



Mapping Invasive Species

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APFSIN Goals

- 1) Raise awareness of invasive species throughout the Asia-Pacific region;
- 2) define and develop organizational structures;
- 3) build capacity within member countries and
- 4) develop and share databases and information.



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Objective

- Introduce GIS and Remote Sensing
- Elements of Mapping
- Open Source Software
- Application Examples



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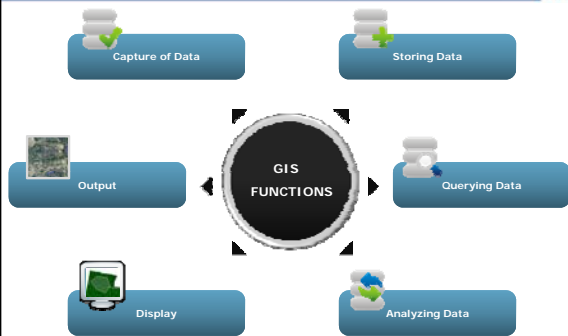
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GIS: Geographical Information Systems



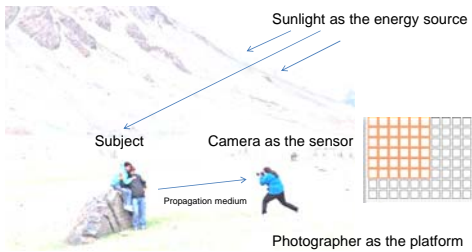
GIS Functions



Remote Sensing



Behind the Scene



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Remote Sensing

- Data Collection Mechanism



Airborne



Space borne



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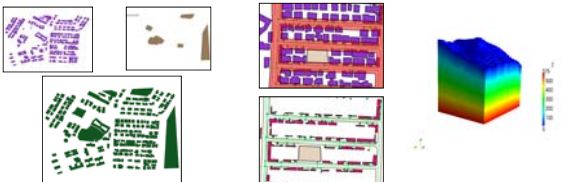
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Analysis

- Geographical Information Systems designed to deal with spatial variables
- Remote sensing data provides regional coverage
- Trends and relationships can be derived



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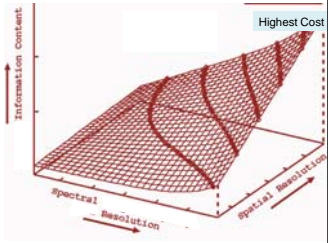
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Data Modeling

- High Spatial Resolution Data
- Hyper-spectral Data
- Temporal Resolution
- Seasonality



Invasives



By Ocean liners



Fire



Ornamental



Water

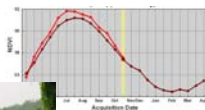


Animal



Mapping Elements

- Database of Previous Occurrences
- At risk areas
- Co-occurrence with other features



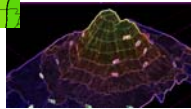
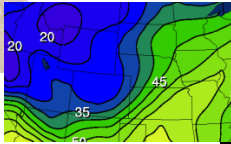
Archive Data

- GPS locations of Outbreaks
- Imagery Archive



Regions at risk

- Suitability Analysis



Co-Occurrence



Dominant



Understory



Clusters



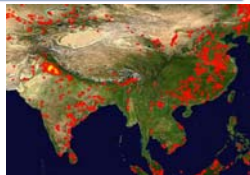
Identifying Invasive Species

- Cluster size
- Spectral signature
- Phenology (Flowering, Senescence, Growth)
- Causality



Causality

- Preceded by
 - Fire
 - Floods
 - Droughts
- Followed by
 - Loss of Canopy
 - Dropping branches
- Disappearance of Native Species



Before Flood



After Flood



Challenges in Mapping

- Cost
- Planning
- Execution



Remote sensing pitfalls

Satellite image:

- Many invasive species are indistinguishable from surrounding species
- Detection of understory species is impossible
- Invasive species can be detected only after they become dense and widespread

Aerial photo:

- Need extensive manual labour for processing
- Need skill and experience for the interpretation



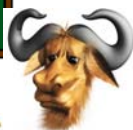
Remote Sensing Methods

- Kudzu – Fast growing
- Leafy Splurge – During flowering
- Salt Cedar /Tamarisk – Sizeable patches
- Cogon Grass – Large Patches
- Southern Pine Beetle – Large scale effects



Opensource Software

Open source is good for me. I will fully embrace it.
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Four basic freedoms (The Free Software Foundation)

- The freedom to run the program, for any purpose.
- The freedom to study how the program works, and adapt it to your needs.
- The freedom to redistribute copies with or without modifications.
- The freedom to improve the program, and release your improvements to the public, so that the whole community benefits.

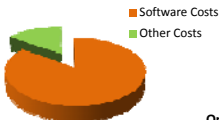


Free Software

“Free software” is a matter of liberty, not price.



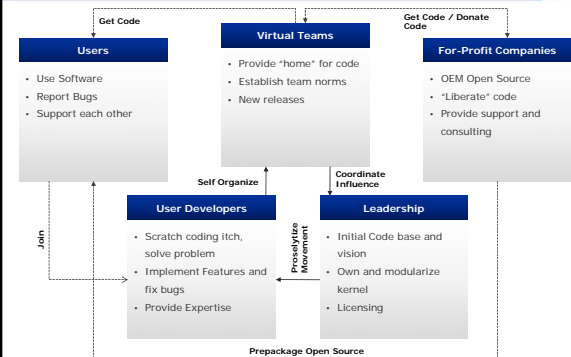
Proprietary Implementations



Open Source



How does Open Source Work?



Opensource GIS Matrix



Opensource vs Proprietary GIS

Functionality	Proprietary	FOSS GIS
Metadata Catalog	CubeWerx CRS	GeoNetwork, degree
GIS Viewer	ArcReader	QGIS, gvSIG, uDig, OpenJump
Cartography	ArcMap/ArcGIS	QGIS, GRASS
Analysis	ArcInfo/ArcGIS/ERDAS/ENVI	QGIS, GRASS, SAGA, ILWIS
Mobile	ArcPad	gvSIG Mobile
WebMapping	ArcGIS Server	MapServer, GeoServer, OpenLayers, Mapbuilder, Mapbender, Mapfish
Spatial Database	Oracle Spatial, ArcSDE	PostgreSQL/PostGIS, Spatial Lite, MySQL Spatial
Virtual Globe	Google Earth, Virtual Earth	OSSIM Planet, NASA WorldWind, Ratman
Spatial Libraries	FME	GDAL, OGR, PROJ4, GEOS, FDO

QGIS, GRASS, R

The screenshot displays the QGIS desktop environment. On the left, a map of India is shown with various administrative boundaries. In the center, the 'Processing' dialog box is open, showing a list of tools and their parameters. On the right, the R console window is active, displaying R code and the output of a histogram plot. The histogram shows a distribution of values, likely related to the spatial data being processed.

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Mapserver, Geoserver

SAME MapServer Demo Interface

The screenshot shows two web-based map services. On the left is the MapServer interface, displaying a topographic map of North America. On the right is the GeoServer interface, showing a street map of a city area. Both interfaces include navigation controls and metadata information. The GeoServer interface also shows a 'Layers' panel with a tree view of the available data layers.

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Mobile - gvSIG

The screenshot illustrates the gvSIG Mobile application. On the left, a view of the application interface is shown with five numbered red circles (1-5) highlighting key elements: 1. The application icon, 2. The main menu, 3. The map area, 4. The toolbar, and 5. The status bar. On the right, two screenshots show the application being started. The first shows the Windows Start menu with 'gvSIG Mobile' listed among the applications. The second shows the application's splash screen with the 'mobile' logo and the gvSIG logo.

A view of the gvSIG Mobile application

Starting the gvSIG Mobile application

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WHAT?

WHERE?

- Any -

Search

Reset Advanced Options

The free text field.

Default Search

List of Global Datasets

- SRTM <http://edcns17.cr.usgs.gov/NewEarthExplorer/>
- Waterbodies Geomorphological Research Group <http://gis.ess.washington.edu/data/vector/worldshore/index.html>
- Soils World Soil Information <http://www.isric.nl/NR/exeres/54580669-6743-402B-B79A-DBF57E9FA67F.htm>
- Protected Areas <http://www.protectedplanet.net/>
- Soil Moisture <http://soils.usda.gov/use/worldsoils/mapindex/smr.html> United States Department of Agriculture Natural Resources Conservation Service
- Fire Occurrence <http://maps.geog.umd.edu/firms/shapes.htm> FIRMS
- Temperature <http://neo.sci.gsfc.nasa.gov/Search.html> NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
- Landcover <http://neo.sci.gsfc.nasa.gov/Search.html?group=20> NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Invasive species monitoring institutes

- The Global Invasive Species Information Network (GISIN)
 - <http://www.gisinet.org/about.html>
- The Asia-Pacific Forest Invasive Species Network (APFISN)
 - <http://www.apfisin.net/>
- Midwest Invasive Plant Network (MIPN)
 - <http://mipn.org/>
- The European Network on Invasive Alien Species (NOBANIS)
 - <http://www.nobanis.org/>
- Caribbean Invasive Alien Species Network (CIASNET)
 - <http://www.ciasnet.org/>



- Create Archives
- Resources focused on data collection/processing rather than Software
- Modeling Spread and Risk
- Crowd sourcing



Thank you

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