Web GIS Application in Disaster Management: Application to Tsunami

Adapted partially from "Web-GIS applications in Disaster Management - application to the Tsunami" presentation by Athar Siddiqui presented at "National Seminar on GIS application in Rural Development with focus on Disaster Management", Hyderabad, March 9-11, 2005.

What is Disaster Management

- Work of a public authority (government) or a group of professions such as police officers, soldiers, or NGOs to manage a Disaster

- Disaster management aims to protect civilians from the *consequences* of disasters, wars or acts of terrorism

Web GIS

- Digital maps published on internet
- Disseminate up to date locational information from a centralized control room
- Authenticity and accuracy of information are guaranteed

- One digital set of maps needs to be maintained at the control room server
- Changes made on these digital maps are reflected to all people accessing them through the internet on real time basis
- Current status of these maps can be updated moment to moment

Web GIS and Disaster Management

- Web GIS can help manage a Disaster by the dissemination of real-time locational information through the net

- The published information can help answer questions as:
  - How the Disaster will affect the population?
  - Where should we set up evacuation teams?
  - What are the most vulnerable locations?
  - What are the routes that are open?

- Updated locational information about:
  - Shelter locations
  - Medical facilities and evacuation teams
  - Telecom equipment
  - Emergency routes
  - Current roads conditions

- To whom:
  - Decision makers
  - Emergency and evacuation teams
  - The public

- Tools of dissemination to the public:
  - Smart phones
  - Hand-held Tablets
  - Social media networks
  - Notifications via SMS messages

What is a Tsunami

- A massive disaster
- Equivalent to impact of several Cyclones
- Takes away thousands of lives
- Destroys many homes and buildings
- Leaves survivors on a long road for rehabilitation

What Causes a Tsunami

- Tsunami is generated when ocean floor shifts vertically, usually due to an **earthquake**

- When a shift in the ocean floor displaces the water above, the body of water travels as a huge wave to regain the equilibrium

- In deep water, a tsunami can travel at ~700 km/hr, but it gets slower near the coast and water mass rises up to 50m

Destruction Caused by a Tsunami

Taken from: TOI Dec 27, 04

A tsunami can strip coasts of sand, uproot trees, wipe out towns. Traveling 100s of meters inland, it can flood coastal towns.

- Tsunami can not be stopped

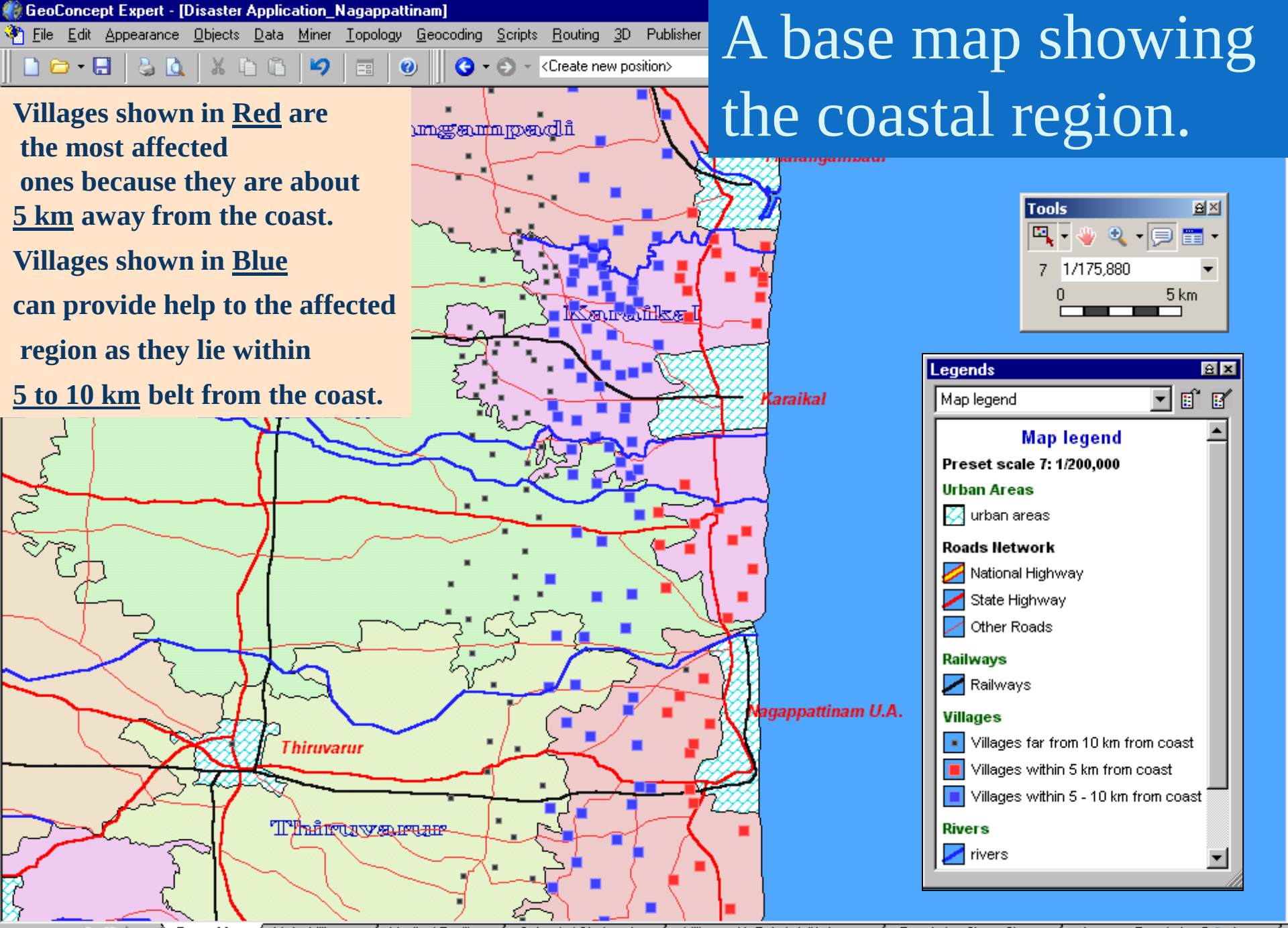
- However it can be prepared for:
  - to minimize destruction
  - repair damage and
  - restore livelihoods

- Relief can be provided as fast as possible.

Case Study of Web GIS in Tsunami Disaster Management in India

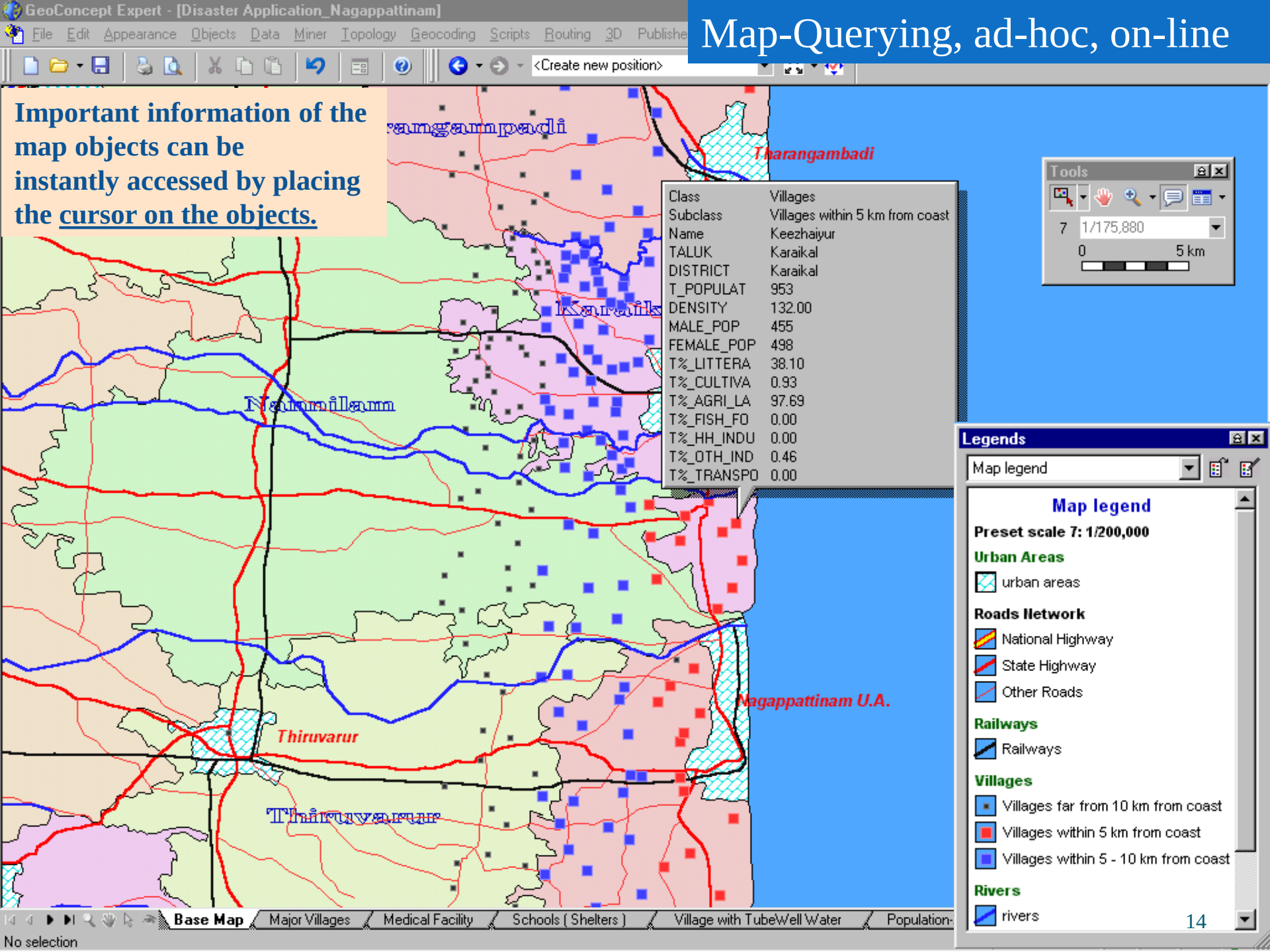
The map used in this example was made by the French Institute, Pondicherry in 2000, under a UNFPA project on Population in South India]

A base map showing the coastal region.

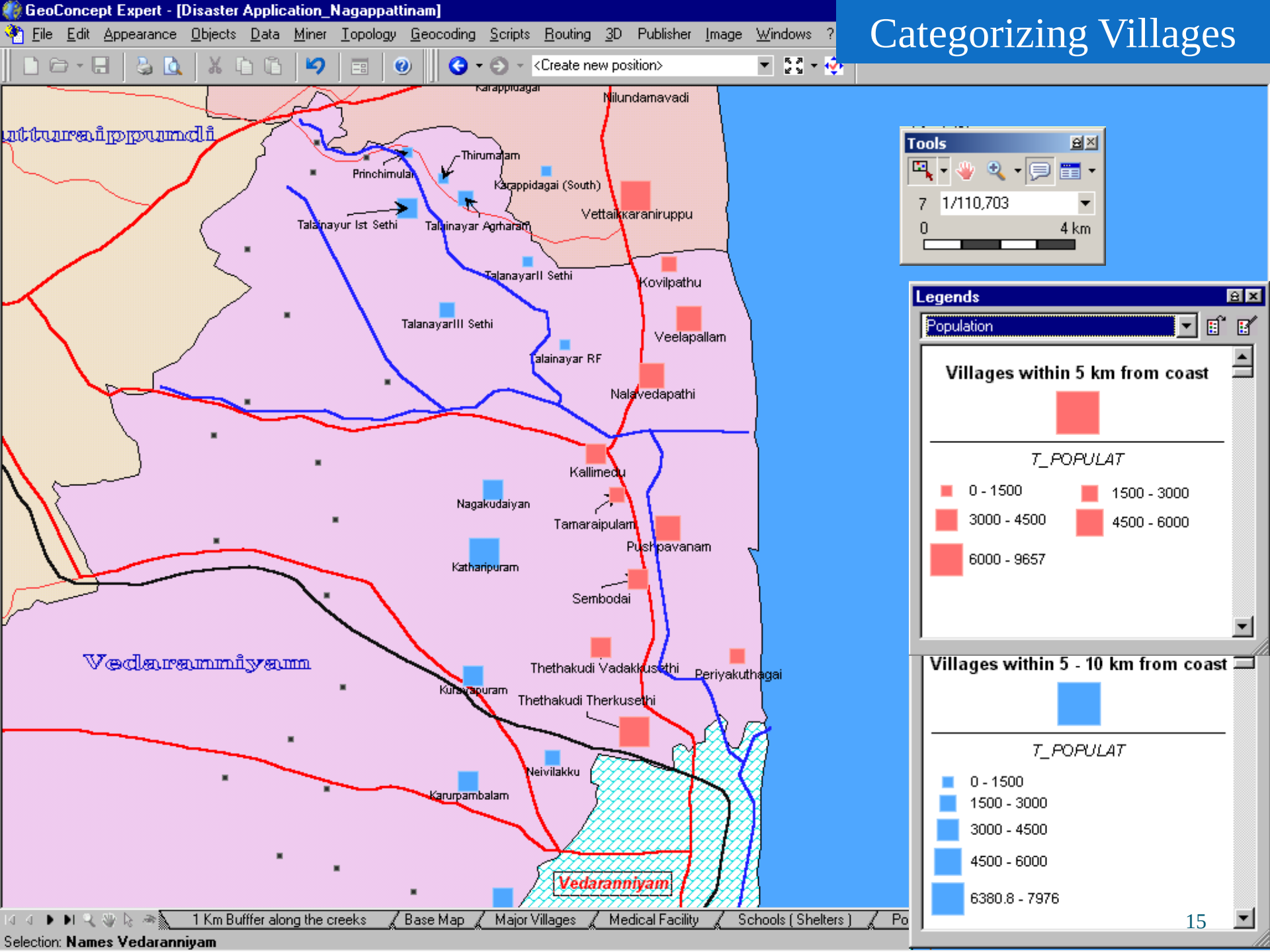


Map-Querying, ad-hoc, on-line

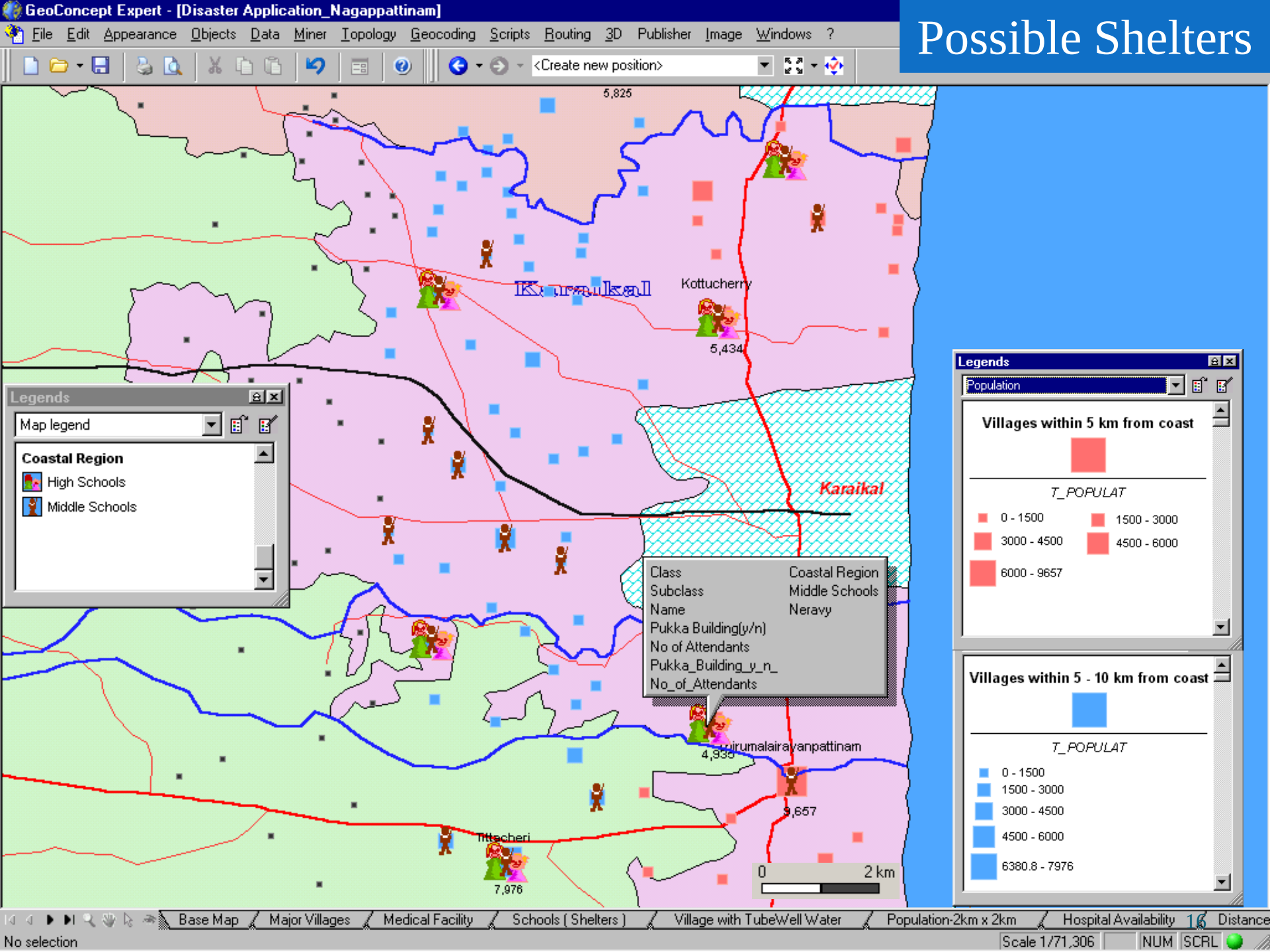
Important information of the map objects can be instantly accessed by placing the cursor on the objects.



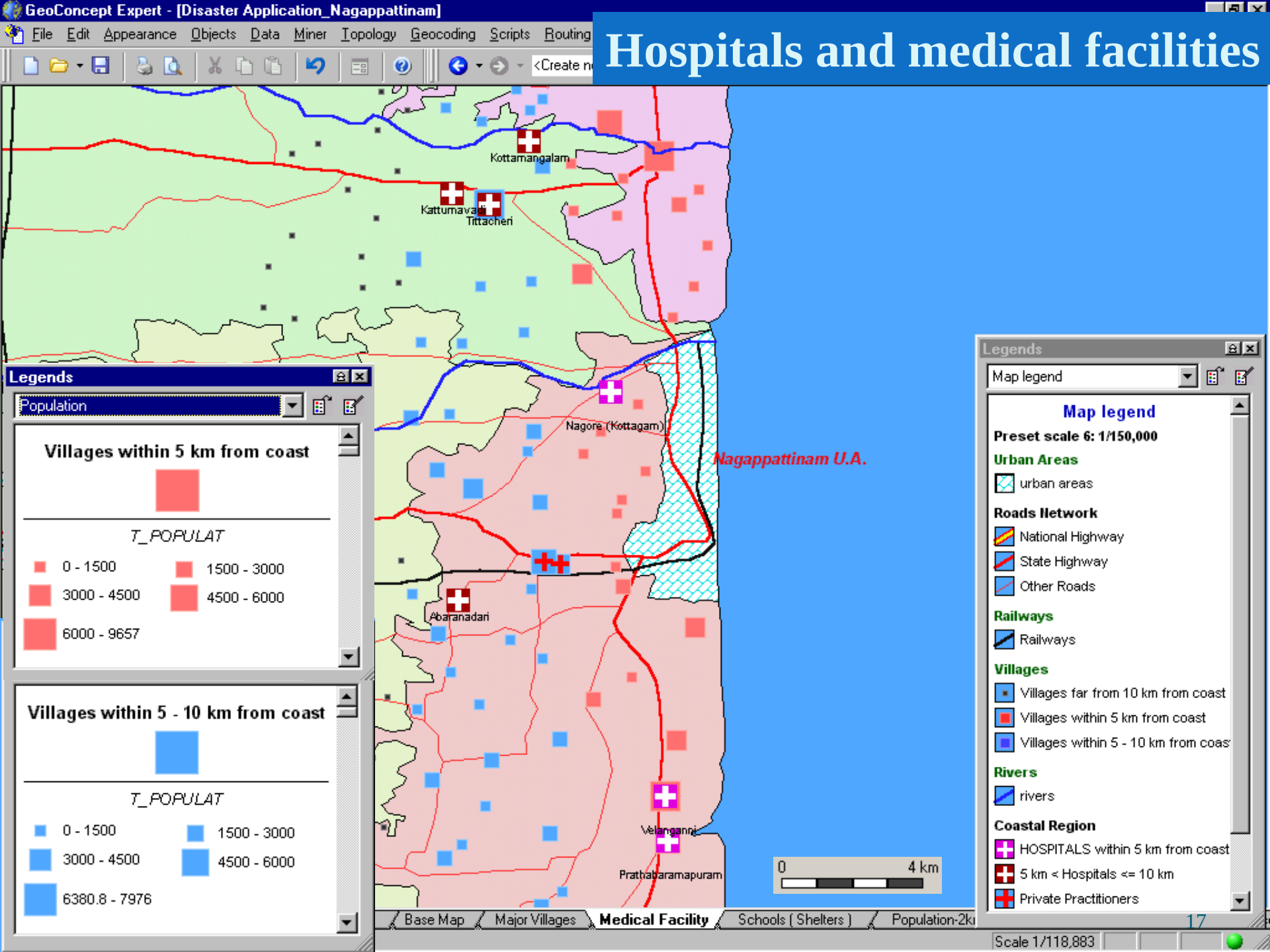
Categorizing Villages



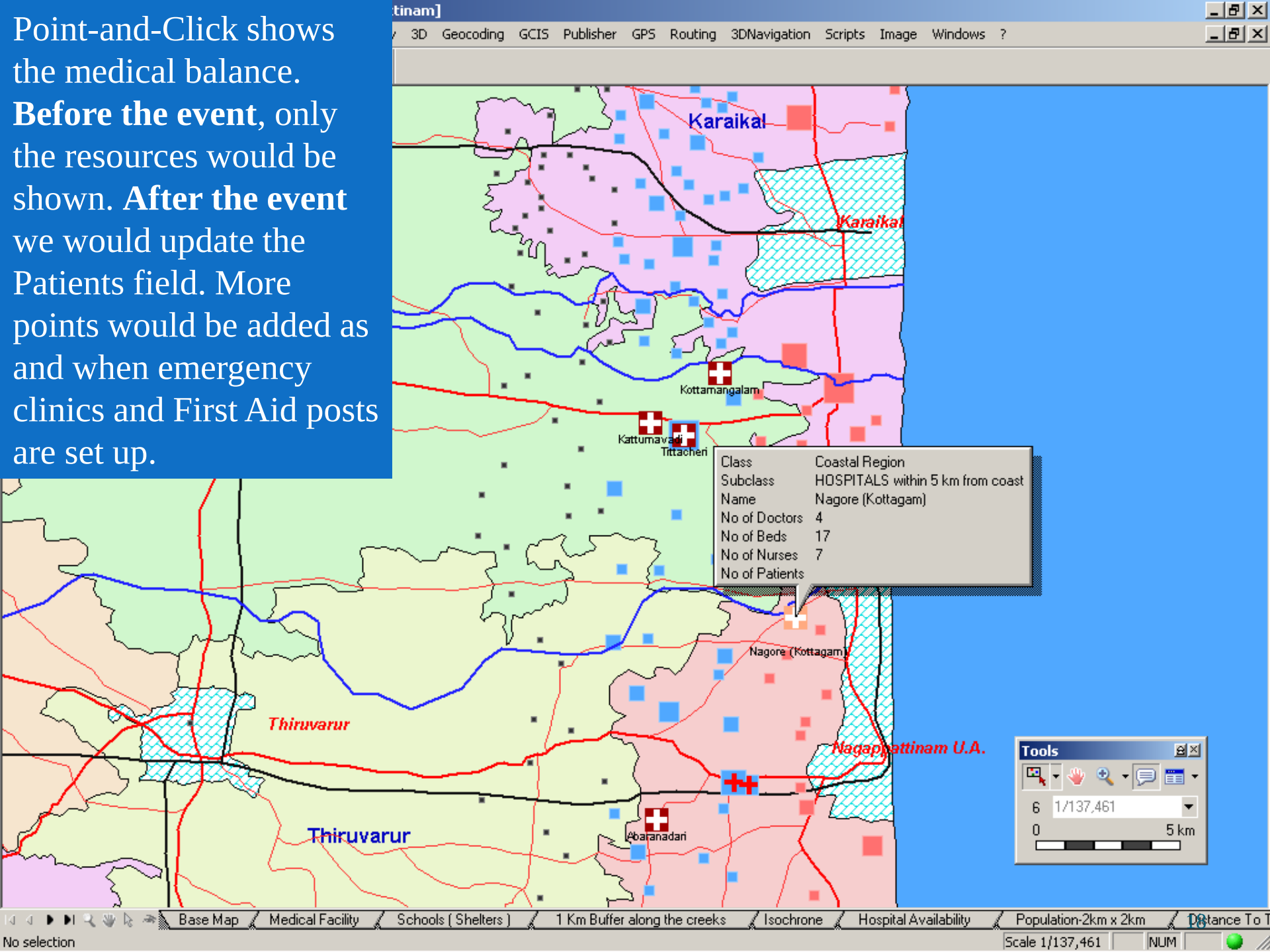
Possible Shelters

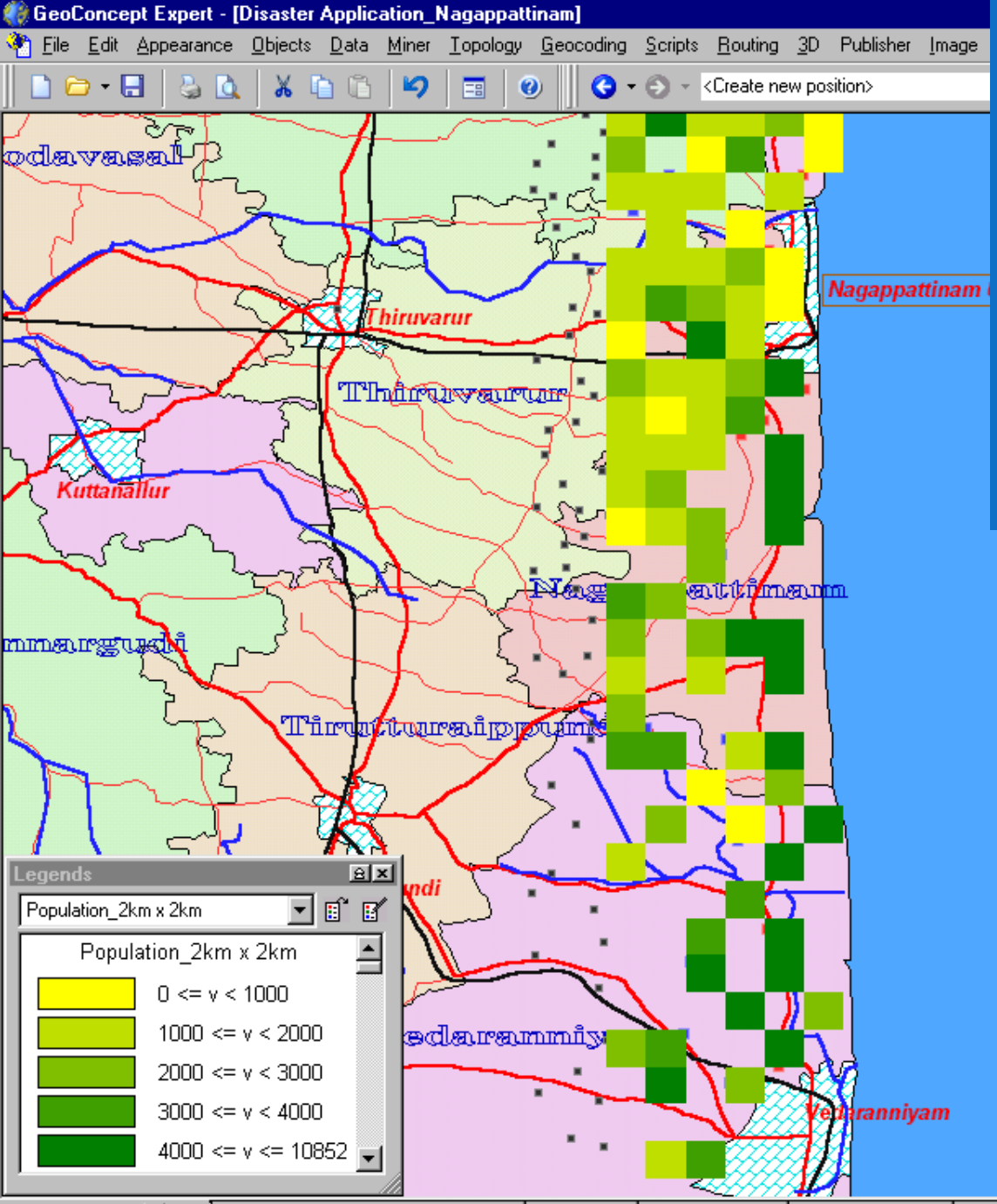


Hospitals and medical facilities



Point-and-Click shows the medical balance. **Before the event**, only the resources would be shown. **After the event** we would update the Patients field. More points would be added as and when emergency clinics and First Aid posts are set up.

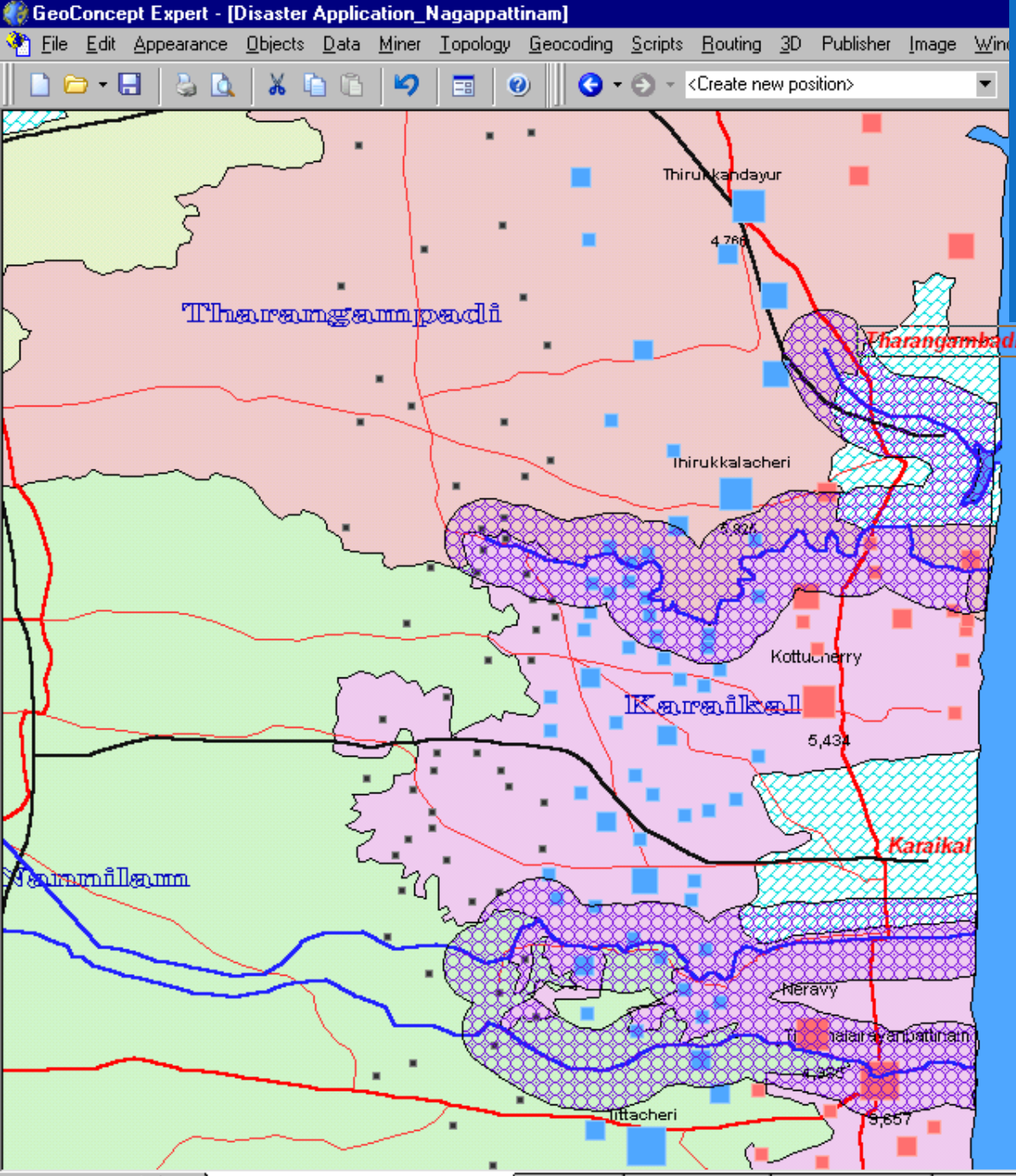


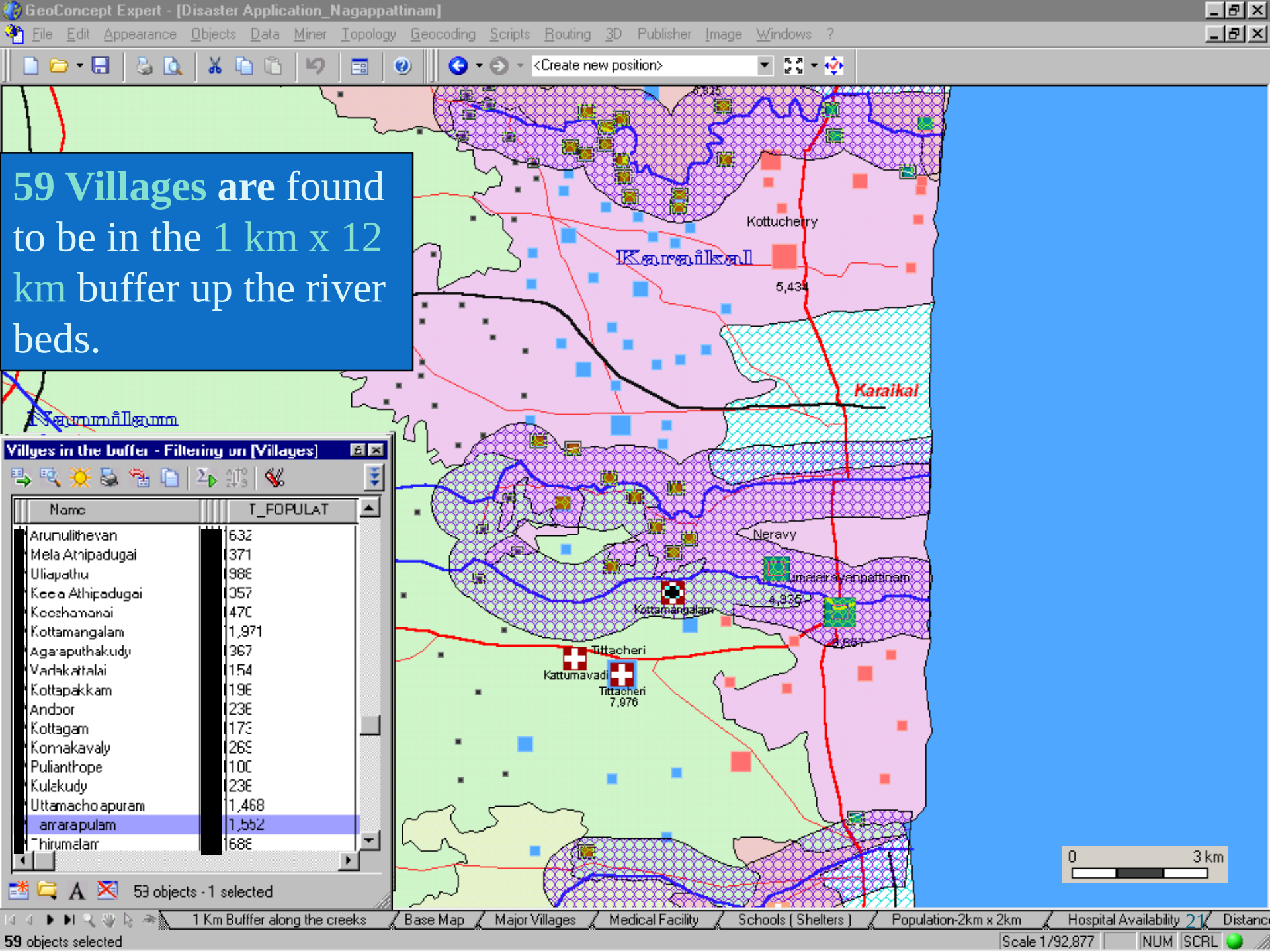


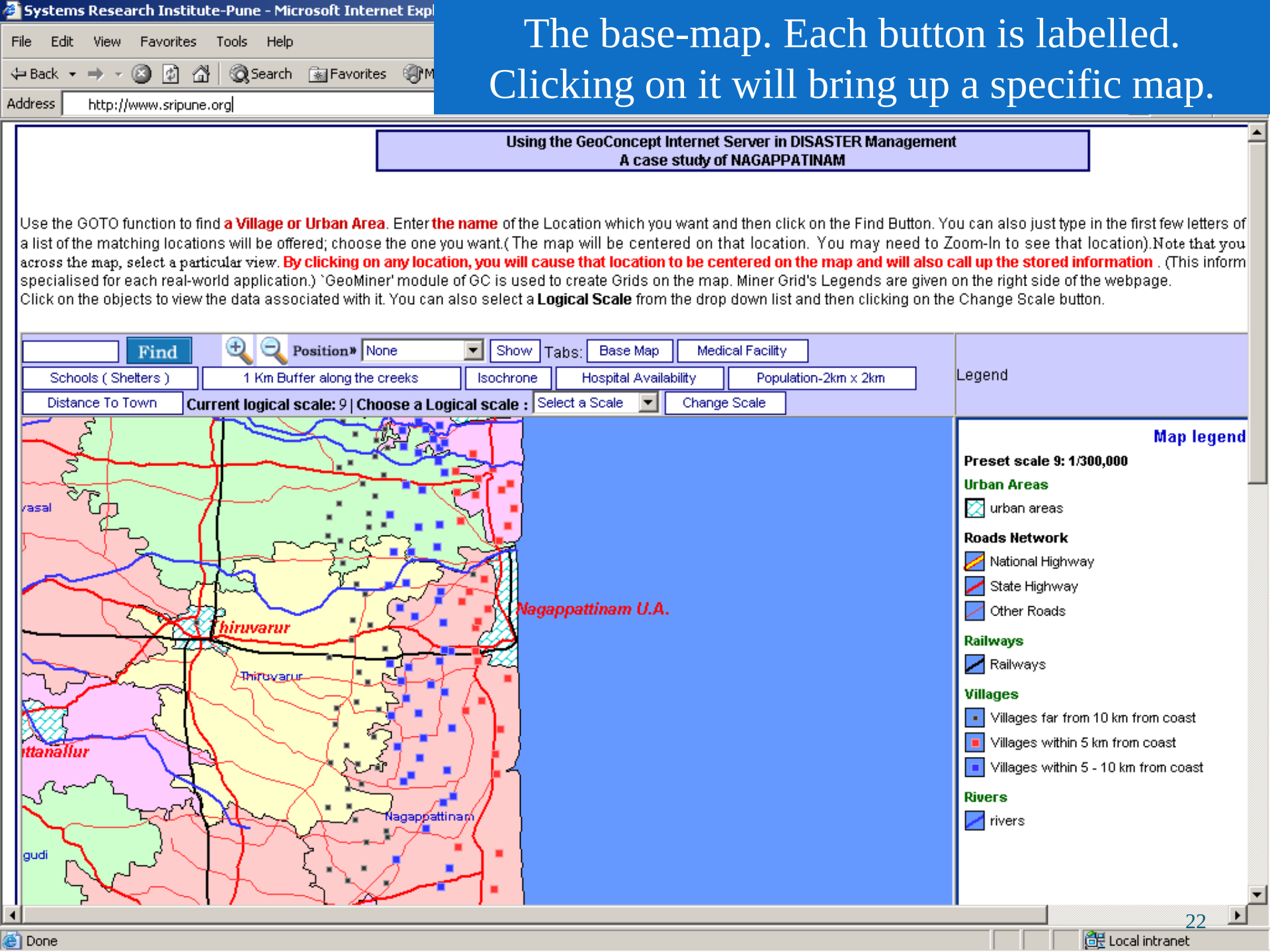
The 2x2 km grid cells give an idea of the geographical distribution of Population. (Gives an idea of the potential number of refugees.)

(map created using the *GC-GeoMiner* module; size of grid is up to the user)

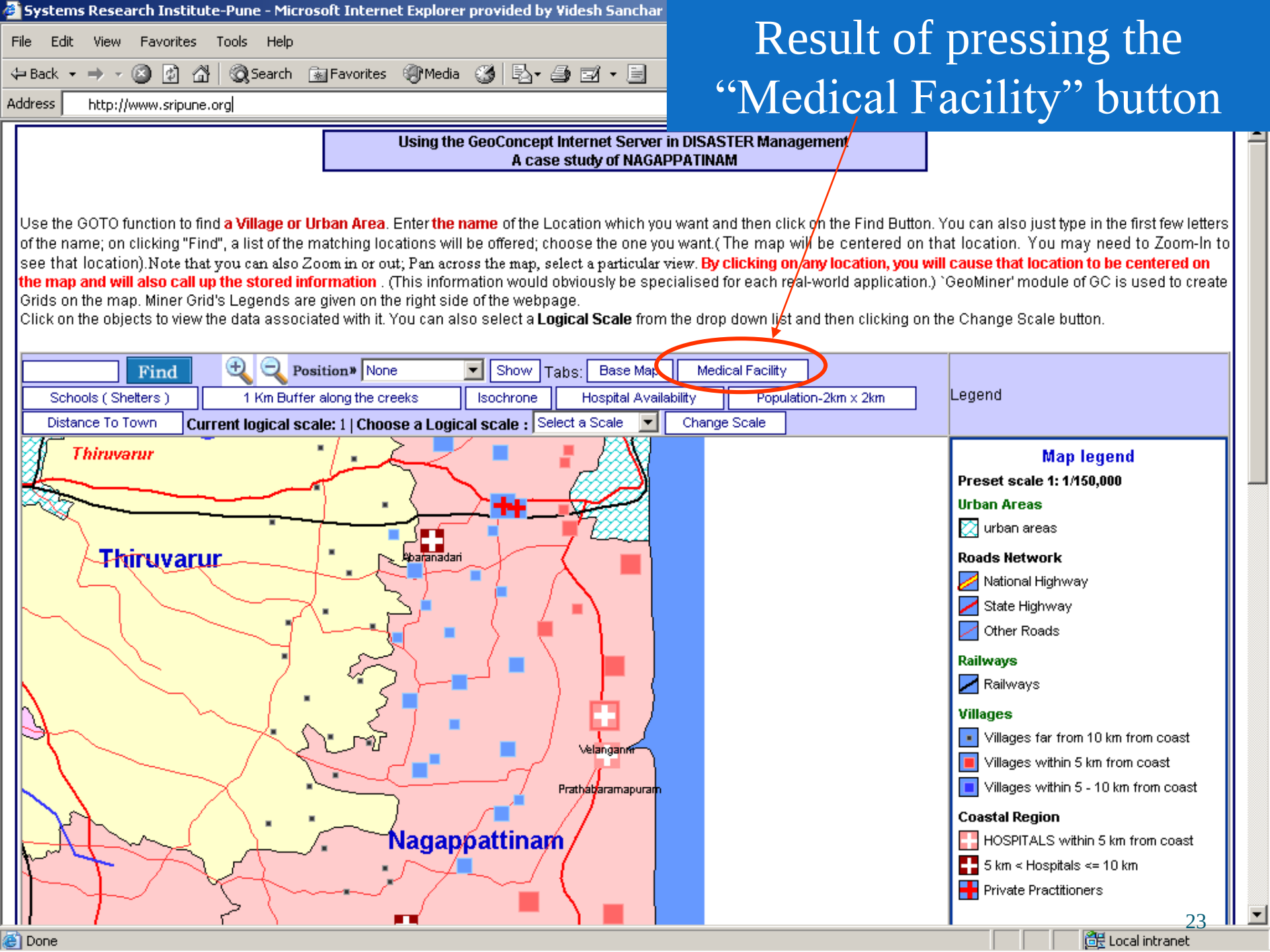
A 1 km Buffer Zone around Creeks / river beds; locations requiring study

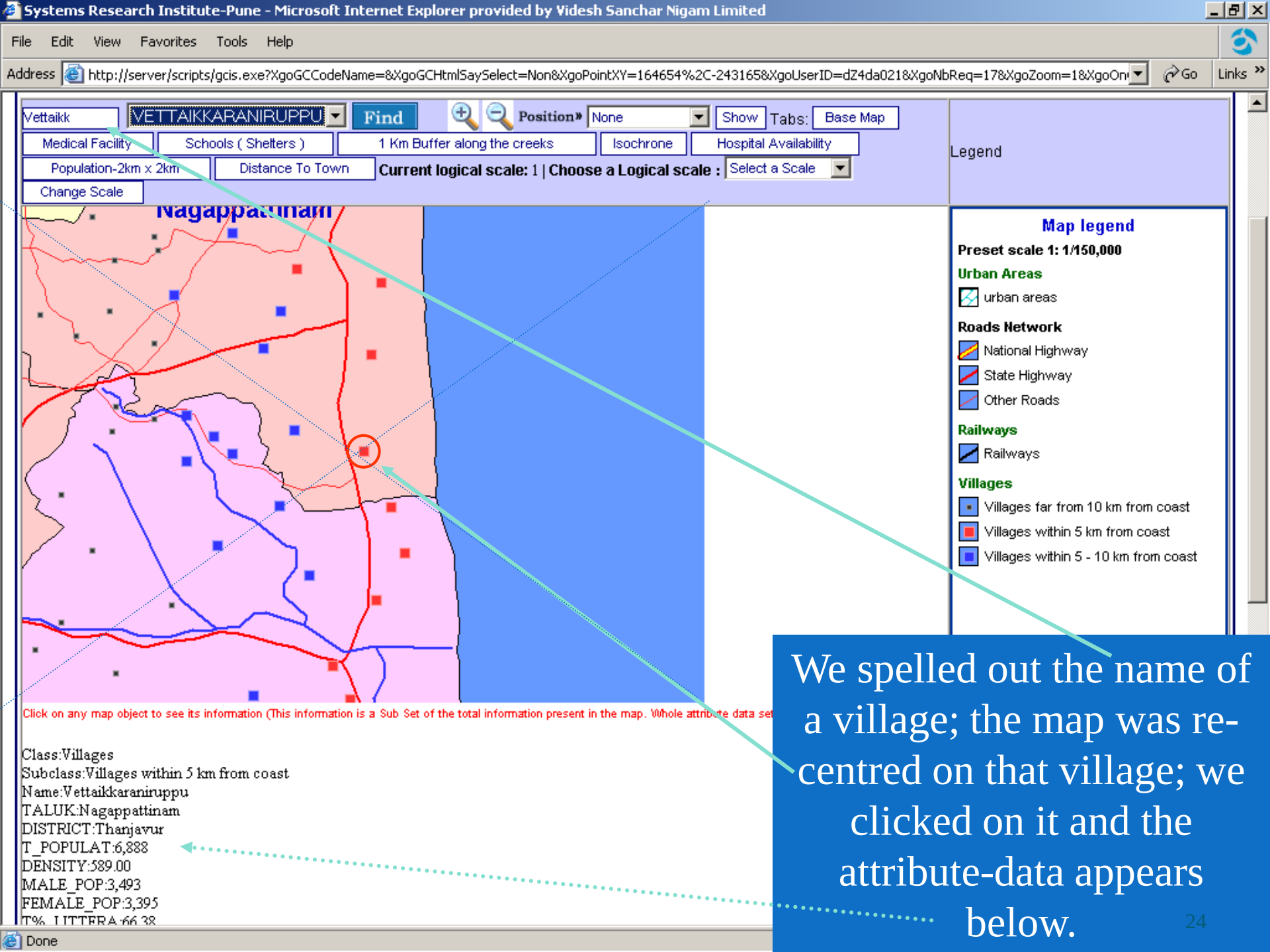



GeoConcept Expert - [Disaster Application_Nagappattinam]
File Edit Appearance Objects Data Miner Topology Geocoding Scripts Routing 3D Publisher Image Windows ?
<Create new position>
59 Villages are found to be in the 1 km x 12 km buffer up the river beds.
Kottucherry
Karaikal
5,434
Karaikal
Neravy
Kottamangalam
Tittacheri
Kattumavadi
Tittacheri
7,976
0
3 km
Villges in the buffer - Filtering on [Villages]
Name
T_POPULAT
Arunulithevan 632
Mela Athipadugai 371
Uliapathu 988
Kee a Athipadugai 057
Koozhomanai 470
Kottamangalam 1,971
Agaraputhakudy 367
Vadakattalai 154
Kottapakkam 196
Andoor 236
Kottagam 173
Komakavaly 269
Pulianthope 100
Kulakudy 236
Uttamachoapuram 1,468
amarapulam 1,552
Thirumalam 688
53 objects - 1 selected
1 Km Buffer along the creeks
Base Map
Major Villages
Medical Facility
Schools (Shelters)
Population-2km x 2km
Hospital Availability
59 objects selected
Scale 1/92,877
NUM
SCRL


Systems Research Institute-Pune - Microsoft Internet Expl
File Edit View Favorites Tools Help
Back Search Favorites
Address http://www.sripune.org
The base-map. Each button is labelled.
Clicking on it will bring up a specific map.
Using the GeoConcept Internet Server in DISASTER Management
A case study of NAGAPPATINAM
Use the GOTO function to find a Village or Urban Area. Enter the name of the Location which you want and then click on the Find Button. You can also just type in the first few letters of a list of the matching locations will be offered; choose the one you want.(The map will be centered on that location. You may need to Zoom-In to see that location).Note that you across the map, select a particular view. By clicking on any location, you will cause that location to be centered on the map and will also call up the stored information . (This inform specialised for each real-world application.) `GeoMiner' module of GC is used to create Grids on the map. Miner Grid's Legends are given on the right side of the webpage.
Click on the objects to view the data associated with it. You can also select a Logical Scale from the drop down list and then clicking on the Change Scale button.
Find
Position»
None
Show
Tabs:
Base Map
Medical Facility
Schools (Shelters)
1 Km Buffer along the creeks
Isochrone
Hospital Availability
Population-2km x 2km
Distance To Town
Current logical scale: 9 | Choose a Logical scale :
Select a Scale
Change Scale
Legend
Nagappattinam U.A.
hiruvarur
Thiruvarur
Nagappattinam
Map legend
Preset scale 9: 1/300,000
Urban Areas
urban areas
Roads Network
National Highway
State Highway
Other Roads
Railways
Railways
Villages
Villages far from 10 km from coast
Villages within 5 km from coast
Villages within 5 - 10 km from coast
Rivers
rivers
22
Done
Local intranet

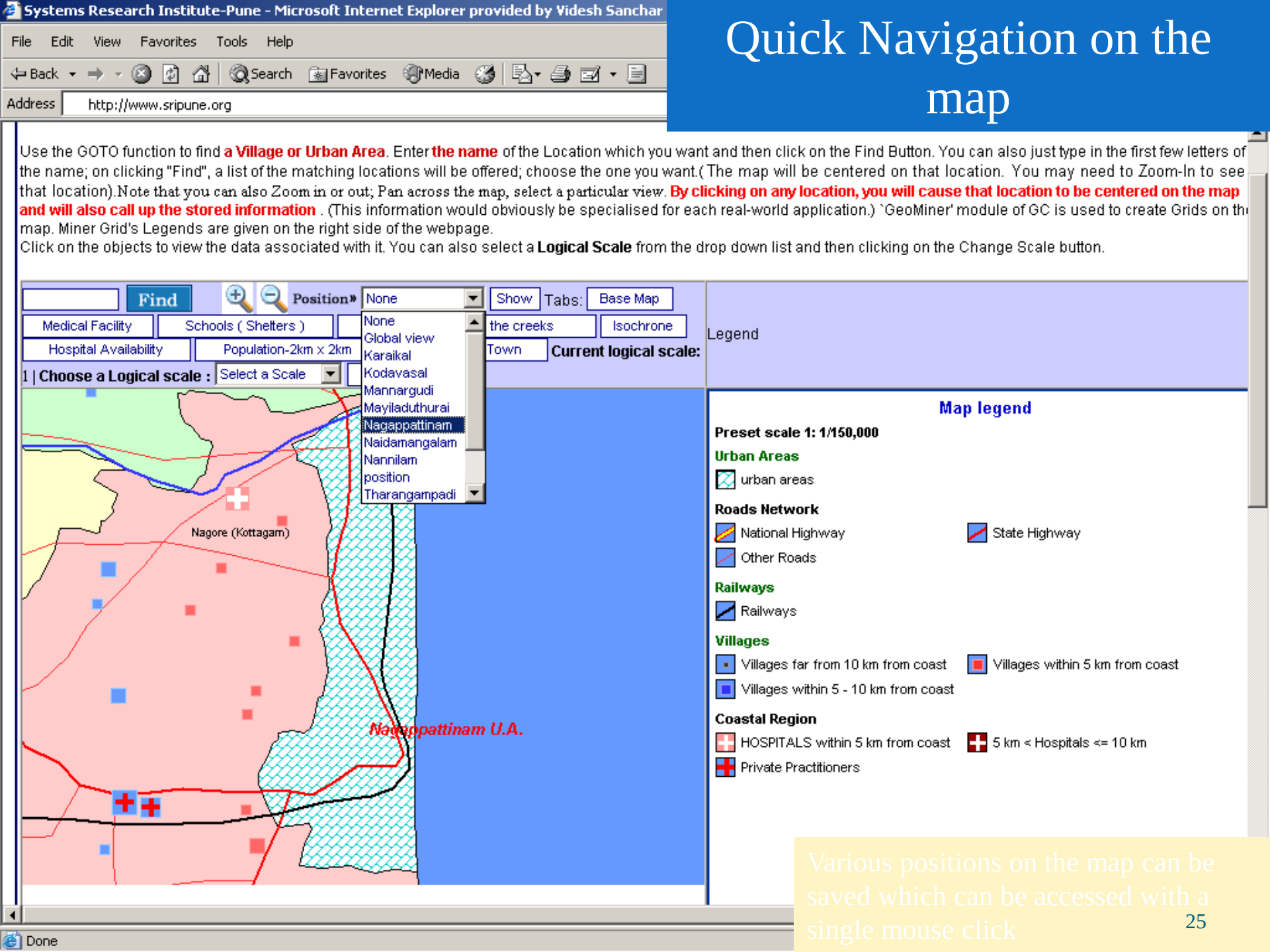
Result of pressing the "Medical Facility" button





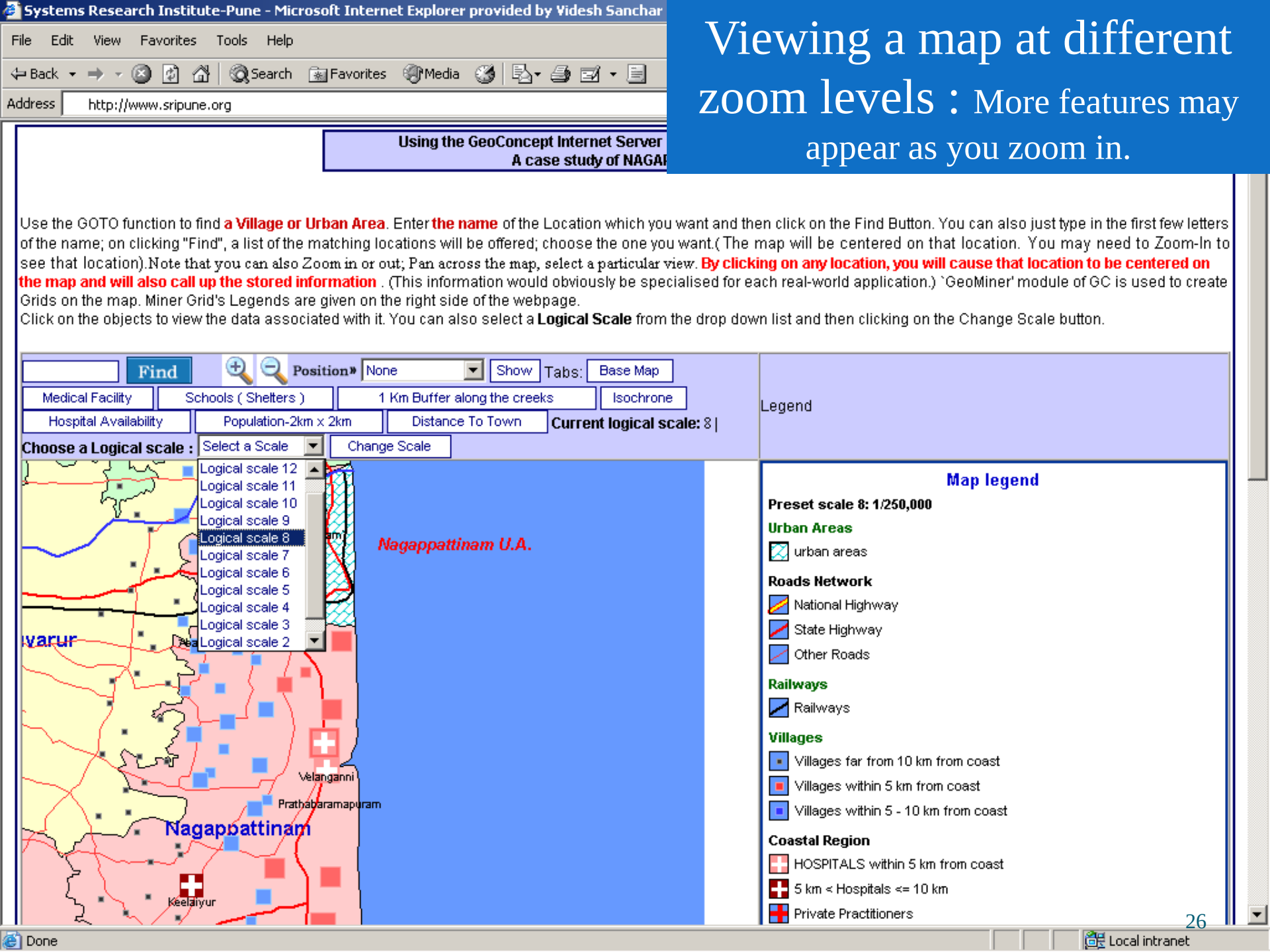
We spelled out the name of a village; the map was re-centred on that village; we clicked on it and the attribute-data appears below.

Quick Navigation on the map



Various positions on the map can be saved which can be accessed with a single mouse click

Viewing a map at different zoom levels : More features may appear as you zoom in.



Possible Shelters

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Address http://www.sripune.org Go Links

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Find | Position» None | Show | Tabs: Base Map

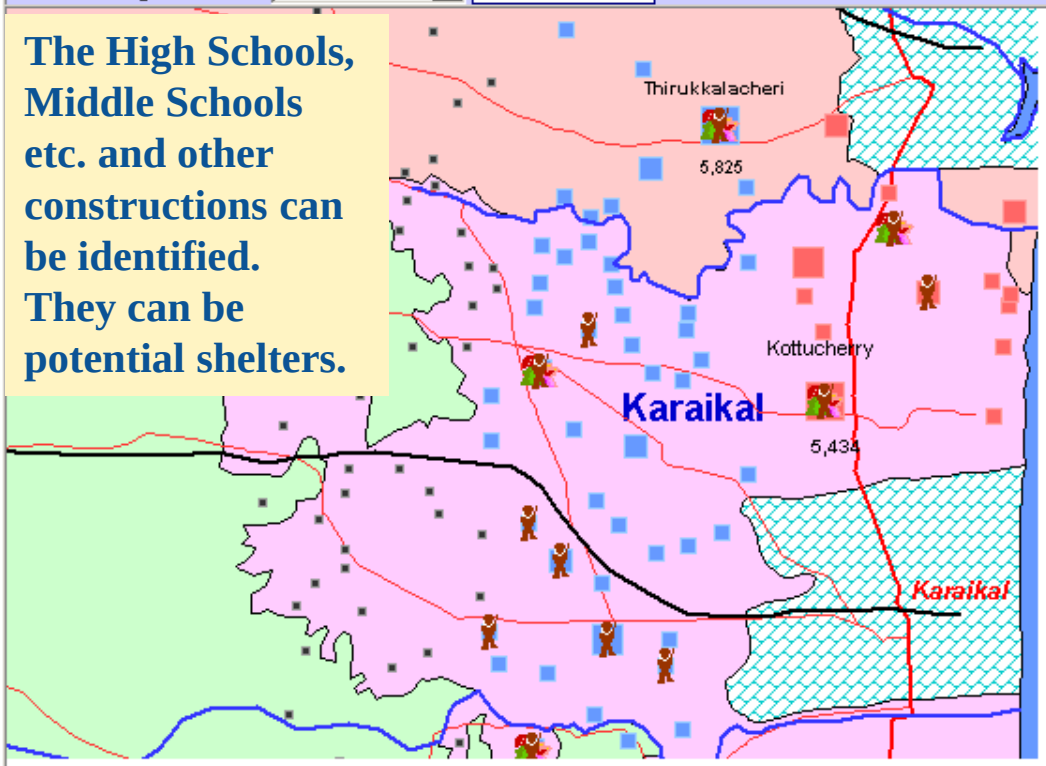
Medical Facility | Schools (Shelters) | 1 Km Buffer along the creeks | Isochrone

Hospital Availability | Population-2km x 2km | Distance To Town | **Current logical scale:** 1 |

Choose a Logical scale : Select a Scale | Change Scale

Legend

The High Schools, Middle Schools etc. and other constructions can be identified. They can be potential shelters.



Click on any map object to see its information (This information is a Sub Set of the total information present in the map. Whole attribute data set can also be displayed.)

Map legend

Preset scale 1: 1/150,000

Urban Areas
- urban areas

Roads Network
- National Highway
- State Highway
- Other Roads

Railways
- Railways

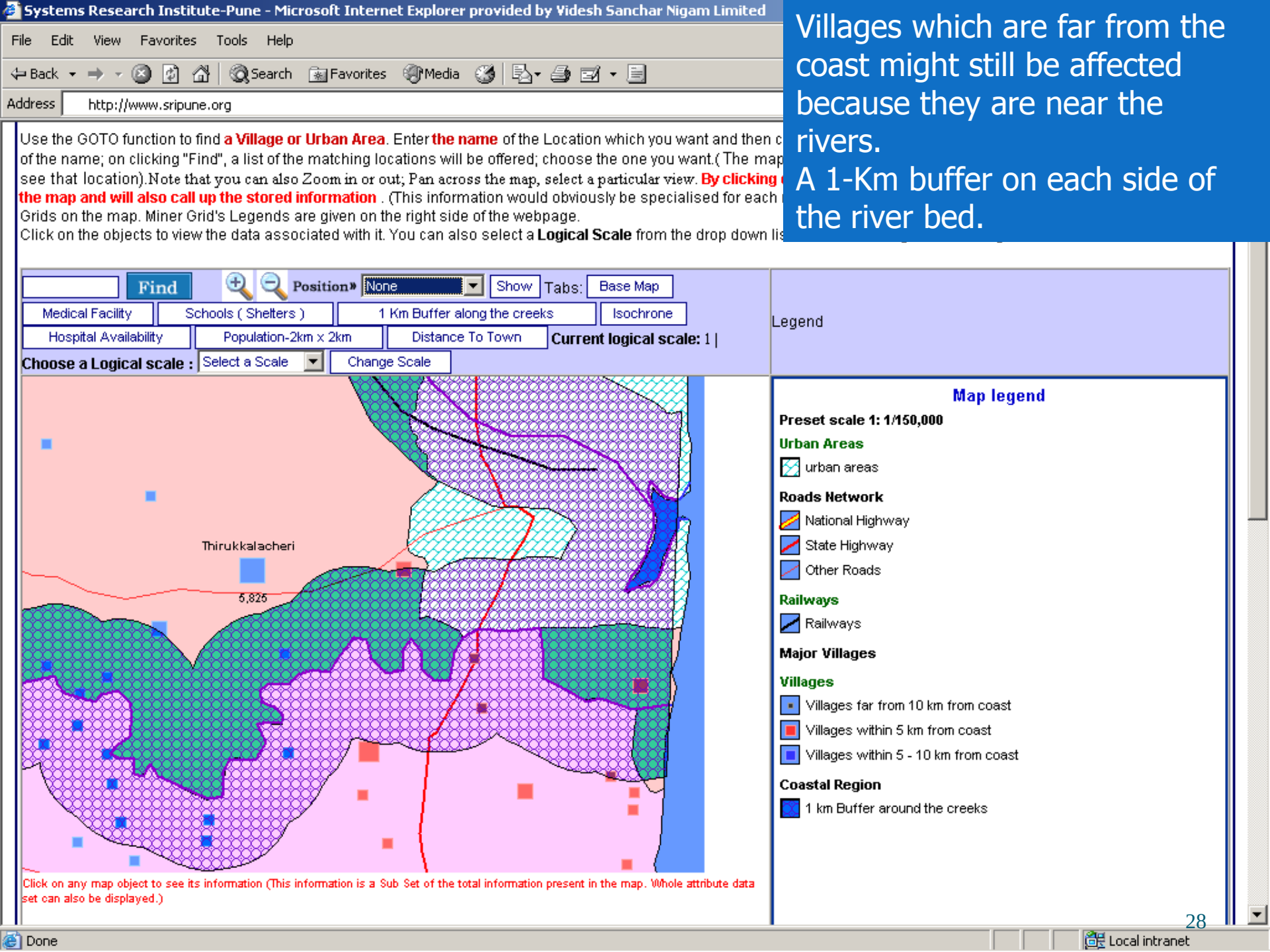
Major Villages

Villages
- Villages far from 10 km from coast
- Villages within 5 km from coast
- Villages within 5 - 10 km from coast

Coastal Region
- High Schools
- Middle Schools

Done Local intranet

Villages which are far from the coast might still be affected because they are near the rivers.
A 1-Km buffer on each side of the river bed.



Showing the **Population density** by using a Grid can be useful in identifying what are likely to be **the worst-affected areas**

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Click on the objects to view the data associated with it. You can also select a **Logical Scale** from the drop down list and then clicking on the Change Scale button.

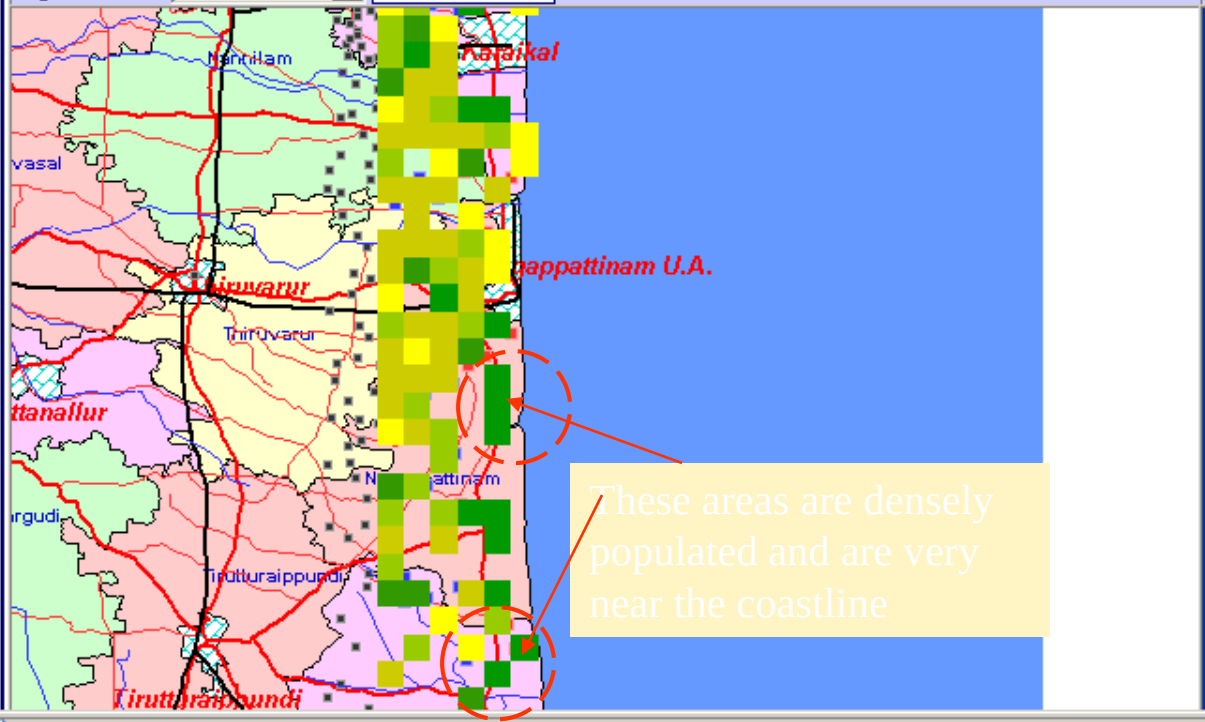
Find | Position» None | Show | Tabs: Base Map

Medical Facility | Schools (Shelters) | 1 Km Buffer along the creeks | Isochrone

Hospital Availability | Population-2km x 2km | Distance To Town | **Current logical scale:** 11 | **Choose a**

Logical scale : Select a Scale | Change Scale

Legend



Map legend

Preset scale 11: 1/550,000

Urban Areas
urban areas

Roads Network
National Highway
State Highway
Other Roads

Railways
Railways

Villages
Villages far from 10 km from coast
Villages within 5 km from coast
Villages within 5 - 10 km from coast

Population_2km x 2km
0 <= v < 1000
1000 <= v < 2000
2000 <= v < 3000
3000 <= v < 4000
4000 <= v <= 10852

Done Local intranet

- The slides shown are only a few examples of using GIS – especially WEB-GIS - in Disaster Management with special reference to Tsunami

- A similar case could be made for GIS-aided management of other natural disasters, such as **Earthquakes** and **floods**

THANKS