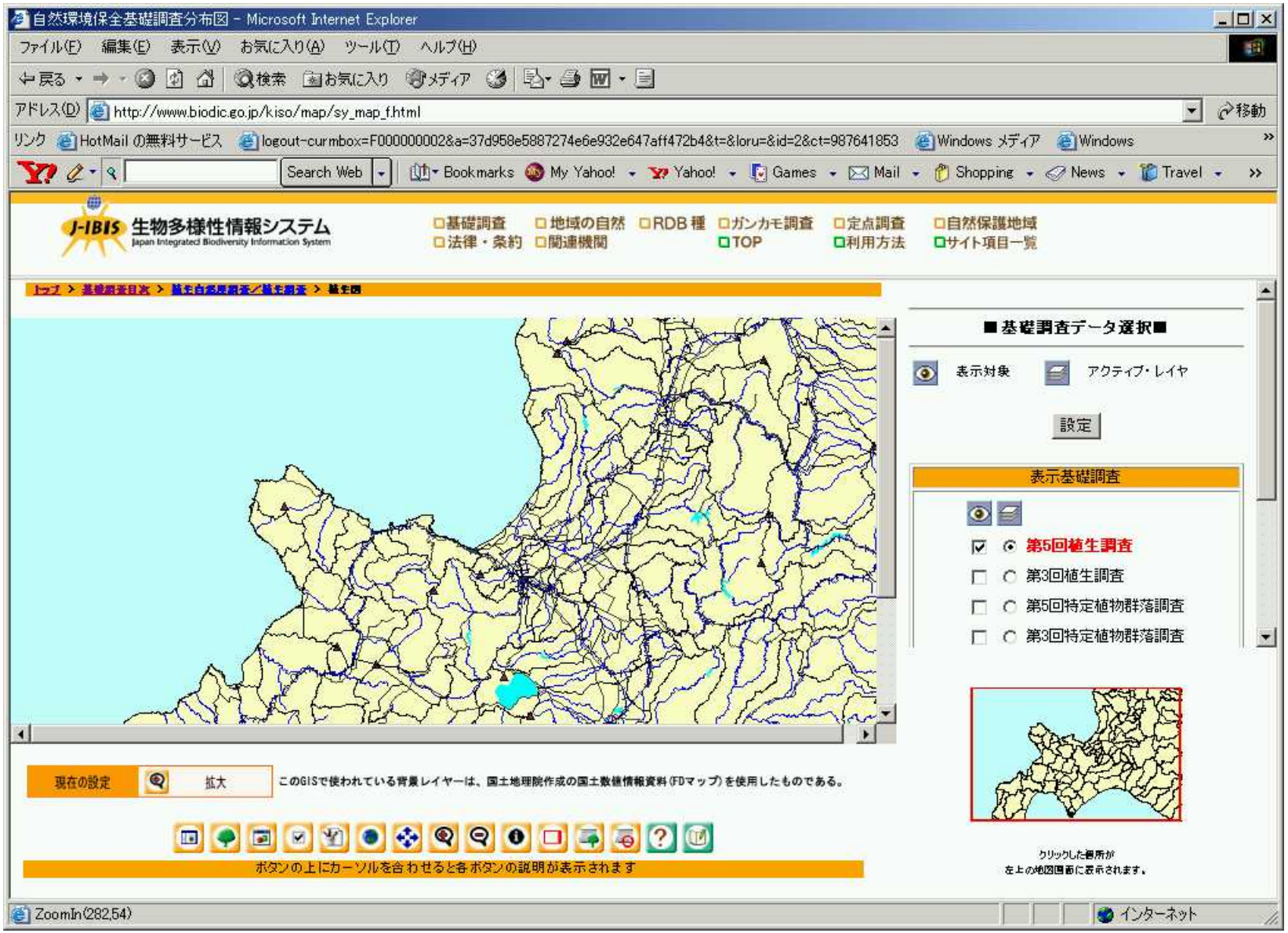

Figure 1.1 Screenshot of Web-GIS of JIBIS

(2) Spatial Data Structure

Data are compiled on a national standard grid with a spacing of approximately 1 km size (i.e. 'Standard Area Grid'). This data format was based on the ASCII text format, reflecting its age when the mainframe computer with little graphical capability as well as computational capability. Text file format ensures a limited level of interoperability between the computer system and operating system. However, these data are difficult to handle for the users who are not familiar with the data format. Spatial data structure should be clearly identified. Metadata would be useful in this regard.

1.1.5 Institutional Aspect

(1) Organization

The Biodiversity Centre of Japan, a focal point of clearing-house in CBD, operates this system.

(2) Data Distribution Policy

A species distribution map was prepared within a Web-GIS sever. The user can focus in on the area that they are interested in, even if they do not have GIS software. However, the original GIS data are not provided by this server. Access for these data is limited to the expert, academics or researcher, and the issue of ID usernames has now ceased. In addition, the Biological Diversity Centre of Japan requests that the data source should be clearly mentioned when users use the data.

1.1.6 Achievement

(1) Species Distribution Data in the 18th century.

A wide variety of species distribution data has been provided by this system. The original concept of the ecosystem approach emerged in the area of conservation biology, as an anti-thesis for species-specific conservation biology. Focusing on the wide variety of species is one of the achievements of the study. It contributes to the supply of basic data for the ecosystem approach.

In addition, several temporal facets of data are prepared. Continuous monitoring is an advantage of the JIBIS, especially the natural environment survey in Japan. Moreover, they are trying to establish a dataset on species distribution in the 18th

century. This data is expected to contribute in evaluating the distribution of invasive species, or drawing lessons learned in terms of the factors and drivers that trigger extinction.

(2) Focus on the Cultural Aspect

The Big Tree Survey collects information on cultural in addition to biological aspects. The local name of trees is sometimes different from place to place in Japan, and anecdotes about the trees sometimes represent their belief or the traditional use of that species. These data are informative sources for studying traditional knowledge concerning the trees.

(3) Local Government-led Data Gathering Initiative

Each prefectural (regional) government is encouraged to get involved in the data gathering activities. This is a good example of decentralization with special attention to regional characteristics. In addition, some surveys such as the environmental indicator species survey or the marine environment survey use predominantly volunteers to gather data. This could be a good practice for data gathering activities.

(4) Volunteer Monitoring

Volunteers and NGOs such as academic societies participate in the data gathering activities in some surveys. For example, the marine habitat survey is carried out at diving spots by local diving societies. A particular benefit of this is the raising of awareness amongst the volunteers.

(5) Inter-Ministerial Coordination for Spatial Data

Some data was provided by the DNLI (Digital National Land Information) project led by Ministry of Land, Infrastructure, and Transport (MLIT), to avoid a duplication of the data. The inter-minisiterial coordination between MLIT and Ministry of Environment (MOE) are found in the data such as coastal and river survey.

(6) Spatial Data Structure

JIBIS provide most of the data in a data structure of a spatial grid system. This system was approved in 1979 as JIS-C6304-1979 in the Japanese International Standard (JIS). A Grid system is suitable for the pattern analysis in landscape ecology. The Grid system was developed in the days when large main-frame computers with little capability for graphical display were commonly used. This system is good in terms of being easily displayed by this equipment.

However, the grid system data is difficult to apply with the recent advancements in techniques of landscape ecology, especially when the user is calculating the degree of fragmentation in the vegetation ecology. In addition, it is still uncertain whether this system contains a metadata database which complies with the International Standard such as ISO19115, a spatial data standard established by ISO-TC2.11. Moreover, users outside Japan find it difficult to use these data, since they are not familiar with the referencing system of the Standard Area Grid System

There still remains an issue whether to select a vector-type or raster-type of spatial data format.

(7) Data Format

Most data were provided in the file format of ASCII text. This ensures interoperability. This is due to the historical context. However, the data was difficult to handle for a non-expert.

1.1.7 Challenges

(1) Revision of Data Format

Currently, spatial data for biological surveys are provided in compliance with the National Standard Grid System. This system has an advantage in the sense that we can estimate the location from the grid-ID. However, it sometimes is not compatible with vector-type data of DNLI, organised by the data structure such as polygon, polyline, and point. Grid data is important in terms of ensuring a compatibility with the past data. However it is slightly difficult to handle these data for users who are not familiar with the Grid Square System in Japan. In order to ensure the international standard, it is recommended that the data would preferably comply with these data standards. In addition, from the viewpoint of landscape ecology, vector data is sometimes useful for calculating some indicators that represents ecosystem characteristics of fragmentation.

(2) Metadata.

There is no metadata relating to the spatial data. Since the original data is not accessible by the public, there is no problem in terms of metadata. However, incorporating metadata would be a future challenge.

(3) Issues on Open Data Policy

Open data policy will bring benefits to the citizens. This approach ensures a greater transparency. However, for experts on planning strategy for conservation of biodiversity, more precise location would be necessary when they estimate the habitat distribution. One must be cautious, however, as in the case of endangered species, information disclosure on their exact location could trigger additional pressures from those seeking to profit from the capture and sale of rare species. Exact location should be kept secret, for the point of view protecting the species. Aggregation with National Grid System would be evaluated positively in this regard.

1.2 DNLIS (Digital National Land Information System)

1.2.1 Background

The Digital National Land Information System is a database of Digital National Land Information (DNLI). It provides spatial data for biodiversity information such as coral reefs, sea grass beds, tidal mud flats and so on, or spatial features like rivers, coast lines, lakes and so on.

In 1974, the former National Land Agency (NLA) launched a project called 'National Land Information Development Project' at its establishment. Based on this project, spatial data has been prepared and updated in order to meet the mandate to provide necessary data for comprehensive national development planning and regional development planning.

1.2.2 Overview

Digital National Land Information was designed to meet the needs of formulating a comprehensive national development plan, and comprises of several themes such as topography, land use, location of public utilities, road, and railway and so on. All the data files can be categorised as follows: (a) Point data, (b) Polyline data, (c) Polygon data, (d) grid data, and (e) table data. Point data, polygon data, and polyline data fall into a category of vector-type data with a topology structure, while grid data is a raster-type data, with data structure information on the coordinates of north-west and a spacing of each cell grid. Table 1.3 summarises types of layers, its data type and original source of the data.

Table 1.3 Types of Layers and Its Data Types of DNLI

Theme	File Name	Year	Data Type	Attributes	Data Source
Designated Area					
Urban Planning Area	KS471-2	1895 1990	Coordinates (Polygon)	None	Urban Planning Map
Natural Park	KS472-1	1985	Coordinates (Polygon)	None	National Park Planning Map
Protected area	KS473-1	1985	Coordinates (Polygon)	None	
Agricultural area	KS474-2	1985	Coordinates (Polygon)	None	Land Use Planning Map
Forestry Area	KS475-2	1985	Coordinates (Polygon)	None	
Wildlife sanctuary	KS461-1	1983	Coordinates (Polygon)	None	List of Wildlife Sanctuary
Designated Area Grid	A02-60M	1985	3rd-order National Grid (Grid)	Urban Planning area, agricultural area, forestry area, natural park, wildlife sanctuary	
Urban Planning Area within 3 metrolopolis	KS490	1990	Coordinates (Polygon)	Built-up area, established area, developed area	
Forestry Area, Governemtal Land	A05-06M	1985	3rd-order National Grid (Grid)	9 types of national land Public Forest, Public Pasture	National Asset Inventory, Ministry of Finance
Resort Area	A07-07A	1995	Coordinates (Polygon)	Project Name, Area Name, Area Extent, Designated Date	List of Resort Area, prepared by Prefecture
Coastal Area					
Coastal Line	C09-59P C10-59L C11-59L C13-60L C14-59L C15-60T C17-59L C18-59L C19-59L C20-59L C22-59L	1984	Coordinates (Polygon, Point, Table)	Fishery Port, Port, Fishing bank, bridge, underlying facility, mining area, waterway, fishery rights	List of fishery port List of fishing spot Documents on ports, by prefecture marine chart
Coastal Area Grid	C04-02M	1990	3rd-order National Grid (Grid)	Depth, Sediment, eddy currents, seagrass bed, fishiing spot tidal flow	Marine chart Document by fishery experimental station
Natural Fishery Spot Wave height, Fog	C05-02M	1990	2rd-order National Grid (Grid)		Documents by Japan Coast Guard
Terrestrial Area along Coast	C23-59L C24-59T C25-59T C26-59L C27-59T C29-59P C30-59L C31-59L C32-59L C33-60L C34-60L C35-60L	1984	Coordinates (Line, Point, Table)	Landfilling/reclamation area Coastal Line Beach Inventory Airport Sand extracting area National Park Area Land Conservation Information Geomorphological Classification in low-lying area	Documents by Prefecture Documents by MLIT Documents by Forest Bureau

				Ground sinkage	
Facility at coastal line Tidal Limit	C07-02P	1990	Coordinates (Point)	Facilities at coastal line, Tidal Observatory, Tidal Limit	Documents by Prefecture Documents by GSJ
High Tide or Tsunami affected area	C08-49T	1974	Table	Disaster record by High Tide Disasater record by Tsunami	Record about 50-100 years
Natural Features					
Geomorphology	G04-56M G05-56M G06-56M G07-56M	1981	Grid	Elevation Slope Mountain Valley Density Land Classification	Topo may 1:25000 by GSJ
Climate	C02-62M	1981	3rd-order National Grid (Grid)	Precipitation Temperature Snowfall	Documents by Meteological Agency and River Bureau of MLIT
Land Price	L04-07P L04-08P L04-09P L04-10P L04-11P L04-12P L04-13P L04-14P	1990-2003	Coordinates (Point)	Area Name Location Land Price Land Use Zoning Category	Land Proce Report, by MLIT
Land Price Survey by Prefecture	L05-07P L05-08P L05-09P L05-10P L05-11P L05-12P L05-13P L05-14P	1990-2003	Coordinates (Point)	Area Name Location Land Price Land Use Zoning Category	Land Price Report , by each prefecture
Land Use	L03-51M L03-62M L03-03M L03-09M	1976 1982 1991 1997	4th-order National Grid (Grid)	Land Use Category l Paddy Field Field Fruits field Forest Buildings Waer .etc	In 1976 and 1982 Topo-map with 1: 25000 In 1991 LANDSAT In 1997 Topo-map with 1:25000
National Schelton					
Road	N01-077L	1990	Coordinates (Line)	Location Management Body Road Type Highway National Road Regonal Road	Topo Map Local Government Profile
Railway	N02-07L	1990	Coordinates (Line)	Location Management Body Station	
Road Desity Road Length per grid	N04-53M		3rd-order National Grid (Grid)	Number of Road that across per grid	Topo Map Road information
Public Utility					
Historical Monument	P01-50P	1975	Coordinates (Point)	Location code	Distribution Map of Archeological Site, by Culture Agency, Ministry of Scinence and Technology
Public Facility	P02-02P	1990	Coordinates (Point)	Name of the Facility Types of the Facility Address Location Responsible Entity	Documets by: Prefecture MLIT MHW

Power Plant	P03-07P	1995	Coordinates (Point)	Loation of the Facility Types of the Facility Capacity Name of the Facility Date of starting operation	Inventory of Power Plant
Industrial Statistics					
Commercial Survey	S01-54M S01-57M S01060M	1979 1983 1985 1986	3rd-order National Grid (Grid)	Number of Shops by industrial category Number of Employees Sales amount Area Extent of shops	Commnercial Survey
Commercial Survey	S02-54M S02-57M S02-60M	1979 1983 1980 1981	3rd-order National Grid (Grid)	Number of Shops by industrial category Number of Employees Sales amount Area Extent of shops	Commercial Survey Establishment Survey
Factory Survey	S03-54M S03-55M S03-57M	1977 1980 1982	3rd-order National Grid (Grid)	Nunber of factories Number of employees Amounts of sales	Factory Survey
Agricultural Survey	S04-50M S04-55M	1985 1990	3rd-order National Grid (Grid)	Population Cultivated area Equipment used Number of cattles	Agricultural Census
Hydrology					
Dam	W01-07P	1990	Coordinates (Point)	Location Dam Code Capacity Date of Operation	Dam Inventory
River and River Network	W03-52T W03-07T	1990	Table	Stream Segment Inventory with segment length & population	Map prepared by River Burau of MLIT
Lake and Marsh	DNL-FL-E W10-50T KS-20	1975	Coordinates (Polygon)	Location, Area extent	Topo map
Lake Grid	W04-57M	1982	3rd-order National Grid (Grid) w/10 divide	Name Elevation at surface Maximum Depth	Topo map
Stream Reach	W05-52P	1977	Coordinates (Point)	Length from the river mouth Elevation at riverbed	Map prepared by River Burau of MLIT
Stream Grid	W06-52M	1977	3rd-order National Grid (Grid)	Stream length by steam type	Map prepared by River Burau of MLIT
river basin boundary	KS-274	1977	Coordinates (Polygon)	Location, code	Map prepared by River Burau of MLIT
River basin grid	W07-52M	1977	3rd-order National Grid (Grid) w/10 divide	Stream	Map prepared by River Burau of MLIT

Source: translated from http://mlftp.mlit.go.jp/ksj/table.html

1.2.3 Data Source

Most of the data were derived from the governmental record or reports. The first step for the 'National Land Information Development Project' is to digitalize these data.

1.2.4 Technical Aspect

(1) System Structure

There are two types of data providing system: (a) Web version and (b) Web-GIS version. A Web-version of the data providing system is now under operation, while the Web-GIS version is still at trial stage.

In the web-version of the data providing system, the user can first identify the spatial data file that they need, and, retrieve a data file of spatial information, together with the appropriate metadata and a file that describe a file format. With the Web-GIS version of data providing system, on the other hand, the user can retrieve necessary data through Web-GIS.

It is noteworthy that from the trial version of Web-GIS, a user can download their choice of DNLI data, by clicking on a location of their choice. In addition, there is a functionality that the user can send to the Web-GIS server a location and attribute information relating to the location. The user can also display the attributes of a location. Although this is still a preliminary version of the Web-GIS functionality, this gives a demonstration of a technical basis for participatory data collecting scheme.

Figure 1.2 Screenshot of Web of DNLIS

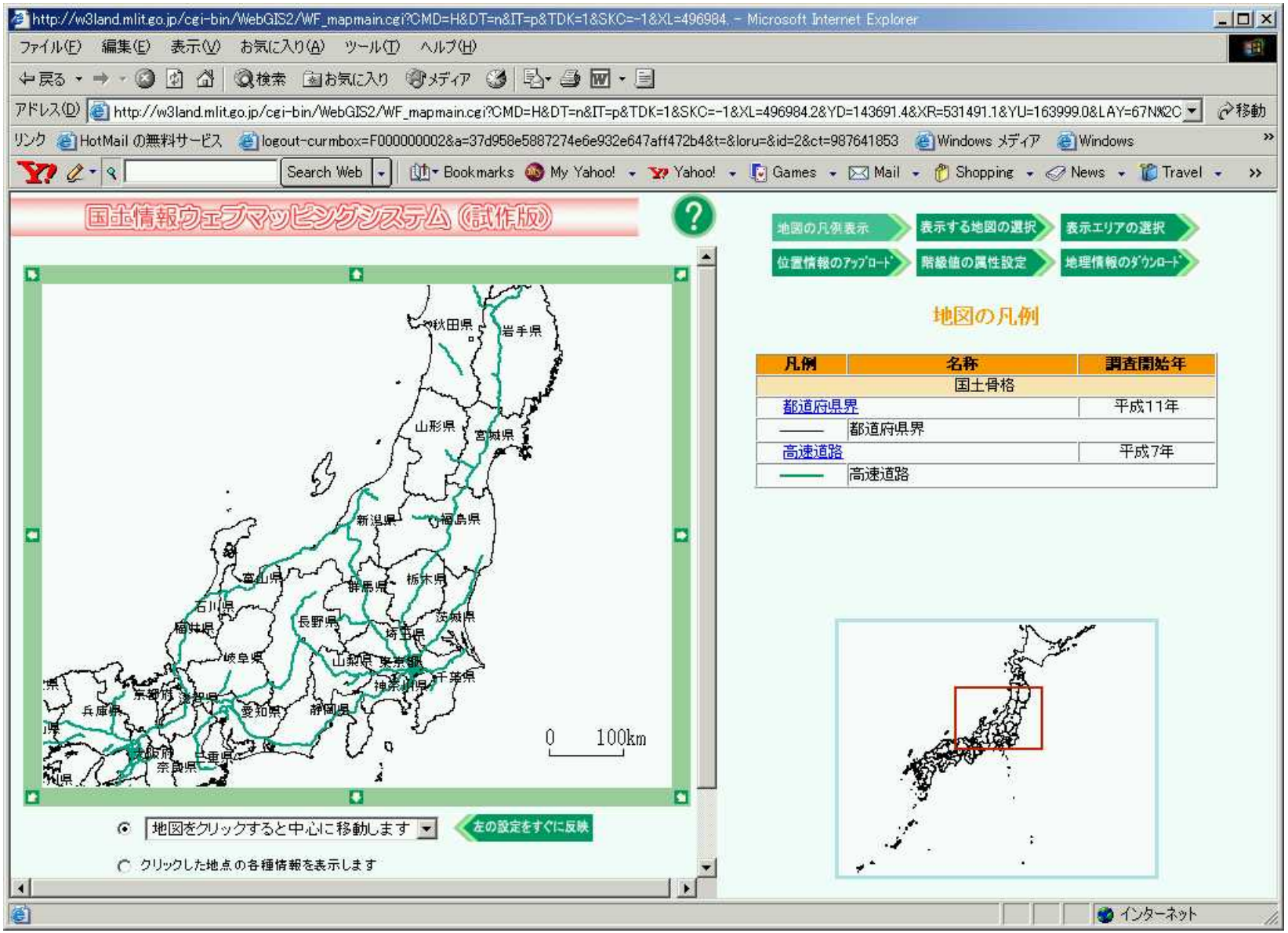

Figure 1.3 Screenshot of Web version of DNLIS

(2) Data Format

For each file, data formats are previously defined, and recorded at its header information as the first line of the data file. ASCII code is used for alpha-numeric character set, and SHIFT-JIS is used for Japanese character set. ANNEX 4, ANNEX 5, ANNEX 6, and ANNEX 7 show data formats for point, line, polygon and grid data types of the data structure.

(3) Metadata

In the development phase of DNLI, there is limited implementation of the concept of metadata. The specifications of data format were attached with a data file, and NLA provided manuals for DNLI users. However, reflecting an international context of standardisation, especially for ISO/TC2.11, NSDIPA, a consortium between GSI and private firms established technical specifications on metadata, 'JMP' (Japan Metadata Profile). Currently, the metadata is defined in accordance with the Japan Metadata Profile (JMP 2.0) as a metadata format. Detailed description on JMP can be found at section 1.3.

1.2.5 Institutional Aspect

(1) Organization

The Ministry of Land, Infrastructure and Transport are responsible for providing a DNLI. However, GSI is responsible for operating the clearing-house for the DNLI-related spatial data.

(2) Data Distribution Policy

Previously, data access for DNLI was limited to the governmental agency, public agencies, or universities that are engaged in planning activities. However these data have been distributed to the public free of charge through the Web site since 2001.

1.2.6 Achievement

(1) Inter-operability

One of the most important features for DNLI is its inter-operability among different computer systems or different operating systems, since the system provides spatial data with a text file of ASCII/SHIFT-JIS code.

(2) Metadata

This system provides spatial data with metadata in compliance with ISO11950, as well as data format for each file.

1.2.7 Challenges

(1) Complexity

In DNLI, there is a mixture of spatial data structure, in terms of raster-type data and vector-type data. This is inevitable in order to keep it compatible with previously-established data. In addition, the data filename is difficult to understand for users, although it is recorded in accordance with some rules. Web-based data providing systems make it easy to specify the desired data files for users. A Web-GIS interface would enhance more flexibility for user-friendliness. .

(2) Web-GIS for Participatory Monitoring

In the web-GIS version of the data providing system, there is a functionality that the user can place their locational information onto a Web-GIS server, and can display it on their screen through Web-GIS. This functionality might be useful for participatory monitoring for species, since users can locate their observation point, even if they do not have a GPS receiver. The development of this functionality and its application to participatory monitoring activity would be of benefit to the user community.

1.3 Inter-Ministerial Clearing House Gateway for Spatial Data

1.3.1 Background

In 1999, the Japanese government launched an inter-ministerial meeting on the GIS, and they have prepared a long-term plan concerning 'the spatial data infrastructure and the extension of GIS'. In accordance with this plan, ministries and agencies that possess spatial data are requested to prepare their metadata on the spatial data that they have, to establish a node-server, and to report the status on the development of metadata to the Geographical Survey Institute (GSI), a responsible entity for the clearing house gateway. GSI is requested to establish a clearing house gateway server that searches and retrieves metadata, together with technical support to the concerned ministries and agencies that possess spatial data.

1.3.2 Overview

This system is a retrieving system for metadata databases that store information on spatial metadata scattered on the Internet. The system is in compliance with ISO 23950, the international standard for metadata retrieving systems under the distributional database environment on the Internet. The user can retrieve a multiple clearinghouse node, by specifying several items, such as geographical extent (longitude, latitude), temporal frame, or keyword.

1.3.3 Technical Aspect

(1) System Structure

This clearinghouse gateway server is powered by a program of Isite version 2.07h-J, under Apache in a UNIX OS environment. The Isite v2.07h-J is a revised version of original Isite, since the original Isite cannot retrieve metadata which contains a two-bite character code. This modification to the Shift-JIS or EUC is very important in the context of Asian countries, since most of the language codes used there are based on the two-byte code.

In addition, software called (a) zserver, (b) Lindex, and (b) zgate and zcon are also installed in the clearinghouse gateway server. 'Zserver' is a software package for the clearing-house server that enables us to retrieve metadata in a SGML/XML format, while 'lindex' is software which conduct a pre-process indexing of the metadata file in SGML/XML format, that contains Shift-JIS or EUC-J code. The pre-process is also a requirement specific to 2-byte code environment such as

Japanese or Chinese. ‘Zgate’ and ‘zcon’ is the CGI software which can establish a HTTP-ISO23950 gateway under the HTTP server, which enables the retrieval of metadata through a web browser, so the user does not need to install any client software ‘. These software packages can be downloaded from the clearinghouse gateway server operated by GSI. Figure 2.5 illustrates a screenshot of this system.

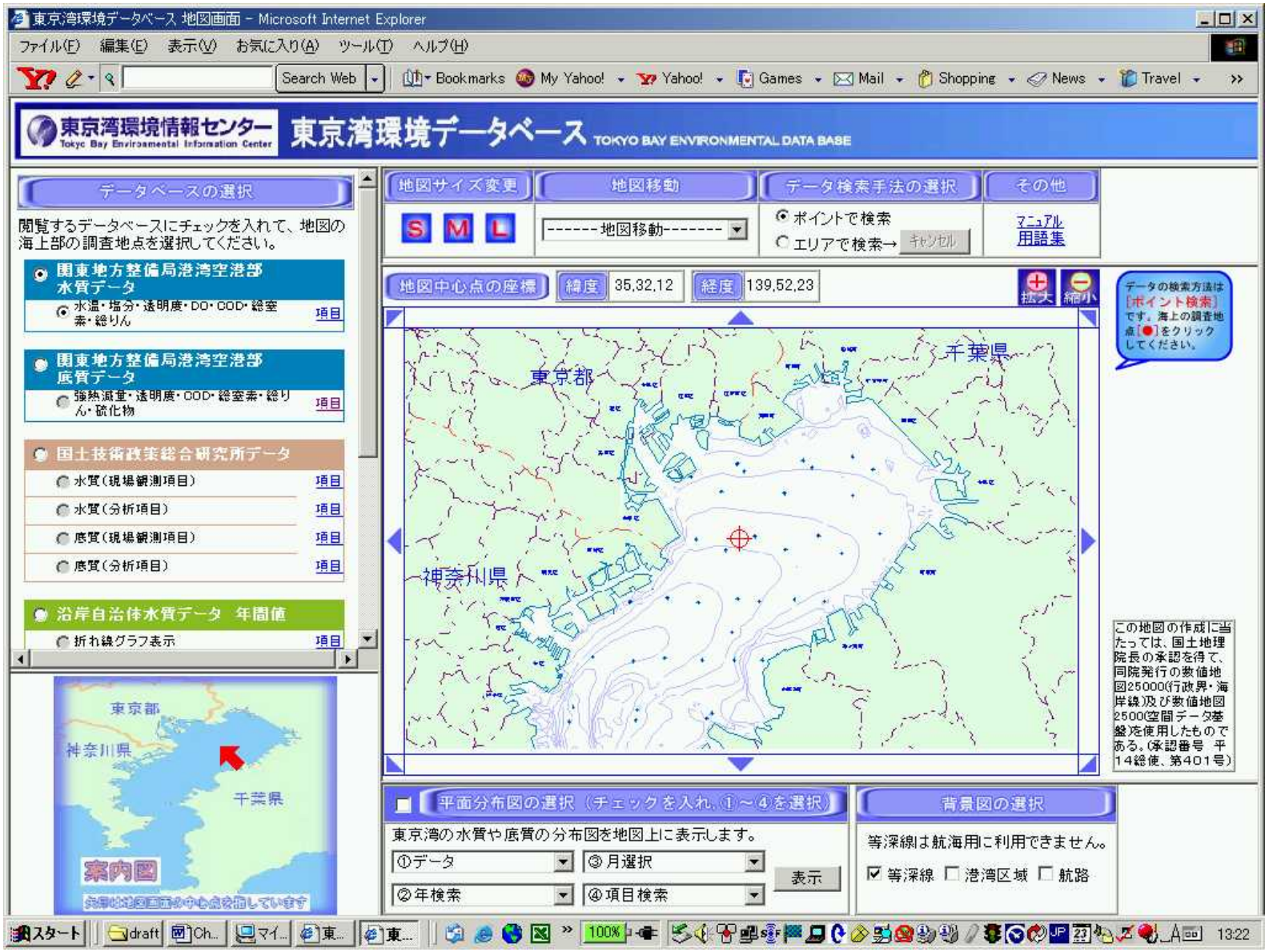

Fig 1.4 Screenshot of Clearing-house gateway of Spatial Data

(2) Data Format (Metadata)

This system uses Japan Metadata Profile (JMP 2.0) as a metadata format.

Japanese experience on the metadata standard for spatial data dates back to 1998, when ISO/TC211 issued a draft standard. A Japanese consortium, comprising of GSI and a private company, formulated a domestic standard called 'Japan Metadata Profile version 1.1a (JMP 1.1a)' in accordance with the draft issued by ISO/TC211. The issuance of the JMP1.1a aimed to extend the use of metadata in Japan.

However, there is a need to modify JMP1.1a, since the draft standard issued by ISO/TC211 has been adopted officially as ISO19115. GSI and 17 private firms formulated the Japan Metadata Profile version 2.0 (JMP 2.0) in May 2003.

The JMP 2.0 comprises (a) 50 core metadata and (b) 70 comprehensive metadata. ISO19115 defines 50 items as core metadata, and 400 items as comprehensive metadata. The use of core metadata is strictly limited, so that it is difficult to insert additional information to this part. Therefore, the consortium decided to add these data to the comprehensive metadata part. The JMP 2.0 was designed to be user friendly so that a layperson could quite easily use the system. These data standard are expected to act as a retrieving system, as well as technical specifications for data products, or the index for inter-operability among different system or applications.

1.3.4 Institutional Aspect

(1) Organization

GSI operates the clearing-house gateway server, and the following organization or agencies are participating in the activities as a clearing-house node. These agencies operate a node-server that stores metadata database for spatial data.

- Ministry of General Affairs
- Ministry of Health and Labour
- Agricultural Land Information under the Ministry of Agriculture, Forestry and Fisheries
- Clearinghouse node of Ministry of Economy, Trade and Industries

- Clearinghouse node of Government Building Department, Ministry of Land, Infrastructure, and Transport
- DNLI, Ministry of Land, Infrastructure, and Transport
- Electronic Chart Database operated by Japan Coast Guard, Ministry of Land, Infrastructure, and Transport
- Earth Observation Database
- Image Archive operated by Southeast Asia Centre, Kyoto University
- Archaeological Database operated by Nara University
- JMCMAP operated by Japan Mapping Centre
- Spatial database issued by private firms, operated by NSDIPA
- GIS database operated by JASIC
- GISMAP by Hokkaido Mapping Company

1.3.5 Achievement

(1) Incorporation of ISO/TC2.11

This gateway service utilizes fully the results of ISO/TC211 activities, and complies with the standard ISO 19115. This is an advantage compared to other data system or clearing-house in Japan.

(2) Inter-ministerial Coordination through Clearing-house Gateway for Spatial Data

Previous experience in Japan illustrates that there are some overlaps or duplication in terms of the spatial data products. This clearing-house mechanism is expected to overcome this.

(3) Involvement non-governmental agency

This gateway pilot project involved a wide range of agencies or organization.

1.4 Tokyo BEIS (Tokyo Bay Environmental Information System)

1.4.1 Background

The coastal area is an interface between land and ocean. It is also an area of ecological sensitivity. At least 40 percent of the world's population lives within the coastal zone. Several metropolises in the world have developed where land meets ocean. In the coastal area, various kinds of activities such as port and harbour development, navigational aids, coastal infrastructure development, fisheries, tourism and recreation, waste disposal and pollution prevention are taking place, some of which have a possibility of conflicting with each other. A way to reconcile these conflicts and harmonize the human activities with nature in a sustainable manner is required.

This situation is true in Japan. Most cities in Japan has been developed near the coast, and of these most are on a bay. Rapid economic growth in the 1960's and 70's and the subsequent concentration of population in metropolises had triggered not only the land-ward expansion but also sea-ward expansion of the city. The coastal zone in and near the metropolis has, as a result, changed drastically. These changes were characterized by the artificial modification of the coast, loss of wetland habitat, declines in fishery stocks, and emergence of landfills with waste disposal. One of the more notable changes was the land reclamation and landfill in the coastal area. The changing history of coastal bay areas must be recorded and the driving force of these changes identified.

1.4.2 Geographical Context

Tokyo metropolitan area, the largest metropolitan area in Japan, extends over the Coastal zone along the Tokyo Bay. There are several problems in the bay area in terms of environmental management: (a) water quality, (b) land use development pressure, (c) conflicting use of sea, and (d) preservation of wetland.

(1) Water Quality Issues

Firstly, there is a water quality problem in the bay. Several rivers flow into the bay, of which the principal ones are (a) the Edo, (b) the Ara, and (c) the Tama. From the mouths of these rivers, freshwater, nutrients and sediments are supplied into the bay. Several dozen sewage treatment plants are also situated along the coast, from which treated water drain into the bay. Water quality problems such as phytoplankon blooms (i.e akashio), upwelling of hypoxia (i.e. awoshio) and so

on also exist. Such phenomena have been monitored and analyzed by several governemental agencies, as well as groups of environmental scientists.

(2) Development Pressure in the Coastal Area

Secondly, development pressures exist in the coastal area. There are six ports in the bay: the port of Tokyo, Yokohama, Kawasaki, Chiba, Yokosuka, and Kisarazu. Each has a tradition and function in the bay area, therefore, these ports are given special status by the Port Act. The port of Yokohama has been the major international port in Japan since its opening in 1859. The port of Yokosuka is the former naval port during World War II; the port of Kawasaki receives raw materials imported from abroad, such as crude oil, coal, and various kinds of ore, and is adjacent to an industrial complex. Due to the recent increase in the numbers of large vessels passing through the bay into these ports, the need for dredging and for anchoring areas is increasing.

Warehouse and transportation infrastructure such as roads, highways, railways and the airport are concentrated around the ports and harbours. Trans-bay bridge, which links Kawasaki and Kisarazu, has already been constructed, and the extension of the Haneda international airport is being planned, and several sites for construction are proposed. If the construction at the airport is confirmed, more demand for landfill would be generated.

Another important factor is that there is a large traffic volume of large-scale tankers concentrated in the narrow channels. There is a growing risk of accidents due to increased traffic, with potential oil spills as a consequence.

(3) Conflicting Use of Sea-scape

Thirdly, there is a conflicting use of the bay for solid waste disposal sites, the bay reclamation and the port area. Over the past several decades, solid wastes were finally disposed by landfill. Several estimates show that the amounts of solid wastes generated in the Tokyo Metropolitan area will be continuously increasing in the next decade, while there is limited capacity for landfill for solid waste disposal in the Bay. Tokyo Metropolitan Government now has an especially severe situation due to the Solid Waste Disposal and Sanitation Act which requires each municipality to collect, process, and dispose all the solid waste generated within their respective territories. The Tokyo Metropolis will have no more room for landfill sites within a few years, whilst retaining waterway and anchoring area within their territory.

Although the plan for inter-prefectural disposal of solid waste such as the 'Phoenix-project' (a landfill project which constructs man-made islands for solid waste disposal in the port area) had been launched in 1980, and several sites have been proposed, it has not yet been fulfilled since it is difficult to build a consensus among stakeholders, on the location of a site for landfill in the port area, especially among the governors of the prefectures and the mayors of cities, which surround Tokyo bay.

(4) Wetland Issues

Fourthly, there is a debate on issues such as the preservation of wetland habitat. Environmental Ecologists say that wetlands are suitable habitats for migratory birds, and should therefore not be lost to landfill. Historically, Tokyo bay has a high productivity and is rich in species diversity, such as the short-necked clam (*Rupitapes japonicus*), clam (*Maretrix lusoria*), prawn (*Penaeus japonicus*), shrimp (*Metapenaeus joyneri*) and mantis shrimp (*Oratosquilla oratoria*). These living marine resources live in shallow water. During the Meiji period, a century ago, Tokyo bay was a good fishing spot, and there were several fishermen's hamlets around the bay. After World War II, the near-shore fishery declined in the Tokyo bay area, because of several factors such as the loss of shallow water by landfill and degradation of water quality in the bay area.

The problems mentioned above are mutually inter-related with each other and, more or less, related to the progress of landfill. The problems must be solved in an integrated and well-balanced manner. The importance and the need for the Integrated Coastal Zone Management are being recognized by the public. The Sea Coastal Law, amended in 1999, prescribed, in the objective article, that the balance between protection, use and environment must be sought/achieved.

1.4.3 Overview

In order to tackle the problem and restore the ecosystem in the Tokyo Bay Area, The Tokyo Bay Area Environmental Information Centre was established, as a focal point for sharing the environmental information in the bay. The main function of this centre is as a clearing-house mechanism for environmental information about the Tokyo Bay

The data are used to determine the project area for the environmental restoration projects in the Tokyo Bay, such as restoration of tidal flats, oil spill contingency planning, and monitoring program.

1.4.4 Technical Aspect

(1) System Structure

This system provides water quality data measured within the bay. There are 36 monitoring points in the bay. Web-GIS is used as a graphical user interface to specify the monitoring points. The system is also capable of building thematic maps that represent a spatial distribution of the parameters, such as water temperature or the concentrations of water quality parameters. This function is achieved through the spatial interpolation with a capability of GIS. Figure 2.5 illustrate a screenshot of the Web-GIS in Tokyo-BEIS.

Fig 1.5 Screenshot of Tokyo BEIS

(2) Types of Data Stored

This system contains water quality data and data on chemical properties of sediment in the bay. The data catalogue is summarized in Table 2.3 Users can download their chosen data by specifying the point, parameters, and the year carried out. Users can also specify types of data layer to be displayed as the background image: These are (a) polygons of port area, (b) bathymetry contour, and (c) navigational channel.

Table 1.3 Data Catalogue of Tokyo-BEIS

ID	Category	Parameters	Period Covered	Frequency of Monitoring	Responsible Entity
1	Water Quality	Depth, Transparency, Water Temperature, Dissolved Oxygen, COD, Total Nitrogen, Total Phosphorous	1978-79 1997		Port and Airport Division, Kanto Regional Bureau, Ministry of Land, Transport, and Infrastructure
2	Sediment	ignition loss, COD, Total Nirogen, Total Phosphorous, Sulfide, Particle Size Distribution	1970 1976-1972 1982 1984-1986 1994-95		Port and Airport Division, Kanto Regional Bureau, Ministry of Land, Transport, and Infrastructure
3	Water Quality	Water Temperature, Salinity, chlorophyll-a, turbidity, DO, saturation	2002	monthly	
4	Waer Quality	pH, COD, DO, coliform, n-hexan, Total Nitrogen, Total Phosphorous, Turbidity, SS chlorophyll-a, NH4-N, NO2-N, NO3-N, PO4-P, VSS, DCOD, POC, PON, POP, DOC, DON, DOP, SIO4-Si	July, 2002	-	
5	Sedinemt	Whether, Cloud cover, Water depth, sediment temperature, colour, smell etc	July, 2002	-	
6	Sedinemt	COD, Total Nitrogen, Total Phosphorous, Sulfate, sand. Silt,	July, 2002	-	
7	Water Quality	Cadmium, Cyanogen, Lead, Sexivalet Chrome Arsenic,		yearly	Local Government at Coastal area
8	Water Quality	pH, DO, COD, SS, Coliform, n-hexan Total Nitrogen, Total Phosphorous	1999-2000 1995-2000	yearly	Local Government at Coastal area
9	Water Quality	dioxin	2000	yearly	Local Government at Coastal area
10	Water Quality	air temperature, water temperature, sampling water depth, water depth, transparency	1989-1999	monthly	Local Government at Coastal area
11	Water Quality	Cadmium, Cyanogen, Lead, Sexivalet Chrome Arsenic, Arsenic, mercury, alkyl-mercury, PCB, trichloro-	1989-1999	monthly	Local Government at Coastal area

		ethylene, tetrachloro-ethylene,			
12	Water Quality	Cadmium, Cyanogen, Organophosphorous, Lead, Sexivalet Chrome, Arsenic, mercury, alkyl-mercury, PCB, trichloro-ethylene,	1989-1999	monthly	Local Government at Coastal area
13	Water Quality	Tetrachloro-ethylene, dichloro-methane, carbon terachloride, 1,2-jichloroethane, 1-1-dichloro-ethylene, 1,2-dichloroetyle,1,1,1-trichloroethane, 1,1,2-trichloroethane, 1,3-dichloropropene, thiram, simazin, thiobencarb, benzol, selenium	1989-1999	monthly	Local Government at Coastal area

Source: translated from htttp://www.tbeic.go.jp/3/DATA.html

1.4.5 Institutional Aspect

(1) Organization

Tokyo Bay Area Environmental Information Centre operates this system. However, three different entities provide data to the centre. These are: (a) Regional Office of the Port Bureau of the MLIT, (b) marine environment division of the National Institute for Land and Infrastructure Management, and (c) local governments around the bay. Each entity has been carrying out the monitoring of water quality. Tokyo Bay Area Environmental Information Centre act as a clearing house mechanism in terms of distributing water quality data.

(2) Data Distribution Policy

Any web user can get the water quality data in free of charge.

1.4.6 Achievement

(1) Integration of Non-biotic Element to Biological Information

This system integrates GIS and non-biotic elements of the Bay environment, such as water quality and sediment.

(2) Central- Local Government Coordination

This system is a good example of coordination between central and local government, in the field of water quality monitoring.

1.4.7 Challenges

Currently, GIS is used as a kind of user interface for retrieving system of water quality database. However, considering that large scale oil refineries are located in the coastal area of the bay, and the a large traffic volume of large-scale tanker traffic are concentrated in a small channel, it would be much better if some functionality of Decision Support System could be added for oil spill contingency planning. The Research and Development activities for oil spill dispersion modelling have already been carried out by the Petroleum Association of Japan.

1.5 Clearing House for Water-Related Information

1.5.1 Background

Since the amendment of River Law in 1999, more focus has been placed on the riverside environment. The law addresses triple objectives: (a) flood control, (b) water use and (c) environment. River bureau of the MLIT are requested to tackle the issues of balancing these three objectives. In order to achieve this, monitoring data is indispensable. Therefore, MLIT were initiated to collect the data for conservation measures of restoration riverside environment.

1.5.2 Overview

This system is a clearing house for water-related information. It comprises of the following databases: (a) disaster prevention database, (b) water information system, and (c) riparian environment database. The disaster prevention database provides an online spatial distribution of precipitation data monitored by radar, together with the change of water level and stream flow rate for each monitoring points maintained by the MLIT. The system also provides information regarding flood warning. This system is expected to act as a preparedness for flooding and mitigating disaster damage.

The Water Information System, on the other hand, stores data on parameters such as water level, stream flow rate, for each monitoring point. Users can access this database through the web site, and they can retrieve and download necessary data. Web-GIS is utilized as a graphical user interface for identifying monitoring point.

The Subsequent section describes the riparian environment database.

1.5.3 Technical Aspect of Riparian Data Base

(1) Data Source

The data source for this database is a National Survey on the Riverside Environment. This survey has been carried out every five years since 1991, with a special focus on monitoring biodiversity aspects at riverside area. Surveys have been carried out in 109 first-class rivers in addition to major second-class rivers. This survey is composed of three types of survey: (a) biological survey, (b) riverside environment survey, and (c) riverside use survey.

The biological survey targets the biological elements of the riverside. It comprises of six species surveys that characterise the riverside ecosystem: (a) fish survey, (b) benthic organism survey, (c) vegetation survey, (d) bird survey, (e) amphibian, herpetic, and mammals survey.

The riverside environment survey aims to monitor the habitat for the species. Results are gathered on: (a) water body, (b) interface area between terrestrial and aquatic habitat, (c) terrestrial, (d) and (e) water quality and water quantity survey. Both riverside environmental survey and biological survey are mutually related to each other, so that these data can be jointly analysed.

(2) Data Structure

In 2001, The river environment division under the river bureau of the MLIT proposed a standard for preparing data for the survey. The specifications are targeted both for biological databases and GIS data. It specifies types of spatial data and attribute data, scale, and data format.

(3) System Overview

Specifying a survey and target river, the user can download results of the survey from a web site, in the form of a list of species observed. The spatial component of the data is not downloadable, since it has not yet been opened to the public on the web. However, these data are available from the Foundation of Riverfront Centre.

1.5.4 Institutional Aspect

(1) Organization

National Land with Water Information Management Centre operates this clearing house.

(2) Data Distribution Policy

A user can download the data from this clearing-house. With respect to the Riverside Environmental Survey, detailed data are available from the Foundation of Riverfront Centre, on a CD-ROM.

1.5.5 Achievement

(1) Data Structure

Data structure clearly defined in a written form, at the design phase of survey. With respect to spatial data, vector-type format is fully utilized. This enables more precise analysis on ecosystem.

1.5.6 Challenges

(1) Limited Fund Availability

Due to a limited availability of funds, the biological survey is not carried out frequently.

(2) Spatial Aspect of Data

The clearinghouse system does not provide spatial data collected through the biological survey component of National Survey on Riverside Environment.

(3) Metadata

It is not clear whether this system has yet prepared a metadata that complies with ISO19115 defined by ISO/TC2.11.

(4) Distribution Habitat Estimation

More detailed research could be directed to the study on how to estimate a habitat distribution from the collected data. This aspect is especially important for the aquatic ecosystem. The Research Institute for Land and Transport, a governmental research institute of the MLIT, continues to investigate how to estimate the distribution of aquatic habitat in the stream-reach system, by using the data. It will be a future challenge.

Chapter 2 CASE STUDIES IN ASIA IN THE CONTEXT OF TRANS-BOUNDARY ENVIRONMENTAL COLLABORATION

2.1 NOWPAP

2.1.1 Background and Overview

In 1994, UNEP launched a regional collaboration project under the title of 'Regional Sea Program'. NOWPAP (North-western Pacific Regional Action Plan) was established in 1994 as an umbrella program of regional collaboration program in the field of environmental management between China, Korea, Russia, Mongolia and Japan. The program focuses on the marine and coastal environment, reflecting growing concern of the marine and coastal environment in the region, triggered by the wreckage of the Russian oil tanker 'Navotkha' and the subsequent oil spill in 1999.

In 1999, NPEC, a focal point for this action program, was designated as a CEARAC, which is responsible for monitoring the marine and coastal environment. The prioritized activities of the CEARAC are: (a) marine and coastal monitoring with remote-sensing techniques, and (b) evaluation of coastal environment with specific focus on the Harmful Algae Bloom (HAB) including red tide.

The system was established with the aim of helping to disseminate information of satellite images.

This system is operated by the NREC (Northwest Pacific Region Environmental Centre). It was established in 1999, and designated as a focal point.

2.1.2 Technical Aspect

(1) System Structure

As a part of NPWPAP/CEARAC activities, a project called 'environmental watch system' was launched in 2001. The objective of this project is to establish a receiving station for satellite images, and an archiving and retrieval system for these images. The system is a retrieval system rather than a Web-GIS. The system comprises the following:

- Recieving station of satellite images;
- Pre-processing of image computer;
- Computers with analytical software;

- Data transfer network;
- Web/ftp server for data archiving system.

(2) Types of Data Stored

Three types of satellite image data are available from this centre: (a) NOAA, (b) MODIS, and (c) FY-1. Derived images, such as SST (Sea Surface Temperature) or NOAA/NDVI ten-day composite index, are also available from these sites.

(3) Data Format

Satellite image data is processed with image analytical software called 'Terra Scan', so that most of the imagery data are provided with the TDF (TeraScan common Data Format) , a native format for 'Terra Scan'. However, images with other de-facto standard format are also available, such as BSQ (Band Sequential) or HDF (Hierarchical Data Format) format for the purpose of GIS, and TIFF, JPEG, PNG, PPM, GIF, GEOTIFF for images.

2.1.3 Institutional Aspect

(1) Organization

NREC is responsible for operating this system, with collaboration from the TERC (Toyama Environmental Research Centre), an environmental centre operated by the Regional government of Toyama. TERC has a receiving station for the satellite images, and they are responsible for carrying out some processing work such as geo-referencing, geometry correction, and data dissemination.

(2) Data Distribution Policy

Currently, the data is used for public purpose only.

2.1.4 Other Information

A three-year scientific research project called 'Toyama Bay Project' was launched in 2003. The objective of this study is to acquire and record scientific knowledge of the bay, thereby contributing a scientific-based management of the bay. Components of this project are (a) field measurement of the physical and chemical parameters of the bay, (b) establishment of hydrodynamic modelling, and (c) establishment of algorithms for calibrating the remote sensing data.

Field measurement is expected to be carried out in 12 points at the mouth of the bay on a monthly basis. Parameters for the measurements are: SST, pH, SS (Suspended Sediment), and DTOC (Dissolved Total Organic Compound). These data are expected to verify the algorithm that represents a statistical relationship between the pixel brightness of the images and the SST, pH, SS, and DTOC.

2.2 PEMSEA (Partnership for Environmental Management in the Sea of East Asia)

2.2.1 Overview

PEMSEA is a regional collaboration program focusing on the marine and coastal environment in the East Asia Sea. The program aims to ensure the sustainable development of the East Asia Sea. It is a GEF-funded project, implemented by UNDP and executed by IMO.

Program components are: (a) Integrated Coastal Management, (b) Management of Pollution Hotspots, (c) Capacity building, (d) Environmental Investment, (e) Scientific research focusing on the carrying capacity and environment, (f) Civil society, (g) coastal and marine policy, (h) regional mechanism, and (i) Integrated Information Management System (IIMS). The Integrated Information Management System is recognized as one of the key components of the program.

Several demonstration sites have been established to ensure the sound implementation of the study.

2.2.2 Technical Aspect

(1) System Structure

The established IIMS is a relational environmental database, capable of handling large sets of data on the coastal and marine environment. It is expected to serve as a decision-support system, when linked with a GIS and hydrodynamic and pollutant fate forecasting models. IIMS is designed to enhance accessibility of information, not only for the participating government institutions, but also for other stakeholders in the coastal and marine environment.

(2) Types of Data Stored

Data to be stored in this system are: (a) socio-economic data, (b) demographic, data, (c) institutional data, (d) data on pollution sources, (e) water quality data, (f) bio-physical data and (g) physiographic data.

CHAPTER 3 ANNEXES

3.1 ANNEX 1 - Literature Cited

http://www.biodic.go.jp/english/J-IBIS.html

http://www.biodic.go.jp/kiso/map/sy_map_f.html (Japanese)

http://nlftp.mlit.go.jp/cgi-bin/ksj/dls/_kategori_view.cgi (Japanese)

http://nlftp.mlit.go.jp/cgi-bin/chm/zgate

http://w3land.mlit.go.jp/WebGIS/

http://giddsurv.gsi.go.jp/gsich/index.html

http://www1.kaiho.mlit.go.jp/KANKYO/

http://www.tbeic.go.jp/opening.html

http://www.mlit.go.jp/river/IDC/index.html

http://www.npec.or.jp/index2.html

http://www.rfc.or.jp/english/top.htm

http://www.pemsea.org/

3.2 ANNEX 2 - Acronyms and Abbreviations

ASCII	American Standard Code for Interchange In
BSQ	Band SeQuential
CBD	Convention on Biological Diversity
CD-ROM	Compact Disk Read Only Memory
DO	Dissolved Oxygen
DTOC	Dissolved Total Organic Compound
EUC	Extended UNIX Code
GEF	Global Environmental Facility
Geo-TIFF	Geo-Tagged Image File Format
GIS	Geographical Information System
GPS	Global Positioning System
GSI	Geographical Survey Institute
HAB	Harmful Algae Bloom
HDF	Hierarchical Data Format
HTTP	Hyper Text Transfer Protocol
IABIN	Inter-American Biodiversity Information Network
IIMS	Integrated Information Management System
IMO	International Maritime Organisation
ISO-TC	International Standard Organisation- Technical Committee
JIBIS	Japan Integrated Biodiversity Information System
JMP	Japan Metadata Profile
JPEG	Joint Photographic Expert Group
MLIT	Ministry of Land, Infrastructuture, and Transport

MODIS	Moderate Resolution Imaging Spectroradiometer
MOE	Ministry of Environment
NDVI	Normalized Differencial Vegetation Index
NEPC	Northwest Pacific Region Environmental Centre
NGO	Non Governmental Organisation
NLA	National Land Agency
NOAA	National Oceanic and atmospheric Administration
NOWPAP	North Western Pacific Regional Action Plan
NSDIPA	National Spatial Data Infrastructure Promoting Association
PEMSEA	Partnership for Environmental Management in the Sea of East Asia
PNG	Portable Network Graphics
SGML	Standard Generalised Mark-up Language
SST	Sea Surface Temperature
TDF	TerraScan common Data Format
TERC	Toyama Environmental Research Centre
Tokyo-BEIS	Tokyo Bay Environmental Information System
UNDP	United Nations Development Programme
UNEP	United Nations Environmental Programme
XML	eXtended Mark-up Language

3.3 ANNEX 3 - Types of Layers and Data Types of DNLI

Theme	File Name	Year	Data Type	Attributes	Data Source
Designated Area					
Urban Planning Area	KS471-2	1895 1990	Coordinates (Polygon)	None	Urban Planning Map
Natural Park	KS472-1	1985	Coordinates (Polygon)	None	National Park Planning Map
Protected area	KS473-1	1985	Coordinates (Polygon)	None	
Agricultural area	KS474-2	1985	Coordinates (Polygon)	None	Land Use Planning Map
Forestry Area	KS475-2	1985	Coordinates (Polygon)	None	
Wildlife sanctuary	KS461-1	1983	Coordinates (Polygon)	None	List of Wildlife Sanctuary
Designated Area Grid	A02-60M	1985	3rd-order National Grid (Grid)	Urban Planning area, agricultural area, forestry area, natural park, wildlife sanctuary	
Urban Planning Area within 3 metrolopolis	KS490	1990	Coordinates (Polygon)	Built-up area, established area, developed area	
Forestry Area, Governemtal Land	A05-06M	1985	3rd-order National Grid (Grid)	9 types of national land Public Forest, Public Pasture	National Asset Inventory, Ministry of Finance
Resort Area	A07-07A	1995	Coordinates (Polygon)	Project Name, Area Name, Area Extent, Designated Date	List of Resort Area, prepared by Prefecture
Coastal Area					
Coastal Line	C09-59P C10-59L C11-59L C13-60L C14-59L C15-60T C17-59L C18-59L C19-59L C20-59L C22-59L	1984	Coordinates (Polygon, Point, Table)	Fishery Port, Port, Fishing bank, bridge, underlying facility, mining area, waterway, fishery rights	List of fishery port List of fishing spot Documents on ports, by prefecture marine chart
Coastal Area Grid	C04-02M	1990	3rd-order National Grid (Grid)	Depth, Sediment, eddy currents, seagrass bed, fishiing spot tidal flow	Marine chart Document by fishery experimental station
Natural Fishery Spot Wave height, Fog	C05-02M	1990	2rd-order National Grid (Grid)		Documents by Japan Coast Guard
Terrestrial Area along Coast	C23-59L C24-59T C25-59T C26-59L C27-59T C29-59P	1984	Coordinates (Line, Point, Table)	Landfilling/reclamation area Coastal Line Beach Inventory Airport Sand extracting	Documents by Prefecture Documents by MLIT Documents by Forest Bureau

	C30-59L C31-59L C32-59L C33-60L C34-60L C35-60L			area National Park Area Land Conservation Information Geomorphologic al Classification in low-lying area Ground sinkage	
Facility at coastal line Tidal Limit	C07-02P	1990	Coordinates (Point)	Facilities at coastal line, Tidal Observatory, Tidal Limit	Documents by Prefecture Documents by GSJ
High Tide or Tsunami affected area	C08-49T	1974	Table	Disaster record by High Tide Disasater record by Tsunami	Record about 50-100 years
Natural Feastures					
Geomprpholo gy	G04-56M G05-56M G06-56M G07-56M	1981	Grid	Elevation Slope Mountain Valley Density Land Classification	Topo may 1:25000 by GSJ
Climate	C02-62M	1981	3rd-order National Grid (Grid)	Precipitation Temperature Snowfall	Documents by Meteological Agency and River Bureau of MLIT
Land Price	L04-07P L04-08P L04-09P L04-10P L04-11P L04-12P L04-13P L04-14P	1990-2003	Coordinates (Point)	Area Name Location Land Price Land Use Zoning Category	Land Proce Report, by MLIT
Land Price Survey by Prefecture	L05-07P L05-08P L05-09P L05-10P L05-11P L05-12P L05-13P L05-14P	1990-2003	Coordinates (Point)	Area Name Location Land Price Land Use Zoning Category	Land Price Report , by each prefecture
Land Use	L03-51M L03-62M L03-03M L03-09M	1976 1982 1991 1997	4th-order National Grid (Grid)	Land Use Category l Paddy Field Field Fruits field Forest Buildings Waer .etc	In 1976 and 1982 Topo-map with 1: 25000 In 1991 LANDSAT In 1997 Topo-map with 1:25000
National Schelton Road	N01-077L	1990	Coordinates (Line)	Location Management Body Road Type Highway National Road Regonal Road	Topo Map Local Government Profile
Railway	N02-07L	1990	Coordinates (Line)	Location Management Body Station	

Road Desity Road Length per grid	N04-53M		3rd-order National Grid (Grid)	Number of Road that across per grid	Topo Map Road information
Public Utility					
Historical Monument	P01-50P	1975	Coordinates (Point)	Location code	Distribution Map of Archeological Site, by Culture Agency, Ministry of Scinence and Technology
Public Facility	P02-02P	1990	Coordinates (Point)	Name of the Facility Types of the Facility Address Location Responsible Entity	Documets by: Prefecture MLIT MHW
Power Plant	P03-07P	1995	Coordinates (Point)	Loation of the Facility Types of the Facility Capacity Name of the Facility Date of starting operation	Inventory of Power Plant

Theme	File Name	Year	Data Type	Attributes	Data Source
Industrial Statistics					
Commercial Survey	S01-54M S01-57M S01060M	1979 1983 1985 1986	3rd-order National Grid (Grid)	Number of Shops by industrial category Number of Employees Sales amount Area Extent of shops	Commnercial Survey
Commercial Survey	S02-54M S02-57M S02-60M	1979 1983 1980 1981	3rd-order National Grid (Grid)	Number of Shops by industrial category Number of Employees Sales amount Area Extent of shops	Commercial Survey Establishment Survey
Factory Survey	S03-54M S03-55M S03-57M	1977 1980 1982	3rd-order National Grid (Grid)	Nunber of factories Number of employees Amounts of sales	Factory Survey
Agriculural Survey	S04-50M S04-55M	1985 1990	3rd-order National Grid (Grid)	Population Cultivated area Equipment used Number of cattles	Agricultural Census
Hydrology					
Dam	W01-07P	1990	Coordinates (Point)	Location Dam Code Capacity Date of Operation	Dam Inventory
River and	W03-52T	1990	Table	Stream Segment	Map prepared

River Network	W03-07T			Inventory with segment length & population	by River Burau of MLIT
Lake and Marsh	DNL-FL-E W10-50T KS-20	1975	Coordinates (Polygon)	Location, Area extent	Topo map
Lake Grid	W04-57M	1982	3rd-order National Grid (Grid) w/10 divide	Name Elevation at surface Maximum Depth	Topo map
Stream Reach	W05-52P	1977	Coordinates (Point)	Length from the river mouth Elevation at riverbed	Map prepared by River Burau of MLIT
Stream Grid	W06-52M	1977	3rd-order National Grid (Grid)	Stream length by steam type	Map prepared by River Burau of MLIT
river basin boundary	KS-274	1977	Coordinates (Polygon)	Location, code	Map prepared by River Burau of MLIT
River basin grid	W07-52M	1977	3rd-order National Grid (Grid) w/10 divide	Stream	Map prepared by River Burau of MLIT

(Source): translated from http://mlftp.mlit.go.jp/ksj/table.html

3.4 ANNEX 4 - Data Format for Point Data in DNLI

Header Data at the 1st line of data file

Items	Data Type	Data Length	Description
Layer code	A3	3	
Producer	A10	13	
Data Code	A10	23	Corresponding to filename in Table 2.3
Data Type	I2	25	
Year	I4	29	In case of multiple year, the first year is embeded
Number of Column per Line	I4	33	
Data Length	I8	41	Descriptor of data length per file
Data afterwards second line			

Items	Data Type	Data Length	Description
Layer Code	A3	3	In the case of point data, always 'P'
Grid Code	I6	3	
X coordinates	I6	9	
Y Coordinates	I8	17	Based on the Coordinates system of
Attribute	I8	25	

(source): traslated from http://nlftp.mlit.go.jp/ksj/point.html

3.5 ANNEX 5 - Data Format for Polyline Data in DNLI

Header Data at the 1st line of data file			
Items	Data Type	Data Length	Description
Layer code	A3	3	
Producer	A10	13	
Data Code	A10	23	Corresponding to filename in Table 2.3
Data Type	I2	25	
Year	I4	29	In case of multiple year, the first year is embeded
Number of Column per Line	I4	33	
Data Length	I8	41	Descriptor of data length per file
Second Line at Header Data			
Items	Data Type	Column	Description
Whole Length of the Data	I8	8	
Number of Line of Node Data	I8	16	
Number of Line for Link Data	I8	24	
Number of Line for Line Data	I8	32	
Number of Lineat for Node inventory	I8	40	
Number of Line for Link Inventory	I8	48	
Number of Line for Line Inventory	I8	56	
(3) Node Data			
Items	Data Type	Column	Description
Layer Code	A3	3	Always 'N', since it is node data
Grid Code	I6	9	
Sequential Number within grid cell	I6	15	

X coordinates	I8	23	
Y Coordinates	I8	31	Based on the Coordinates system of
Existence of Node Inventory	I2	33	If exist '1', otherwise '0'
Node Attribute ID	I10	43	Corresponding to ID in Node Attribute Inventory
Number of Links connected to this Node	I3	46	
Map frame	I2	48	If within frame '0', otherwise '1'
Corresponding Grid	I6	54	

(4) Link Data (at the first recorded line in the data file)

Items	Data Type	Column	Description
Layer Code	A3	3	Always 'L', since it is link data
From Node: grid Code	I6	9	
From Node: ID	I6	15	
To Node:Grid Code	I6	21	
To Node:ID	I6	27	
Sequential Number within the grid that From Node located	I6	33	
Existence of Link Inventory	I2	35	If exist '1', otherwise '0'
Node Attribute ID	I10	45	Corresponding to ID in Link Attribute Inventory
Number of Midpoint that consists of this link	I6	51	From Node and To-Node are included

(5) Link Data after 2nd line (each line contains information on 5 midpoint per line)

Items	Data Type	Column	Description
Midpoint #1: X-coordinate	I8	8	
MIdpoint #1: Y-coordinate	I8	16	
Midpoint #2: X-coordinate	I8	24	
Midpoint #2: Y-coordinate	I8	32	
Midpoint #3: X-coordinate	I8	40	
Midpoint #3: Y-coordinate	I8	48	
Midpoint #4: X-coordinate	I8	56	
Midpoint #4: Y-coordinate	I8	64	

Midpoint #5: X-coordinate	I8	72	
Midpoint %5:Y-coordinate	I8	80	

(6) Line Data (at the first recorded line in the data file)

Items	Data Type	Column	Description
Layer Code	A3	3	Always 'S'
Start Link: Grid-Code	I6	9	
Start Link: ID	I6	15	
End Lind; Grid-Code	I6	21	
End Link; ID	I6	27	
Line Sequential Number	I8	35	
Existence of Line Inventory	I2	37	If exist '1', otherwise '0'
Line Attribute ID	I10	47	Corresponding to ID in LineAttribute Inventory
Number of Lines that consists of this link	I6	53	

(6) Line Data (after the second recorded line in the data file)

Items	Data Type	Column	Description
Link #1; Grid-code	I6	6	Always 'S'
Link #1: ID	I6	12	
Link #1: Flag	I2	14	If link to be displayed, '1', othewise '0'
Link #2: Grid-code	I6	20	
Link #2: ID	I6	26	
Link #2: Flag	I2	28	If link to be displayed, '1', othewise '0'
Link #3: Grid-code	I6	32	
Link #3; ID	I6	38	
Link #3; Flag	I2	40	If link to be displayed, '1', othewise '0'
Link #4: Grid-code	I6	46	
Link #4: ID	I6	52	
Link #4; Flag	I2	54	If link to be displayed, '1', othewise '0'
Link #4; Grid-code	I6	60	
Link #4; ID	I6	66	
Link #4: Flag	I2	68	If link to be displayed, '1', othewise '0'

(7) Inventory Data Format for Node, Link, and Line

Items	Data Type	Column	Description
Layer Code	A3	3	Node Inventory; 'DP', Link Inventory 'DL', Line Inventory 'DS'
Attribute ID	I8	11	Corresponding to Attribute ID of Data format
Number of Lines for Attribute Data	I3	14	If the data exceeds 80 column, add '2'
Attribute #1	I3	17	
Attribute #2	I3	20	
Attribue #n	I3		

(Source): translated from http://nlftp.mlit.go.jp/ksj/line.html

3.6 ANNEX 6 - Data Format for Polygon Data in DNLI

Header Data at the 1st line of data file

Items	Data Type	Data Length	Description
Layer code	A3	3	
Producer	A10	13	NLA', 'GSI' or 'MSA' are described NLA: National Land Agency GSI: Geographical Survey Institute MSA: Japan Coast Guard
Data Code	A10	23	Corresponding to filename in Table 2.3
Data Type	I2	25	Always '3', a code that represents a polygon
Year	I4	29	In case of multiple year, the first year is embeded
Number of Column per Line	I4	33	always '80'

Second Line at Header Data

Items	Data Type	Data Length	Description
Whole Length of the Data	I8	8	
Number of Line of Node Data	I8	16	
Number of Line for Link Data	I8	24	
Number of Line for Polygon Data	I8	32	
Number of Lines at for Node Inventory	I8	40	
Number of Line for Link Inventory	I8	48	
Number of Line for Polygon Inventory	I8	56	

(3) Node Data

Items	Data Type	Column	Description
Layer Code	A3	3	Always 'N', since it is node data
Grid Code	I6	9	
Sequential Number within grid cell	I6	15	
X coordinates	I8	23	
Y Coordinates	I8	31	Based on the Coordinates system of
Existence of Node Inventory	I2	33	If exist '1', otherwise '0'
Node Attribute ID	I10	43	Corresponding to ID in Node Attribute Inventory
Number of Links connected to this Node	I3	46	
Map frame	I2	48	If within frame '0', otherwise '1'
Corresponding Grid	I6	54	

(4) Link Data (at the first recorded line in the data file)

Items	Data Type	Column	Description
Layer Code	A3	3	Always 'L', since it is link data
From Node: grid Code	I6	9	
From Node: ID	I6	15	
To Node:Grid Code	I6	21	
To Node:ID	I6	27	
Sequential Number within the grid that From Node located	I6	33	
Existence of Link Inventory	I2	35	If exist '1', otherwise '0'
Node Attribute ID	I10	45	Corresponding to ID in Link Attribute Inventory
Number of Midpoint that consists of this link	I6	51	From Node and To-Node are included

(5) Link Data after 2nd line (each line contains information on 5 midpoint per line)

Items	Data Type	Column	Description
Midpoint #1: X-coordinate	I8	8	

MIdpoint #1: Y-coordinate	I8	16	
Midpoint #2: X-coordinate	I8	24	
Midpoint #2: Y-coordinate	I8	32	
Midpoint #3: X-coordinate	I8	40	
Midpoint #3: Y-coordinate	I8	48	
Midpoint #4: X-coordinate	I8	56	
Midpoint #4: Y-coordinate	I8	64	
Midpoint #5: X-coordinate	I8	72	
Midpoint %5:Y-coordinate	I8	80	

(6) Polgygon Data (at the first recorded line in the data file)

Items	Data Type	Column	Description
Layer Code	A3	3	Always 'A', since it is a polygon data
Representative Point : Grid code	I6	9	
Representative Point : X coordinate	I8	15	
Representative Point : Y coordinate	I8		
Polygon Sequential Number	I8	35	
Existence of Polygon Inventory	I2	37	If exist '1', otherwise '0'
Polygon Attribute ID	I10	47	Corresponding to ID in LineAttribute Inventory
Number of Links that consists of this Polygon	I6	53	

(6) Polygon Data (after the second recorded line in the data file)

Items	Data Type	Column	Description
Link #1; Grid-code	I6	6	Always 'S'
Link #1: ID	I6	12	

Link #1: Flag	I2	14	If link to be displayed, '1', othewise '0'
Link #2: Grid-code	I6	20	
Link #2: ID	I6	26	
Link #2: Flag	I2	28	If link to be displayed, '1', othewise '0'
Link #3: Grid-code	I6	32	
Link #3; ID	I6	38	
Link #3; Flag	I2	40	If link to be displayed, '1', othewise '0'
Link #4: Grid-code	I6	46	
Link #4: ID	I6	52	
Link #4; Flag	I2	54	If link to be displayed, '1', othewise '0'
Link #5; Grid-code	I6	60	
Link #5; ID	I6	66	
Link #5: Flag	I2	68	If link to be displayed, '1', othewise '0'

(7) Inventory Data Format for Node, Link, and Line

Items	Data Type	Colum m	Description
Layer Code	A3	3	Node Inventory; 'DP', Link Inventory 'DL', Line Inventory 'DS'
Attribute ID	I8	11	Corresponding to Attribute ID of Data format
Number of Lines for Attribute Data	I3	14	If the data exceeds 80 column, add '2'
Attribute #1	I3	17	
Attribute #2	I3	20	
Attribue #n	I3		

(Source): tranlated from http://nlftp.mlit.go.jp/ksj/polygon.html

3.7 ANNEX 7 - Data Format for Grid Data in DNLI

Header Data at the 1st line of data file

Items	Data Type	Data Length	Description
Layer code	A3	3	Always 'H'
Producer	A10	13	NLA', 'GSI' or 'MSA' are described NLA: National Land Agency GSI: Geographical Survey Institute MSA: Japan Coast Guard
Data Code	A10	23	Corresponding to filename in Table 2.3
Data Type	I2	25	Always '4', a code that represents a grid data
Year	I4	29	In case of multiple year, the first year is embeded
Number of Column per Line	I4	33	
Number of Line per file	I8	41	always '80'
Second Line at Header Data			

Items	Data Type	Data Length	Description
Layer Code	A3	3	Always 'M'
Grid size	I2	5	
1st order grid code	I4	9	
2nd-order grid code	I2	11	
3rd-order grid code	I2	13	
Attribute#1	I8	48	
(source): translated http://nlftp.mlit.go.jp/ksj/mesh.html			