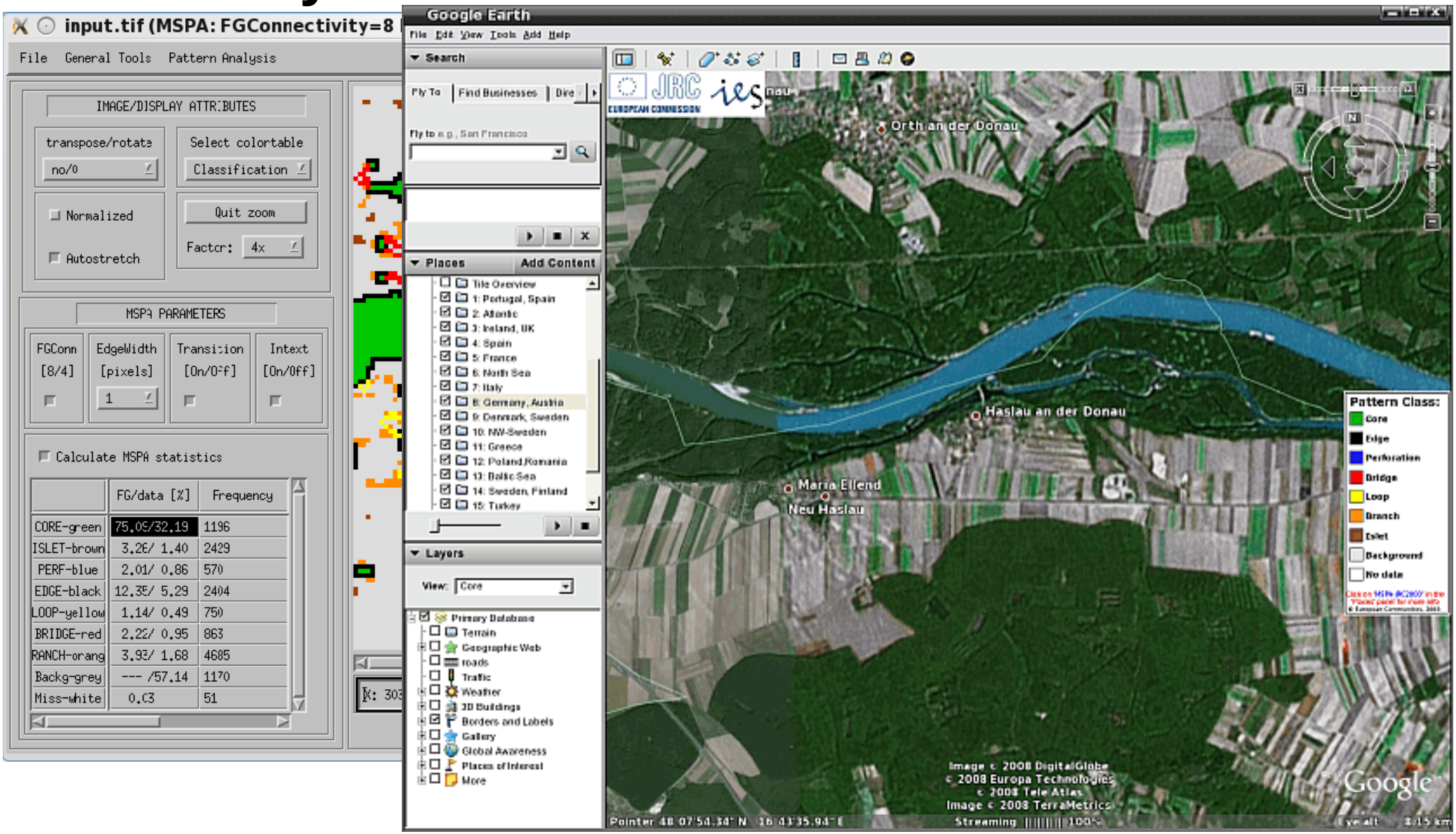
MSPA-GUIDOS: Innovative methods in landscape pattern analysis

From analysis…

to end-user products

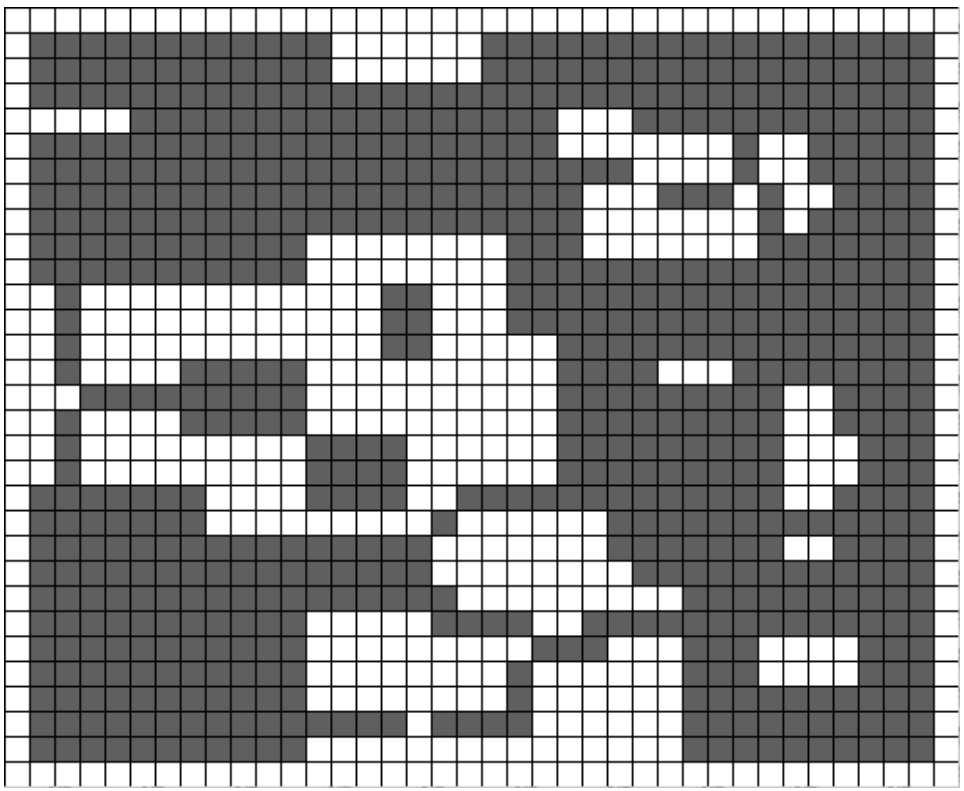


Peter Vogt, European Commission, JRC, IES

Morphological Spatial Pattern Analysis (MSPA)

- Generic, scale-independent pixel-level analysis
- Automated description of pattern and connectivity

MSPA: →



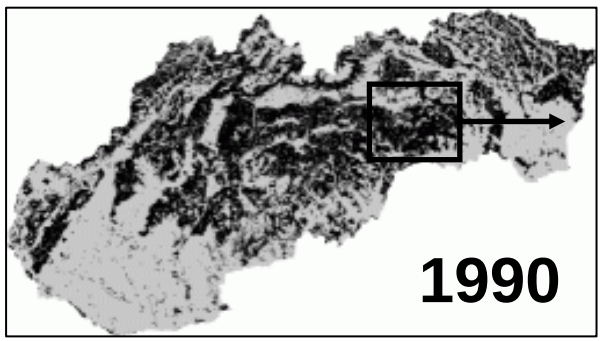
Segmentation of a binary mask

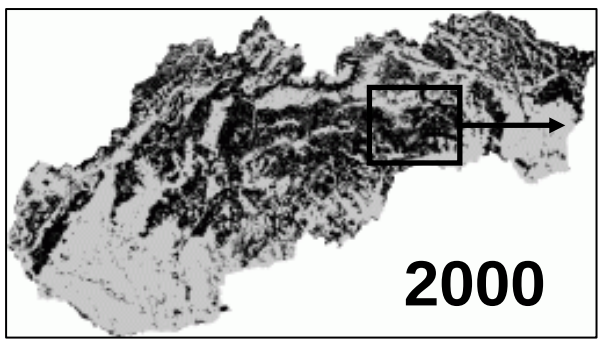
- CORE: interior area
- ISLET: isolated small object
- LOOP: connects same core
- BRIDGE: connects different cores
- PERFORATION: interior perimeter
- EDGE: external perimeter
- BRANCH: perimeter extension

Spatial Pattern: FRAGSTATS

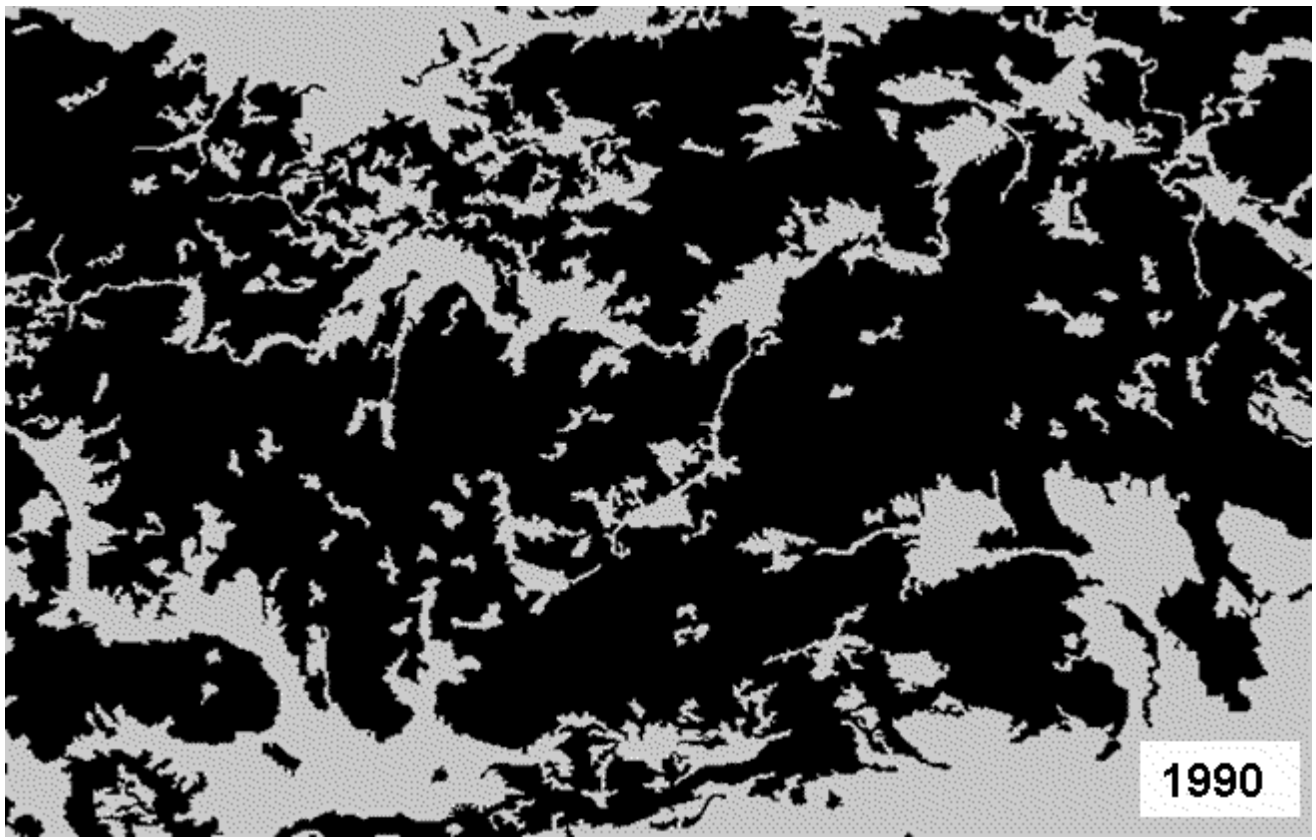
FRAGSTATS: 100+ statistical parameters

Slovakia: 'Average Patch Size' & 'Total Forest Area' = constant





constant !?



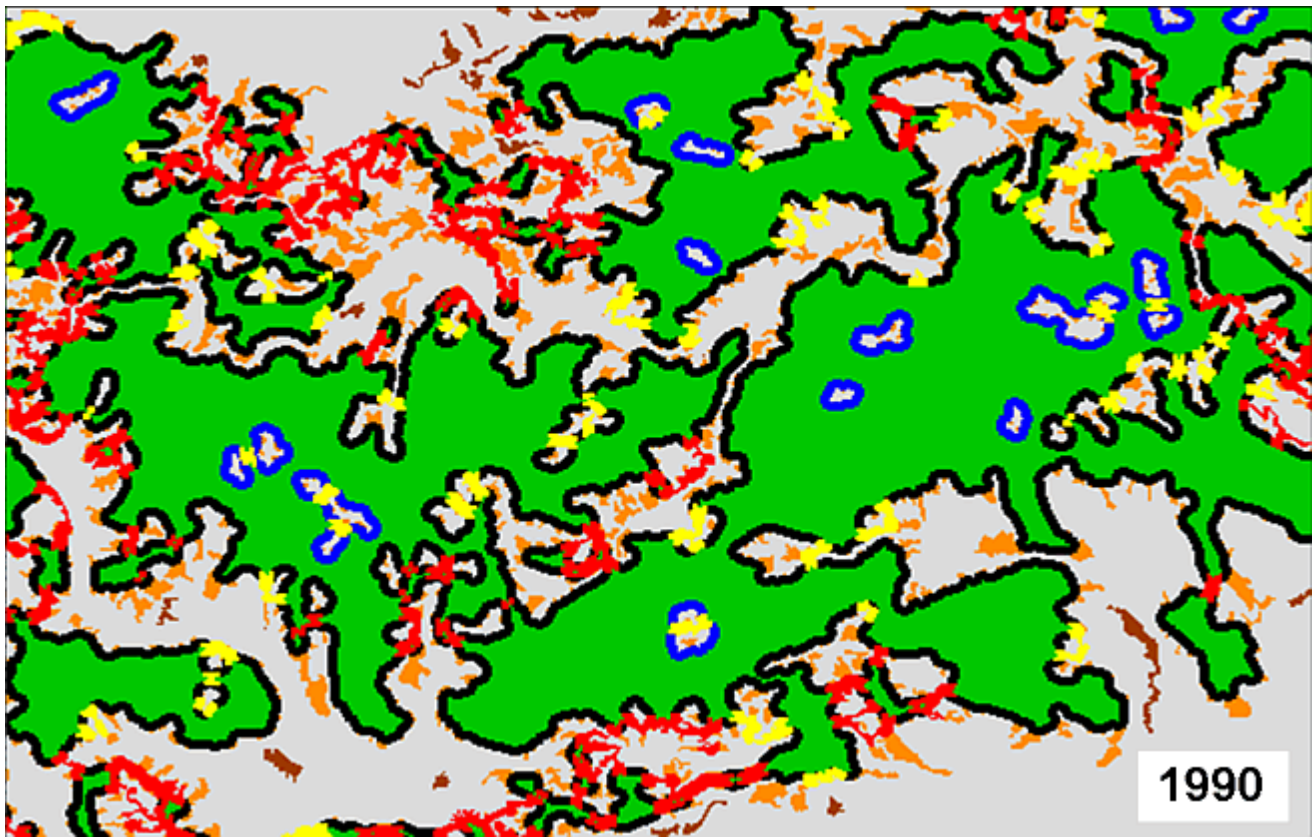
Pro: **some meaningful statistics, widely accepted**

Con: **interdependent, non-intuitive for pattern analysis**

Spatial Pattern: MSPA

MSPA: **7 classes:**

Core*, *Islet*, *Perforation*, Edge, *Branch*, *Loop*, *Bridge



New: **reliable statistics, intuitive map product, user-driven and flexible analysis, internal/external, connectivity**

Morphological segmentation of binary patterns (Soille & Vogt, Pattern Recognition Letters (2009) 30:456–459)

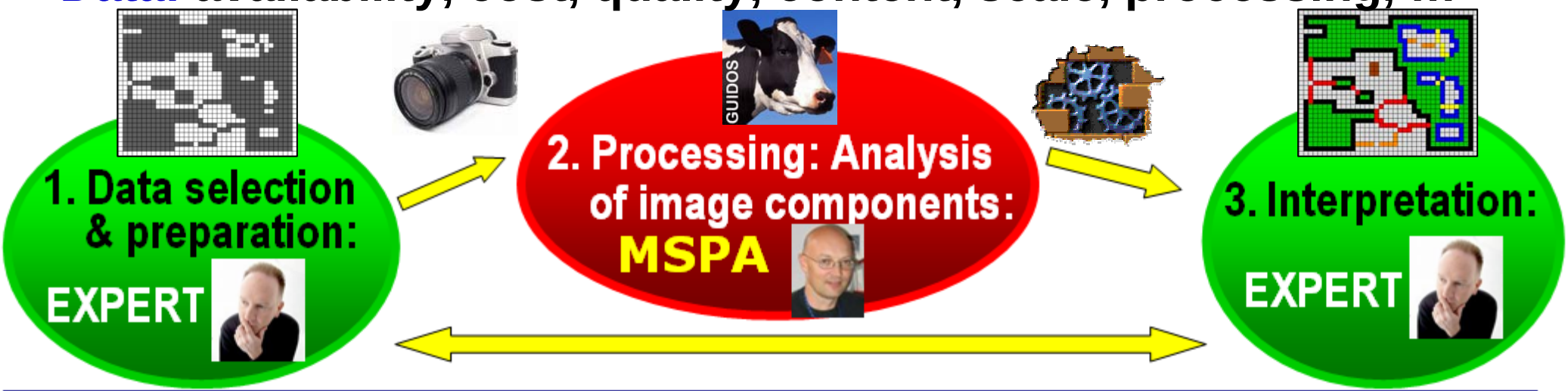
Why Spatial Pattern ?

Vogt: Guidos-MSPA, ECONNECT workshop, 2009/11/05

Functional Ecological Processes

Structural Spatial Pattern (SP)

Very complex system & very different fields of interests/issues for:
- **Understanding:** natural-human processes, economics/biodiv., …
- **Users:** industry, science, management, politics, …
- **Data:** availability, cost, quality, content, scale, processing, …

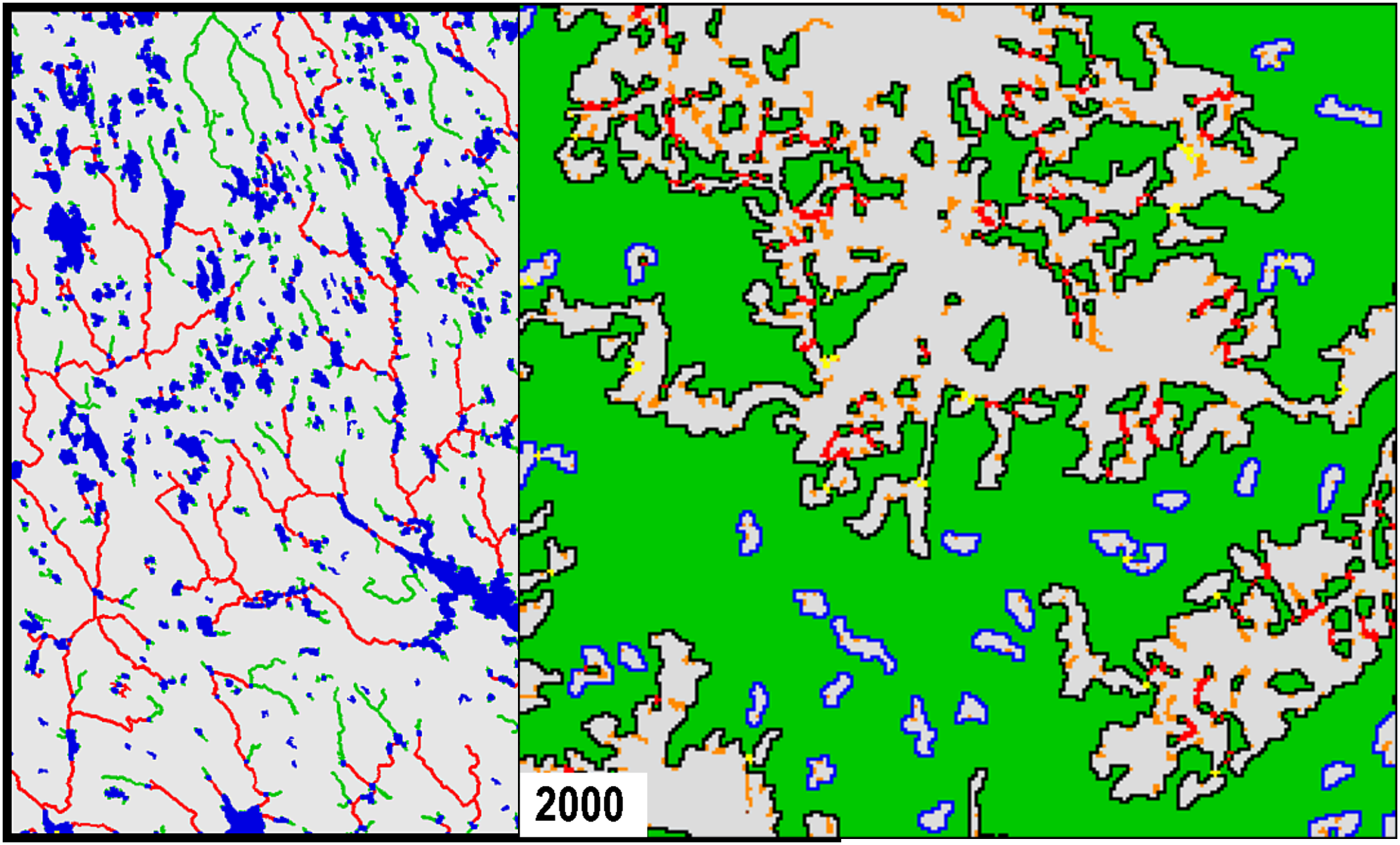


Aim: Toolbox for a generic description of spatial pattern

MSPA: structural pattern…

Rivers & wetlands…

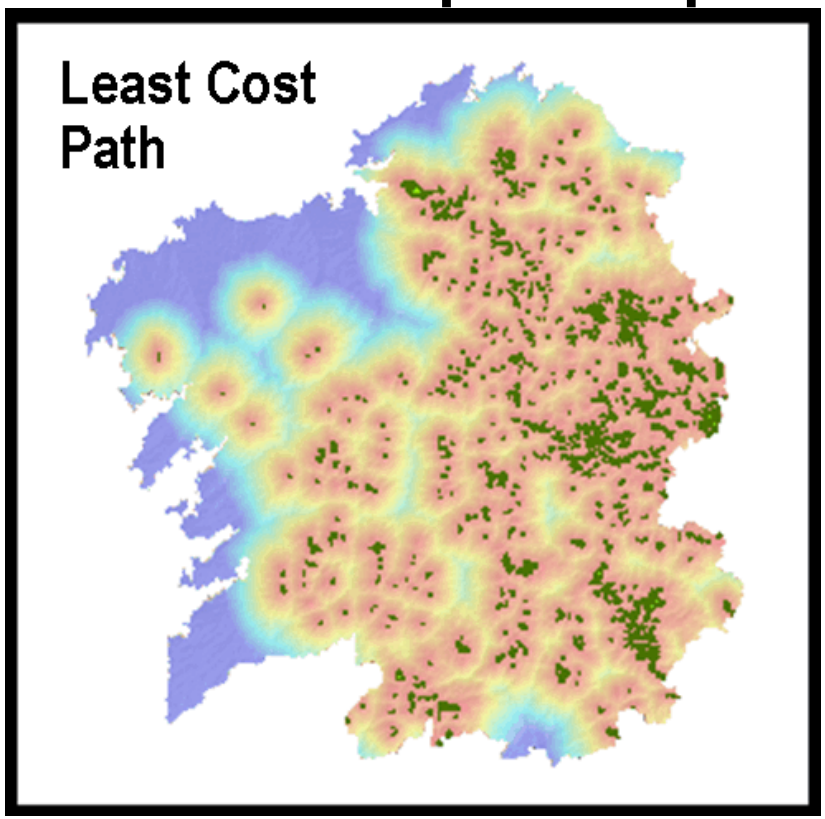
Forest decline…



MSPA: functional connectivity…

Vogt: Guidos-MSPA, ECONNECT workshop, 2009/11/05

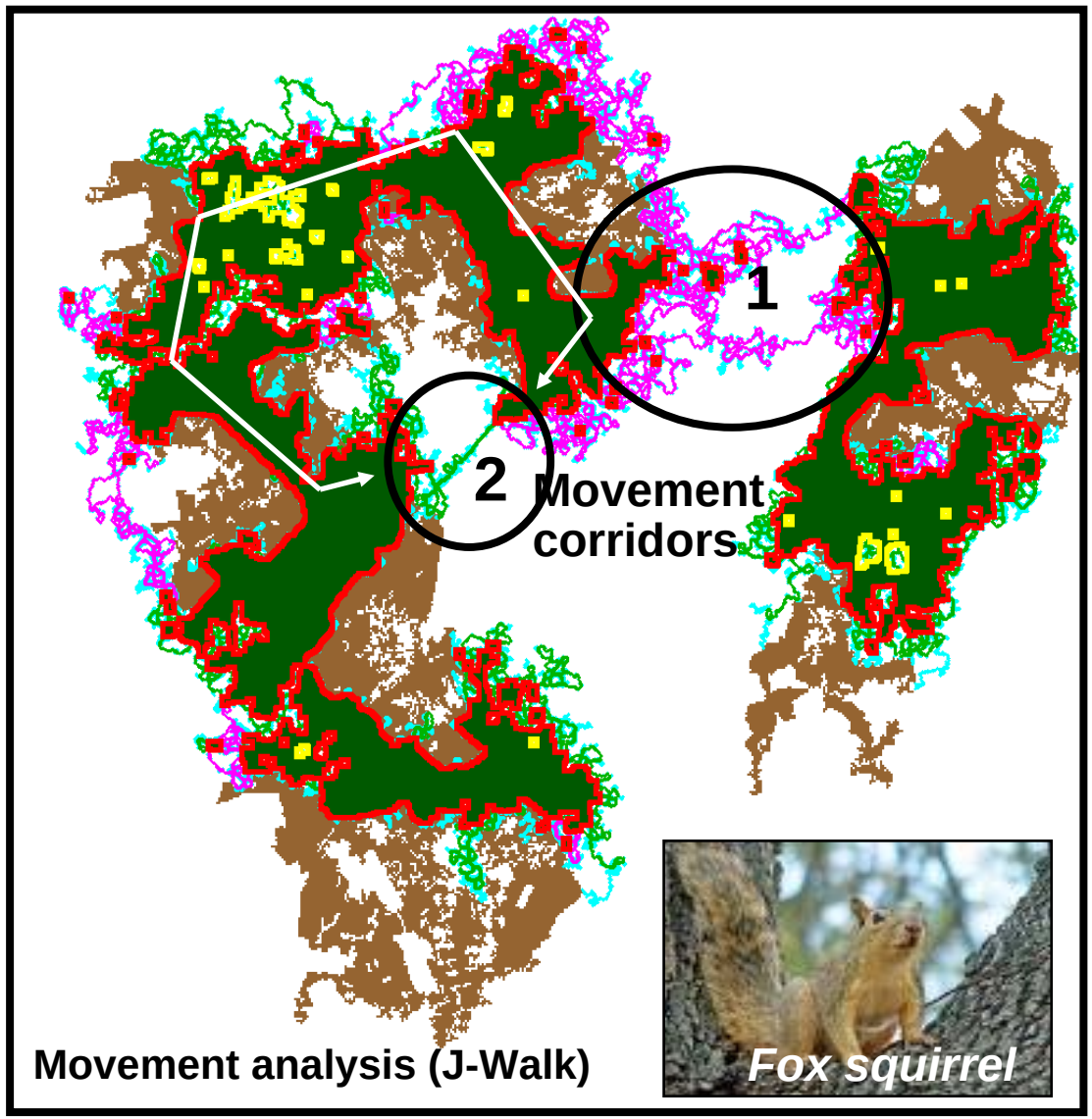
Pattern frequency on a least cost path map



Rodriguez et al., IUFRO-IALE Chengdu, 2008

Mapping functional connectivity
(Vogt et al., Ecol. Indicators (2009) 9:64-71)

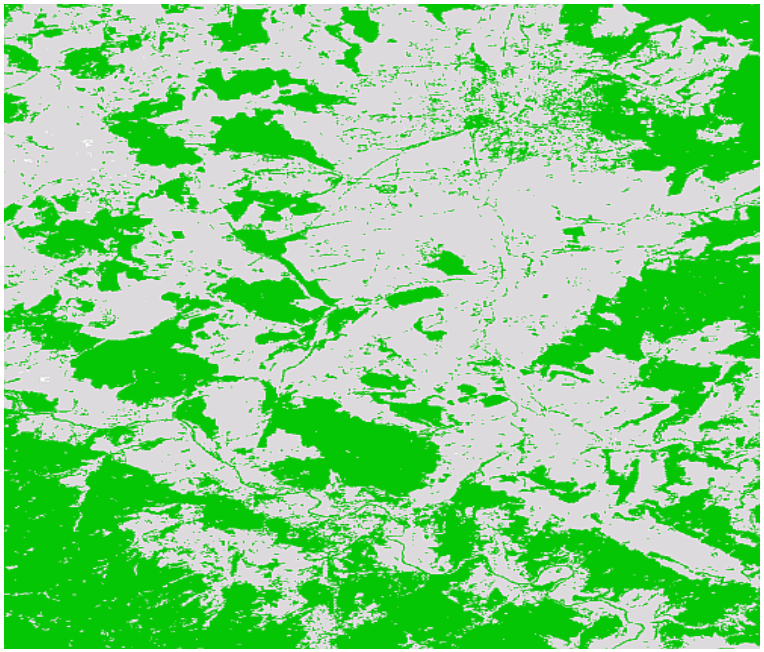
Patterns of species movement

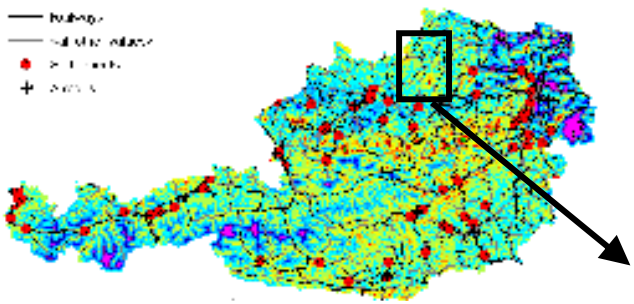


University of Maryland Center for Environmental Science
APPALACHIAN LABORATORY

Forest Compactness

Vogt: Guidos-MSPA, ECONNECT workshop, 2009/11/05



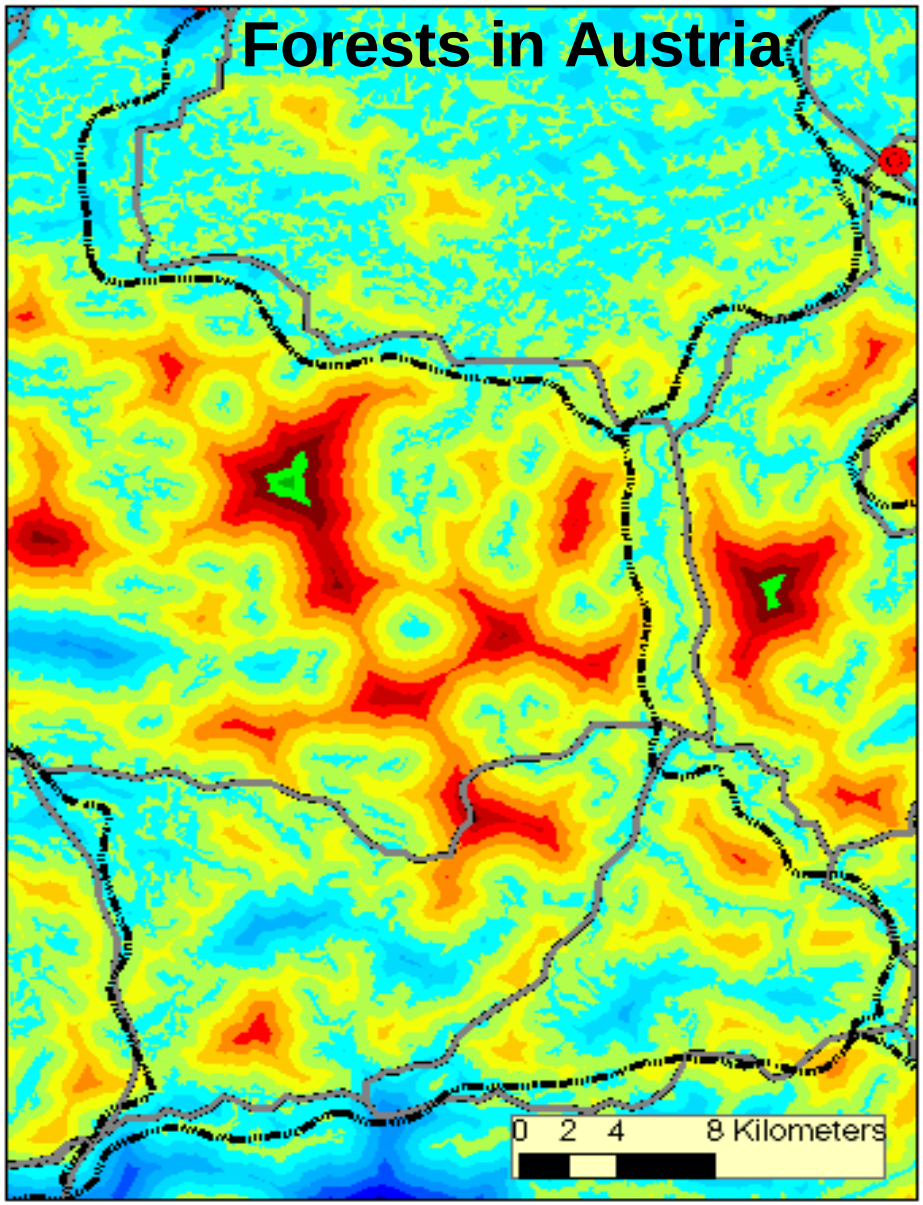


Railways

Roads

Settlements

Airports



Depth [m]

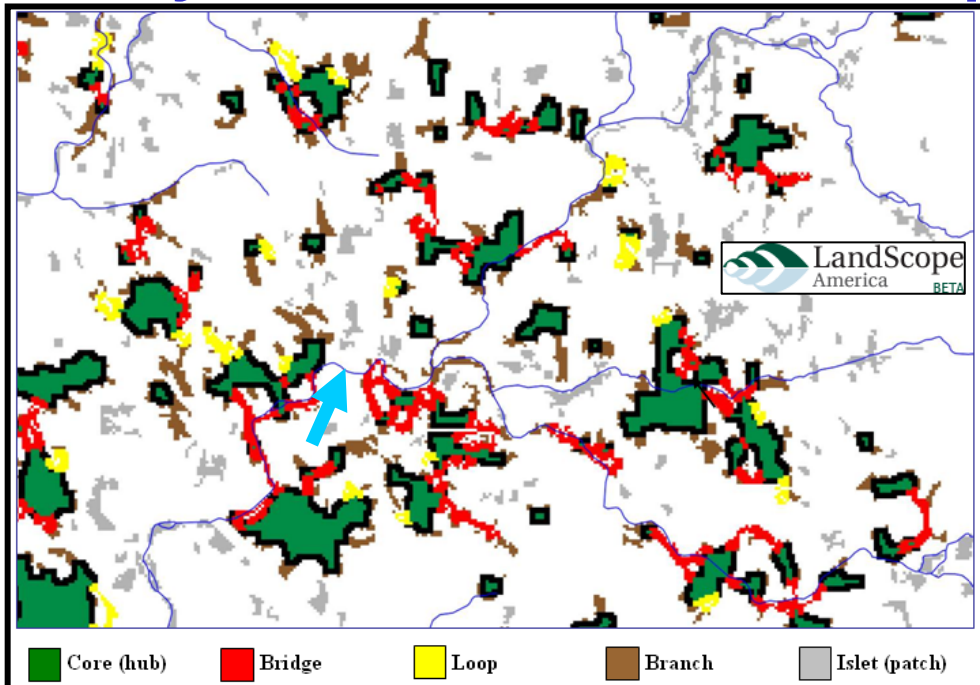
- [4500 → 5000]
- [4000 → 4500]
- [3500 → 4000]
- [3000 → 3500]
- [2500 → 3000]
- [2000 → 2500]
- [1500 → 2000]
- [1000 → 1500]
- [500 → 1000]
- [0 → 500]
- −[0 → 500]
- −[500 → 1000]
- −[1000 → 1500]
- −[1500 → 2000]
- −[2000 → 2500]
- −[2500 → 3000]
- −[3000 → 3500]
- −[3500 → 4000]
- −[4000 → 4500]
- −[4500 → 5000]

Average distance fore-/background (adf/adb): 5.9/5.2 *500m

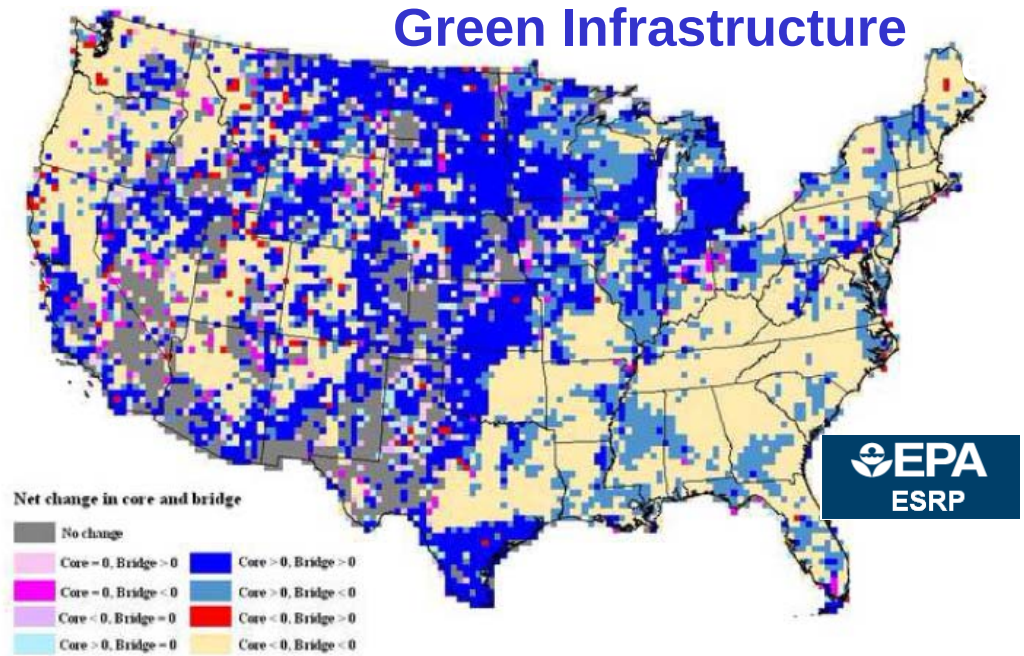
MSPA: US - EPA

Vogt: Guidos-MSPA, ECONNECT workshop, 2009/11/05

Analyze conservation, landscape planning, ecosystem services.



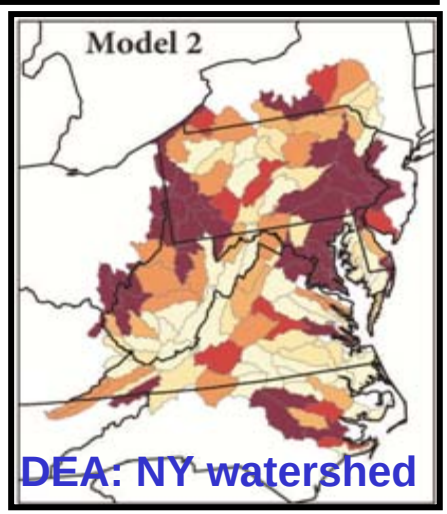
Conservation, restoration, water quality



Wickham et al. (2010): US GI Assessment, in print

Application fields:

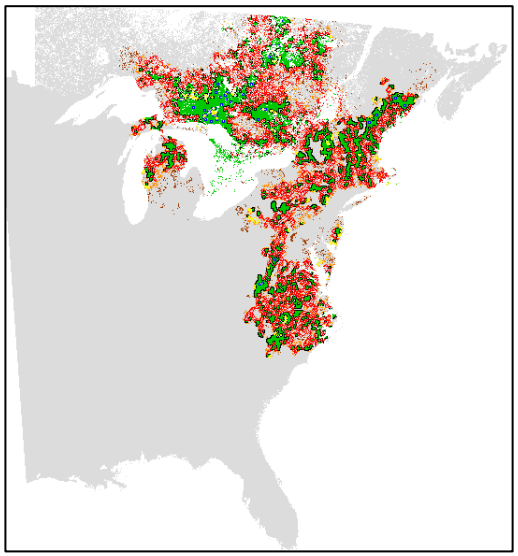
- MSPA + GIS: maximize benefits, land trusts in guiding land purchase, urban growth.
- Data Envelopment Analysis (DEA): evaluate efficiency of decision making units.



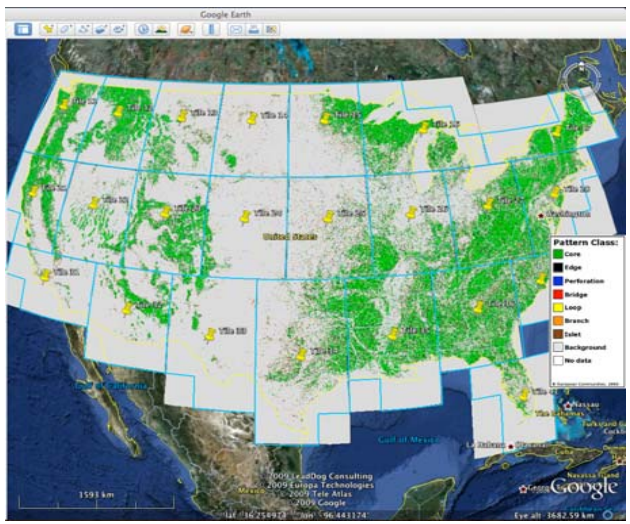
DEA: NY watershed

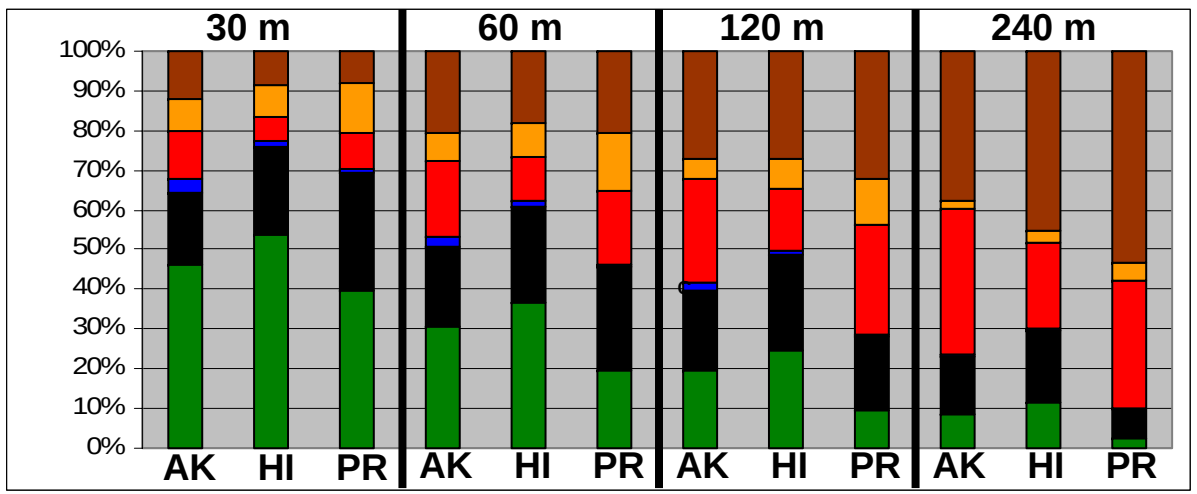
MSPA: US - Forest Service

Vogt: Guidos-MSPA, ECONNECT workshop, 2009/11/05



Disease spread: disease/alien species spread models simulate infection/spread scenarios. MSPA: detect narrow pathways to combat spread, evaluate costs and efficiency using simulation models & including ancillary data sources



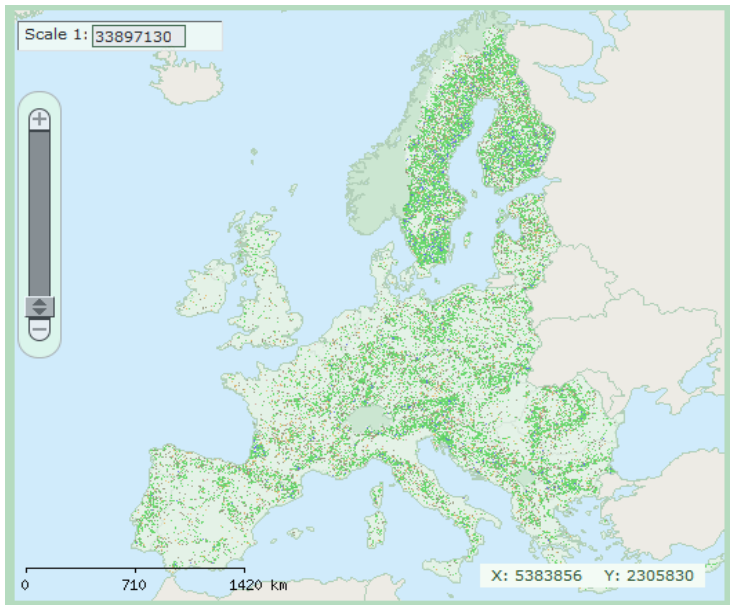


Forest/Grassland: f(edge width, State), data source: 2001 NLCD.

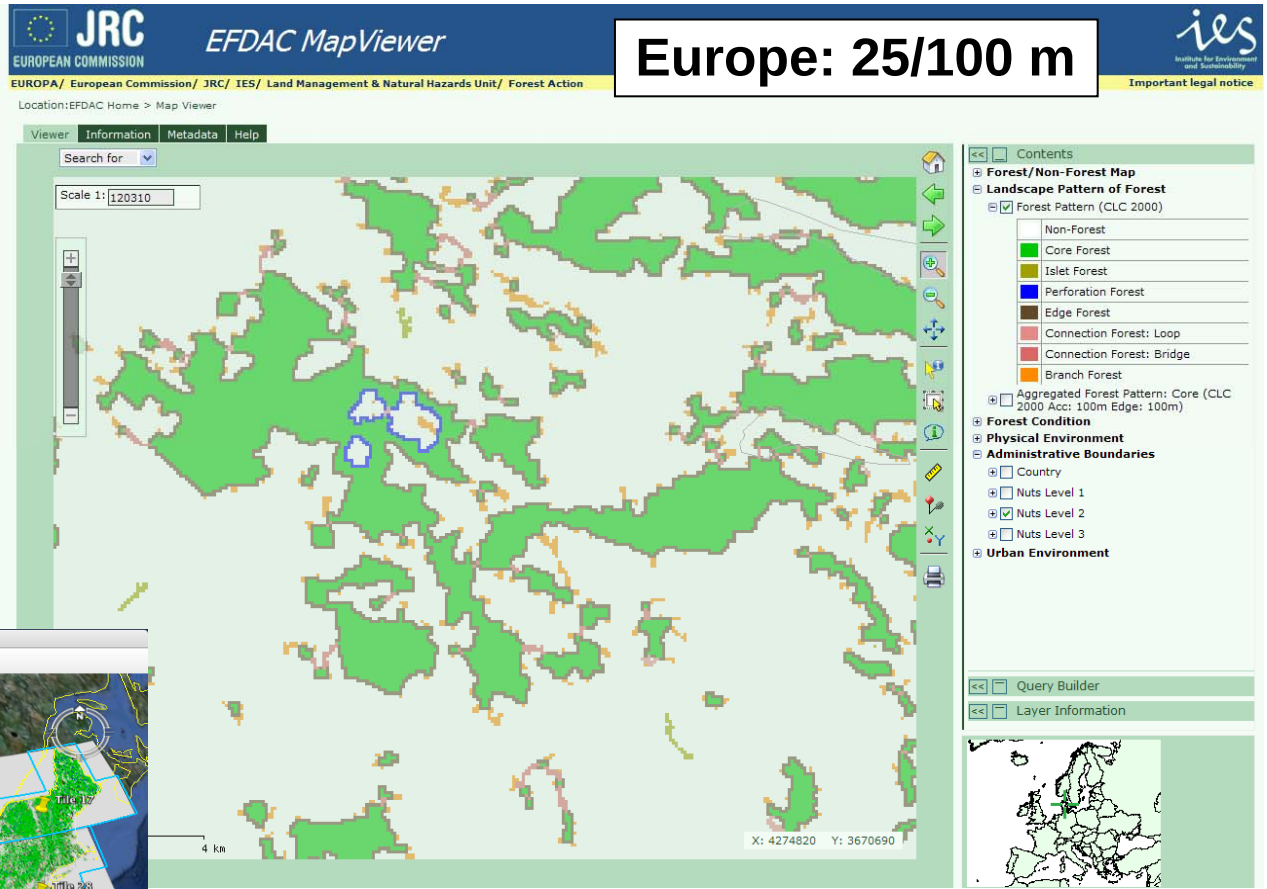
Riitters, K. 2009: Landscape Pattern and Context of Forest and Grassland in Alaska, Hawaii, and Puerto Rico. In: Potter, K (ed), Forest Health Monitoring National Techn. Report 2009. US Forest Service, Southern Research Station, in preparation.

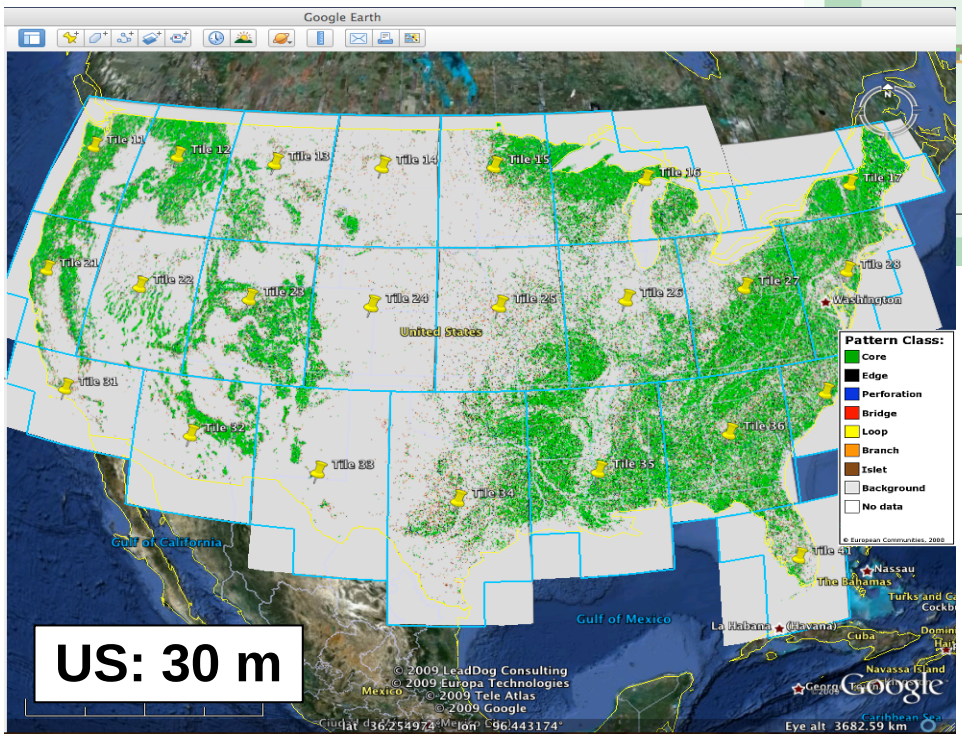
MSPA: maps & statistics

Vogt: Guidos-MSPA, ECONNECT workshop, 2009/11/05

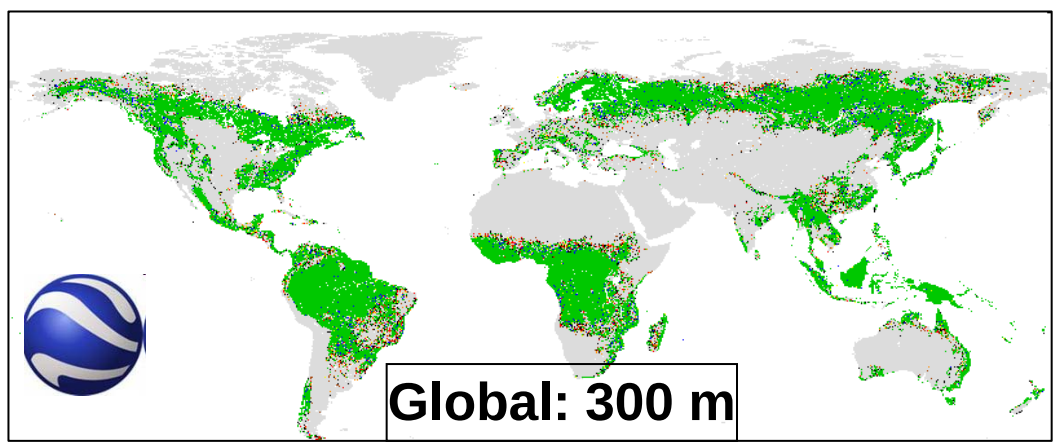


Europe: 25/100 m





US: 30 m



Global: 300 m

GUIDOS: MSPA products

Vogt: Guidos-MSPA, ECONNECT workshop, 2009/11/05

European Commission
Joint Research Centre
Institute for Environment and Sustainability

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Forest Data and Information Systems

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DATA

Please select one of the following links to access full resolution datasets or Google Earth overlays produced by the Forest Action at the JRC:

Forest *Cover Maps*

European Forest cover maps derived from high resolution satellite data.

MSPA *Pattern Maps*

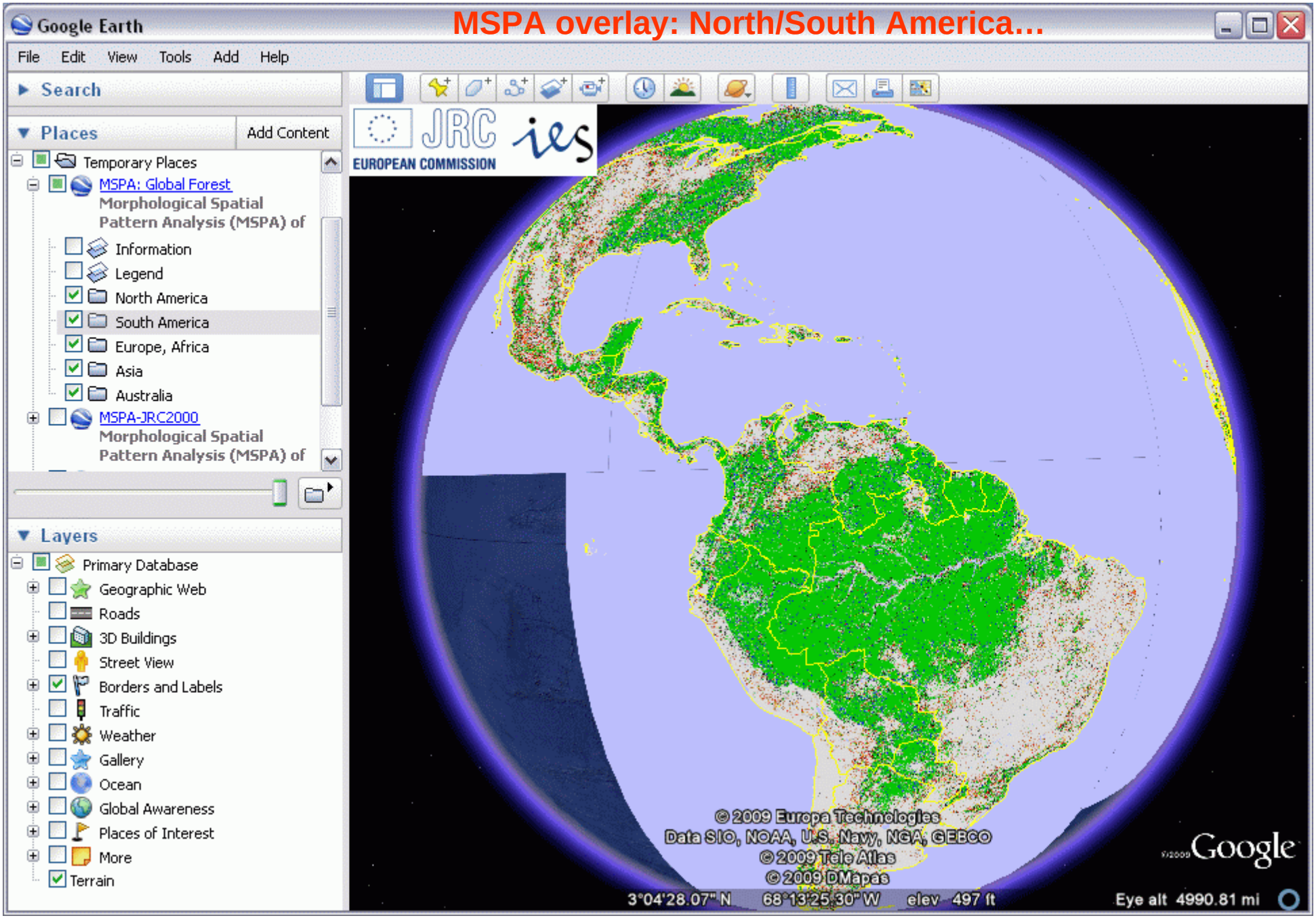
Morphological Spatial Pattern (MSPA) maps based on the Forest Cover maps.

Google Earth *Overlays*

Overlays of Forest Cover and MSPA maps for display in Google Earth.

MSPA: global forest (300m)

Vogt: Guidos-MSPA, ECONNECT workshop, 2009/11/05



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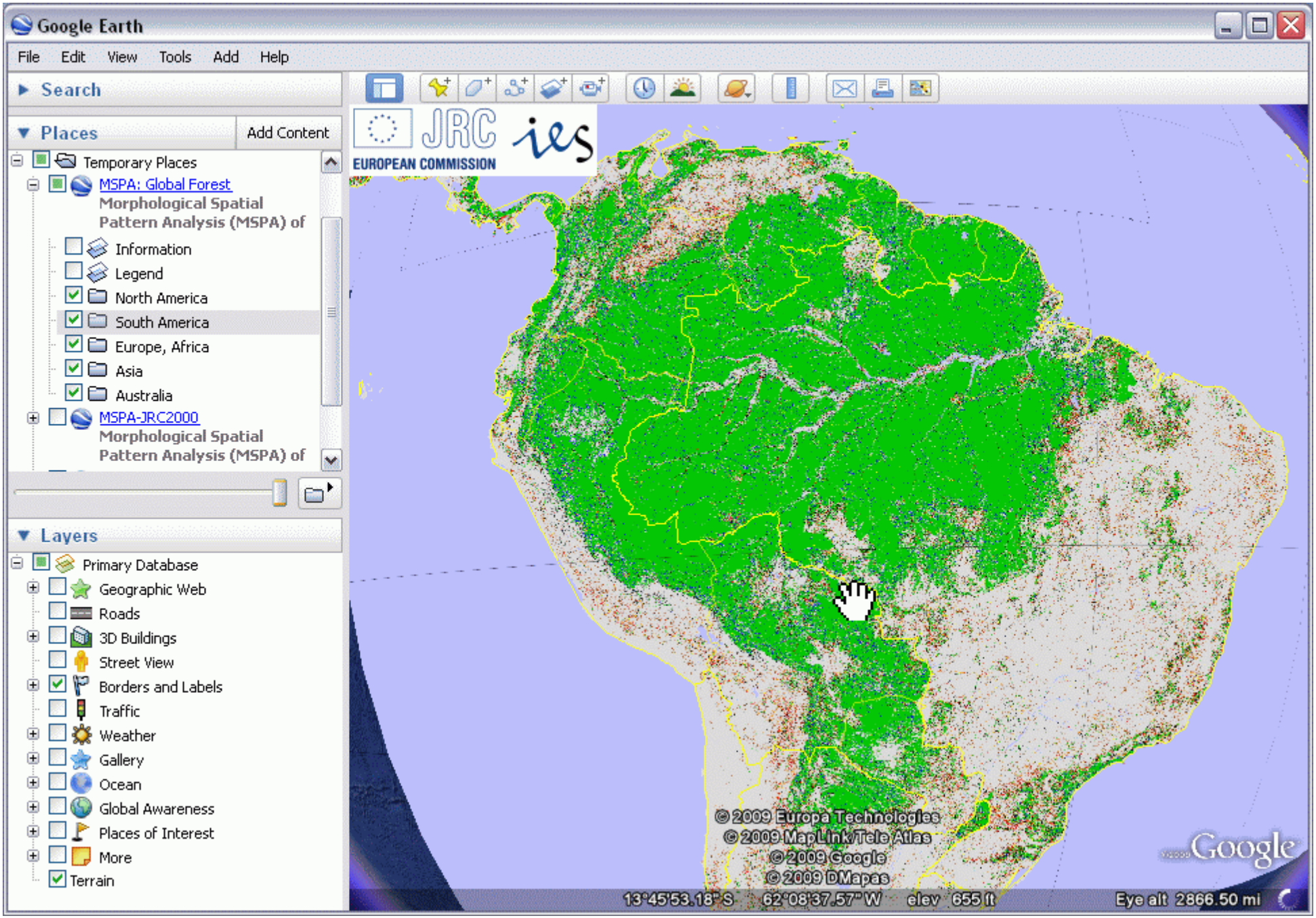

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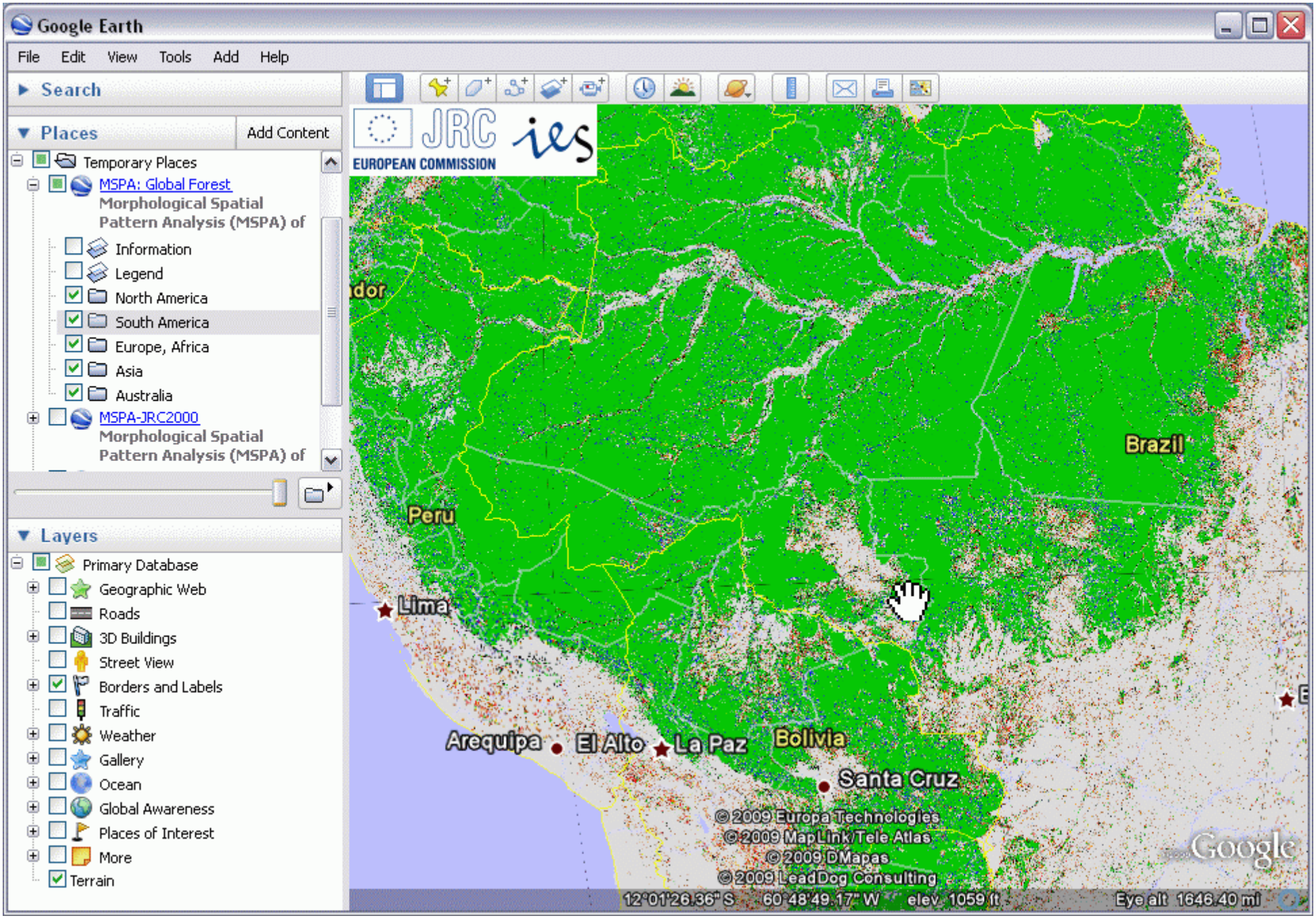

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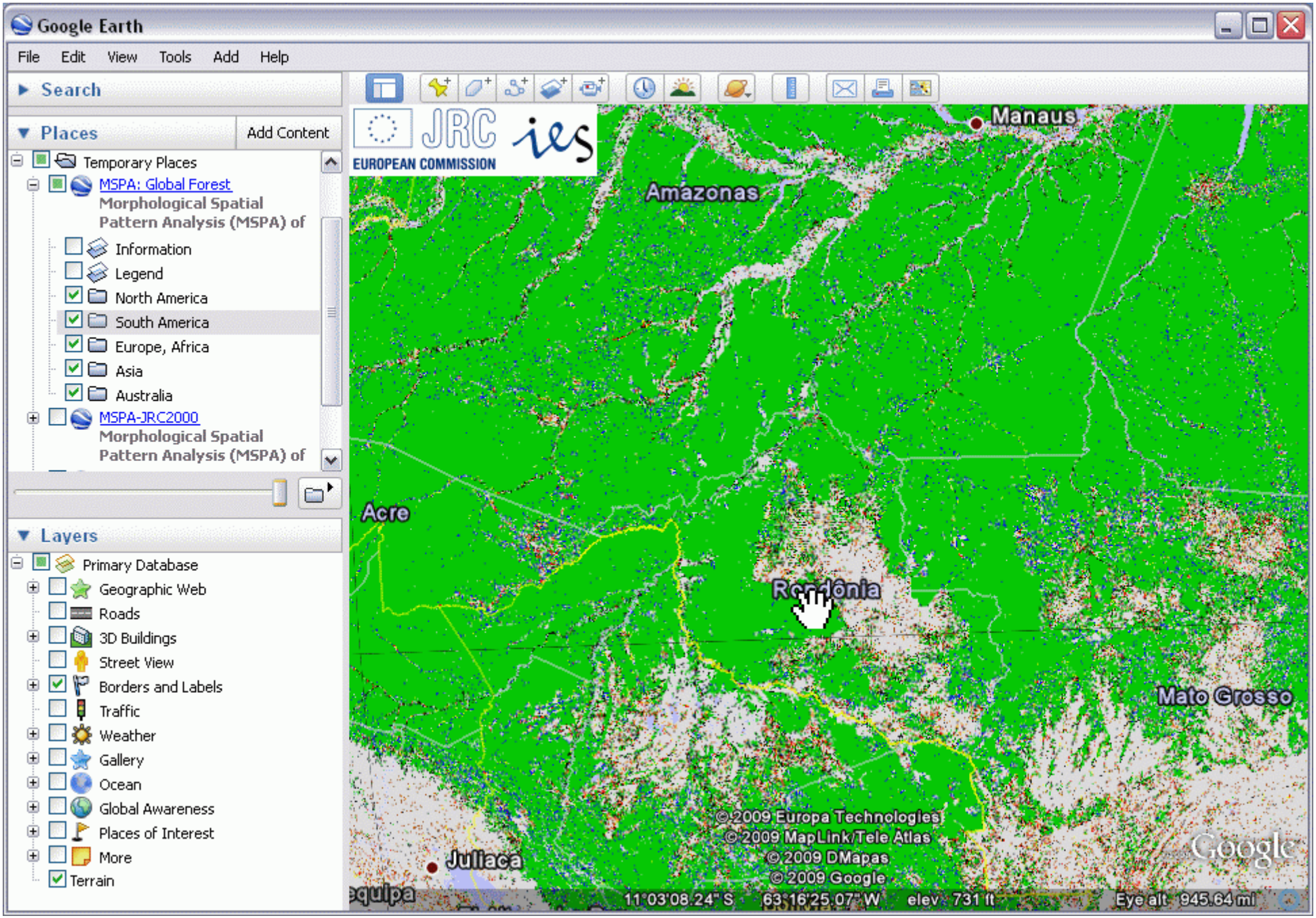
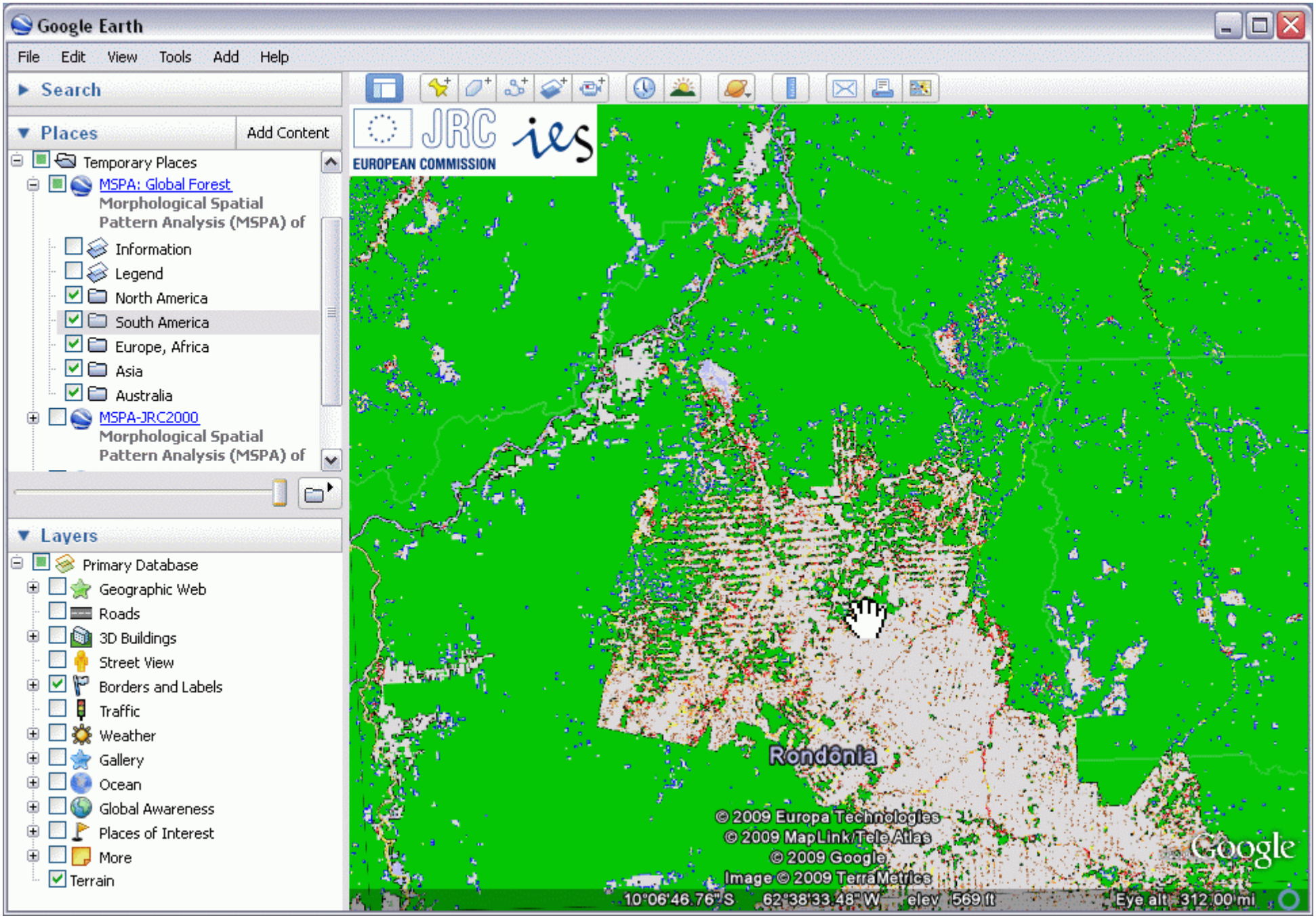


MSPA: global forest (300m)

Vogt: Guidos-MSPA, ECONNECT workshop, 2009/11/05



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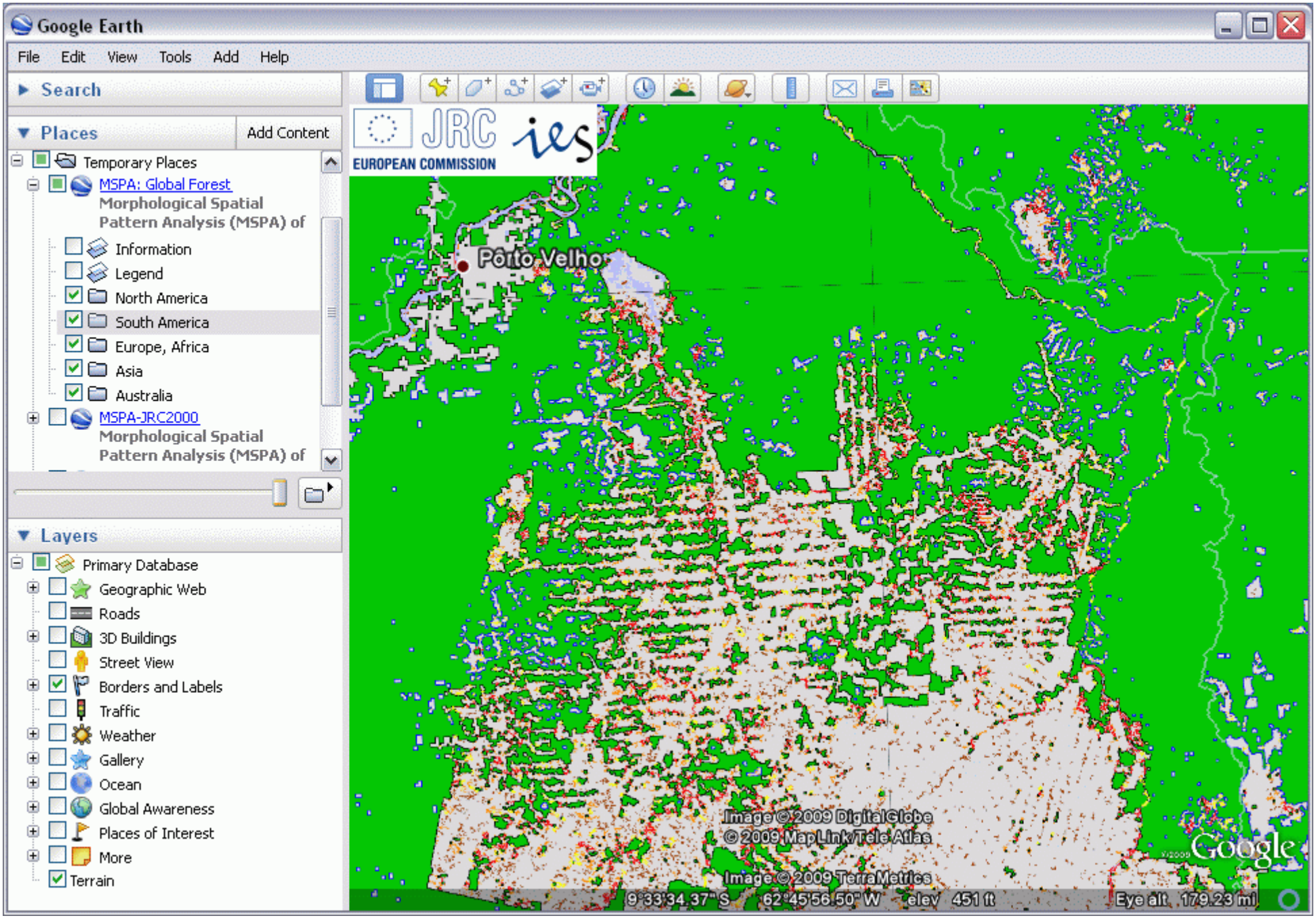
Vogt: Guidos-MSPA, ECONNECT workshop, 2009/11/05



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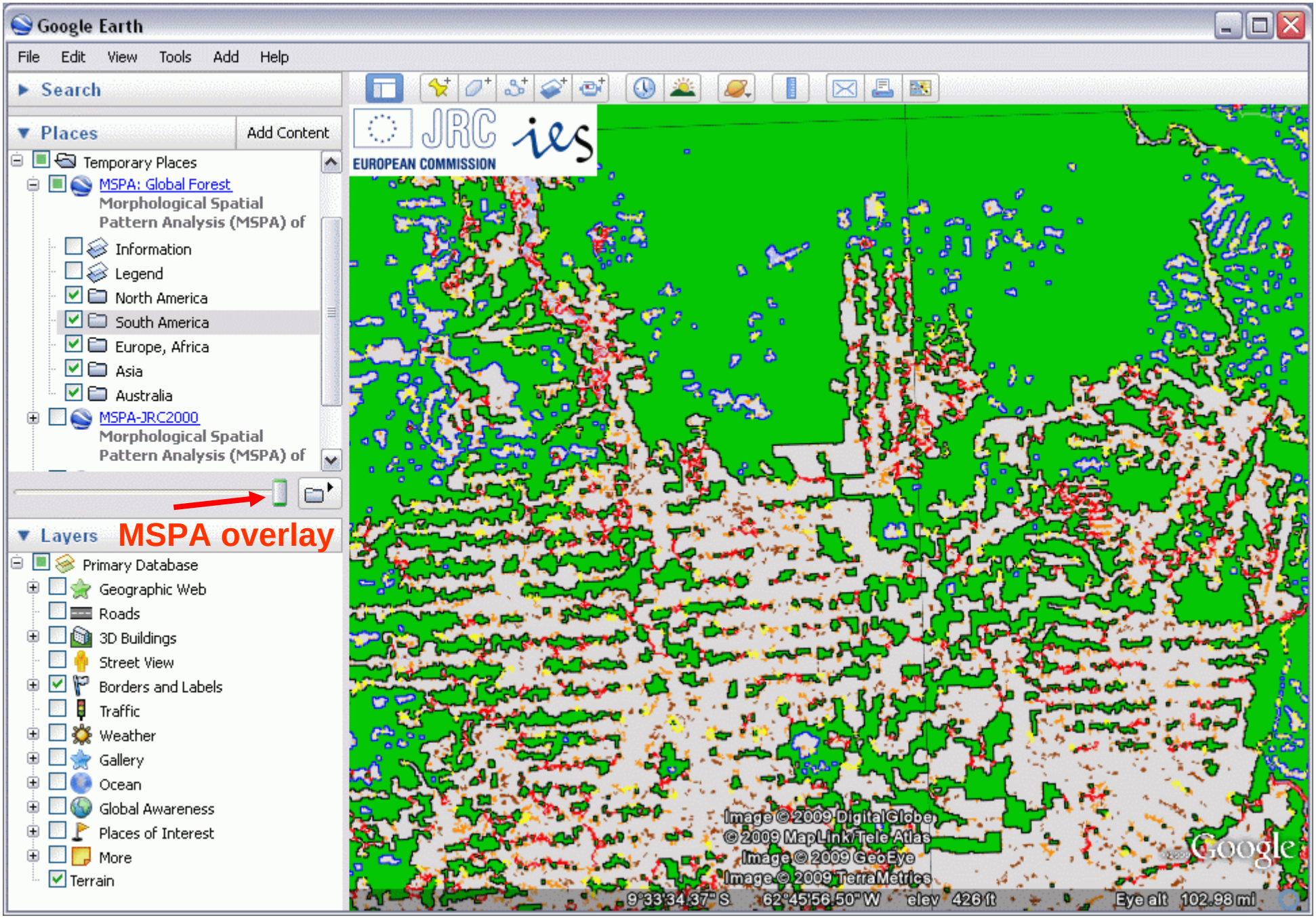

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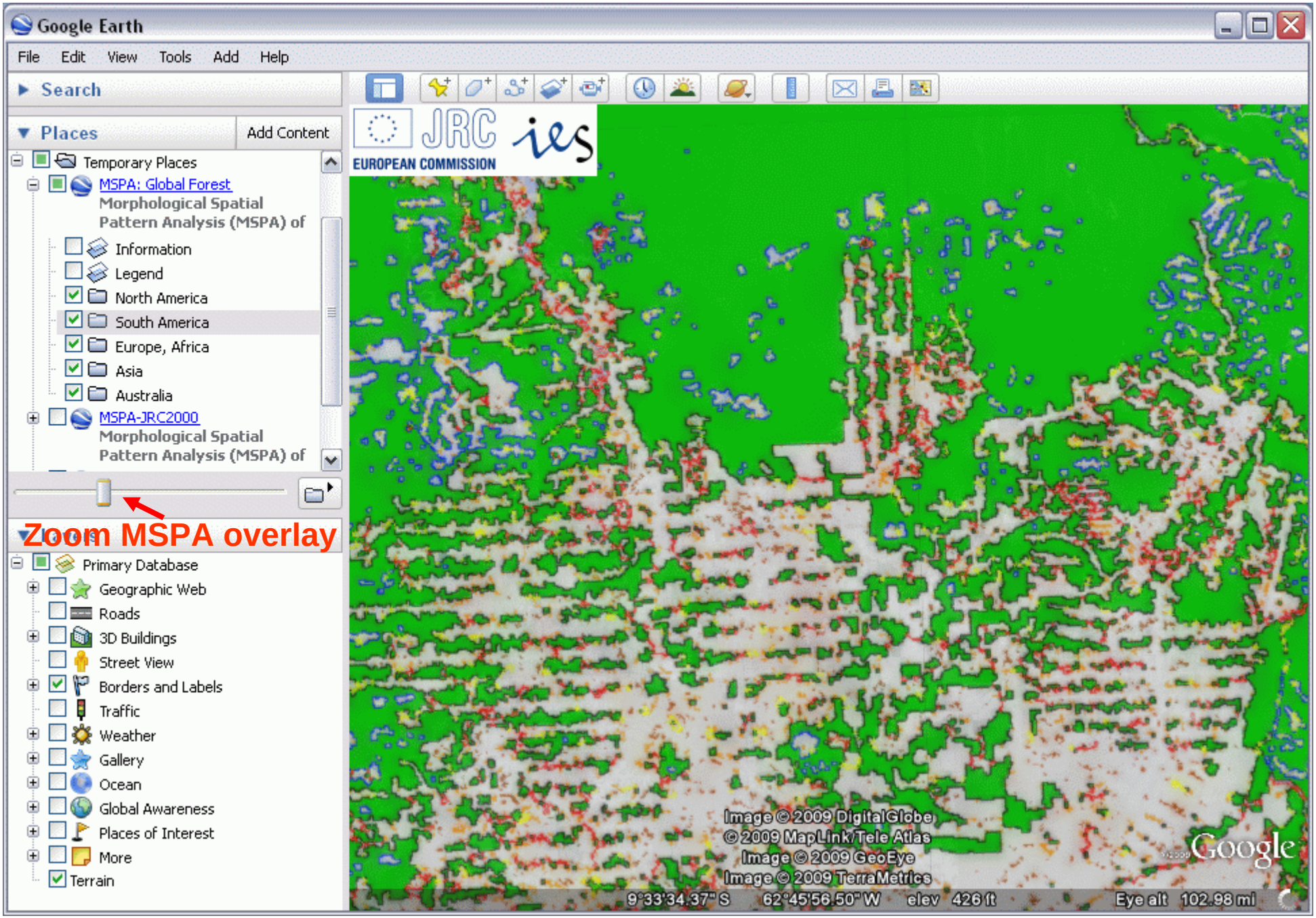

MSPA: global forest (300m)

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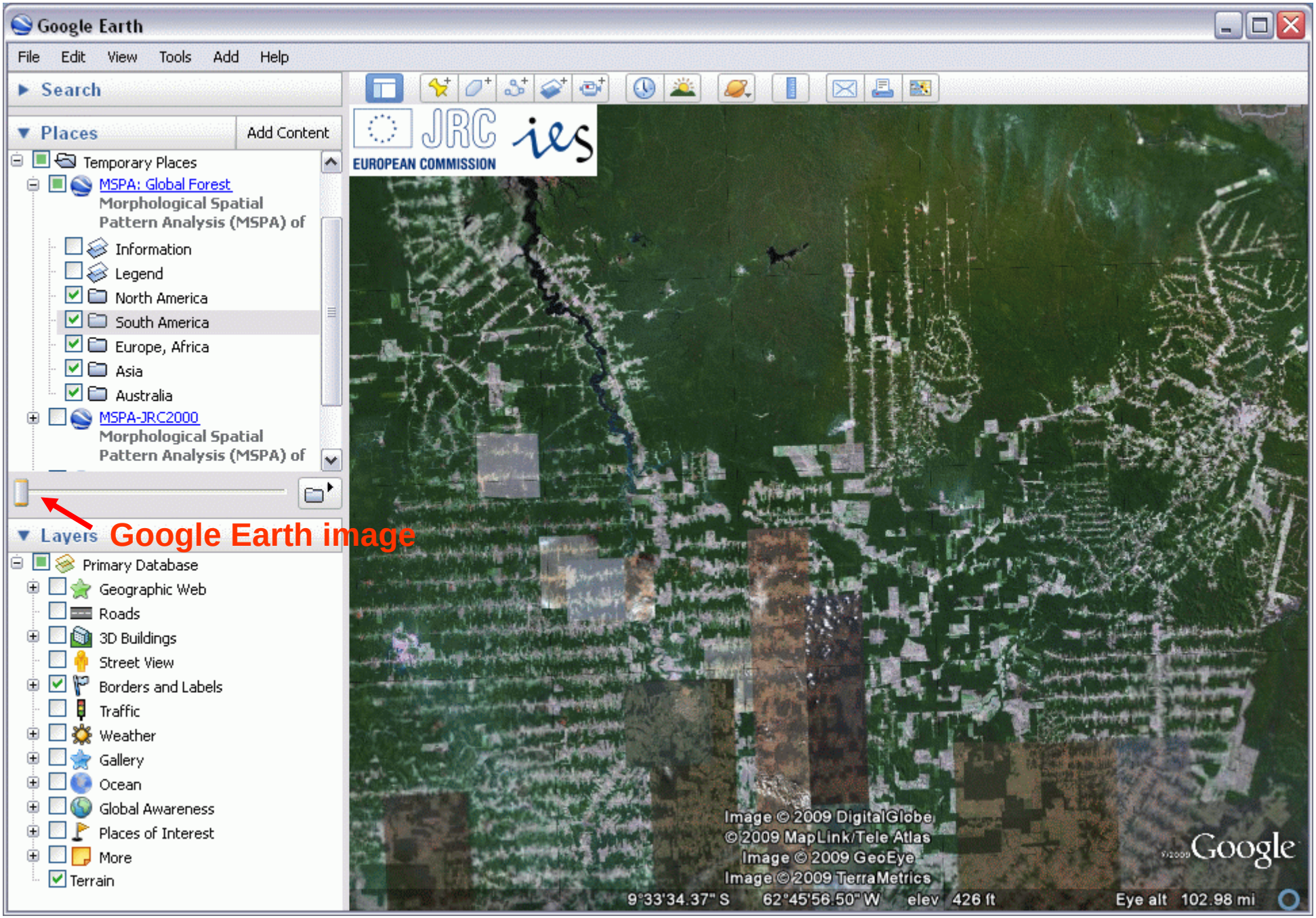
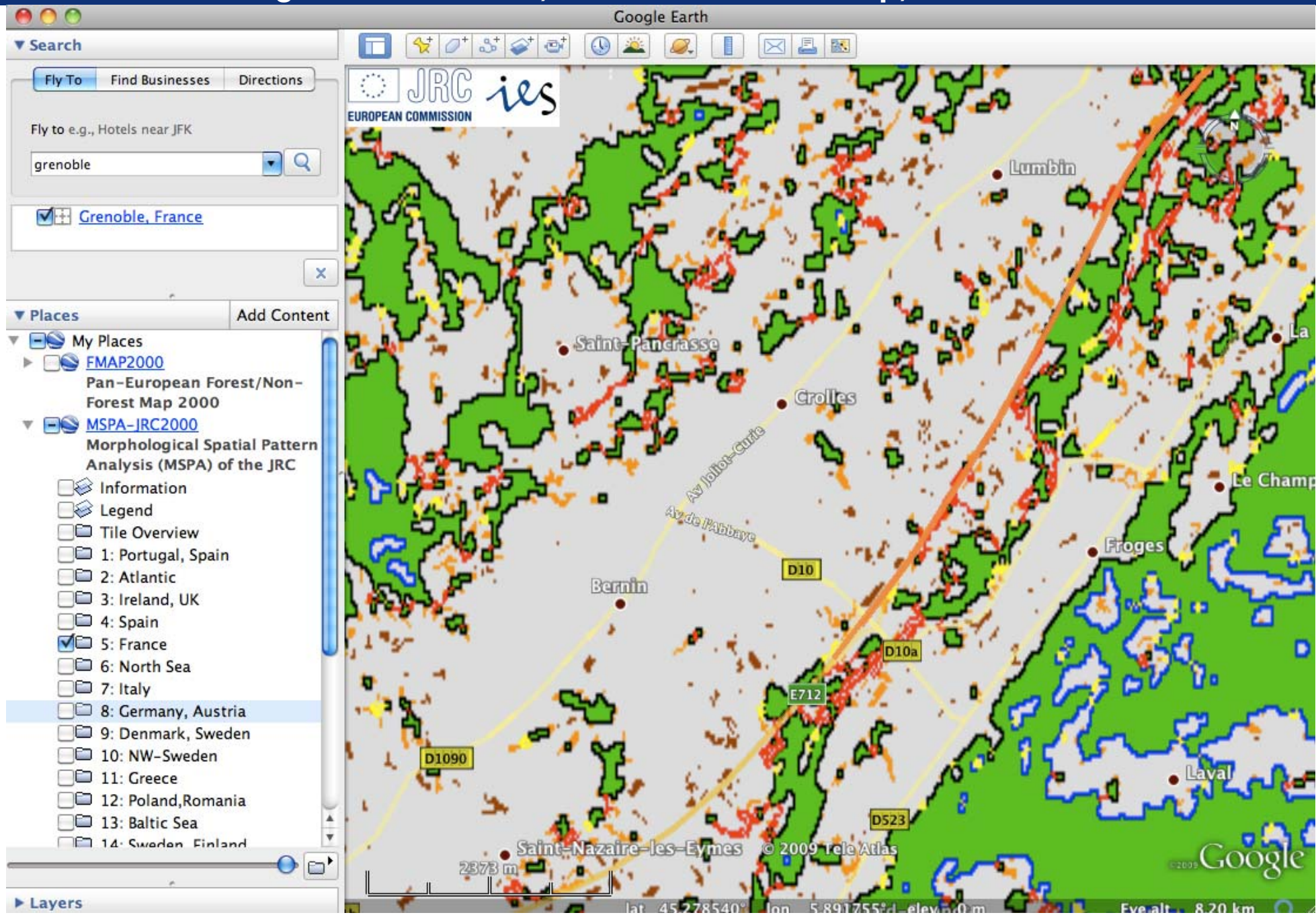


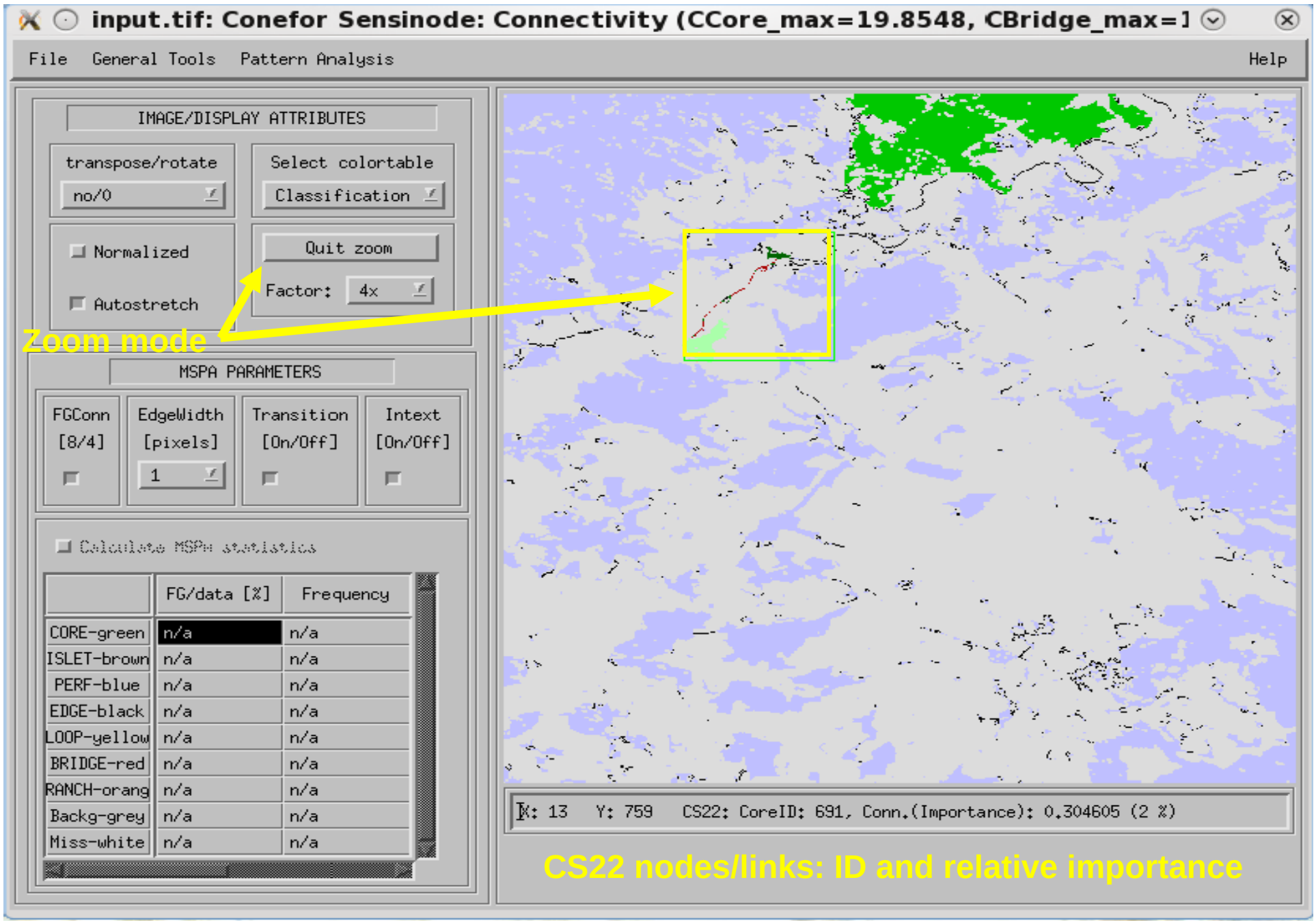
MSPA: Bernin (25 m)

Vogt: Guidos-MSPA, ECONNECT workshop, 2009/11/05



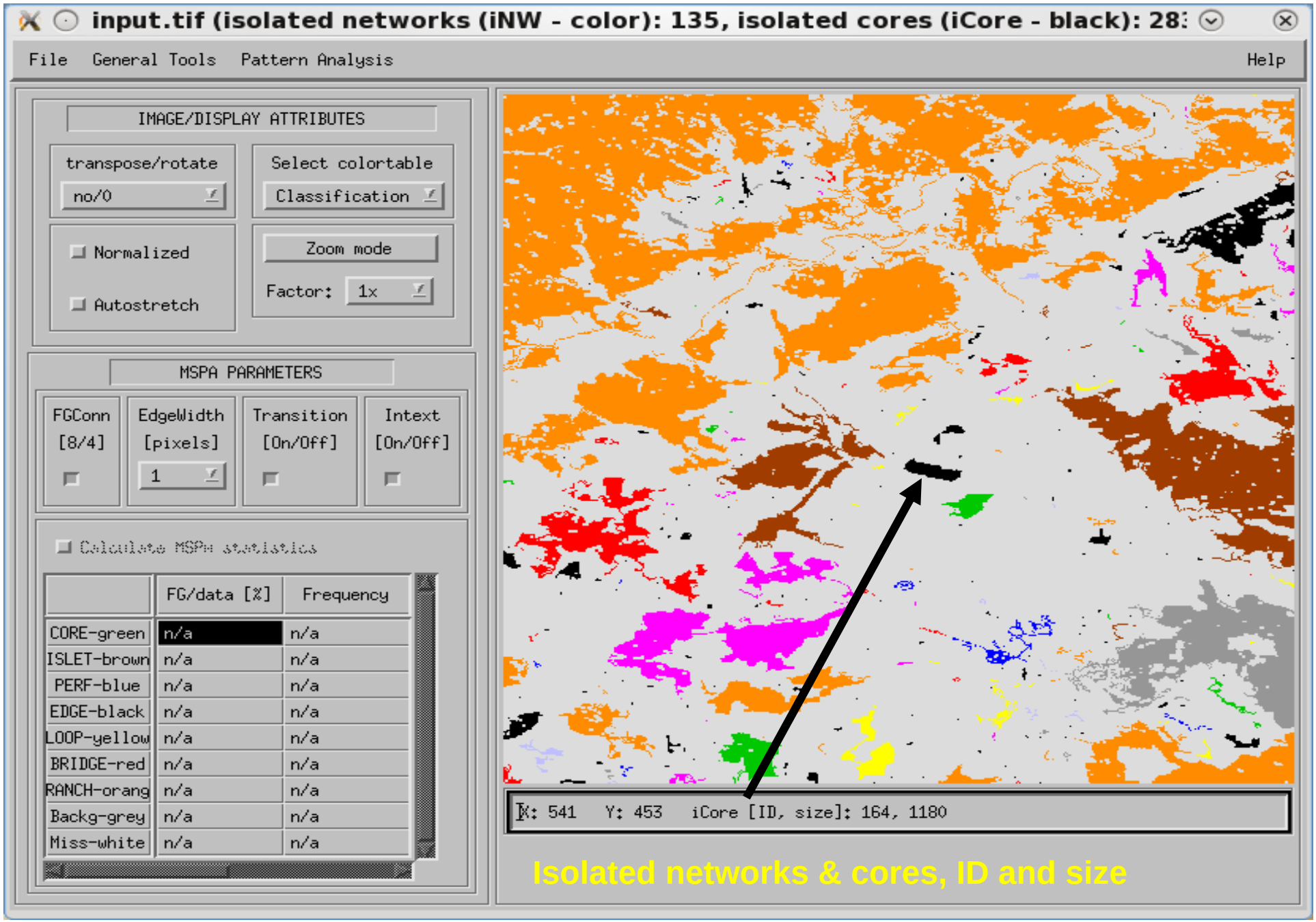
GUIDOS+CSS: quantify connectivity

Vogt: Guidos-MSPA, ECONNECT workshop, 2009/11/05



GUIDOS: network analysis

Vogt: Guidos-MSPA, ECONNECT workshop, 2009/11/05

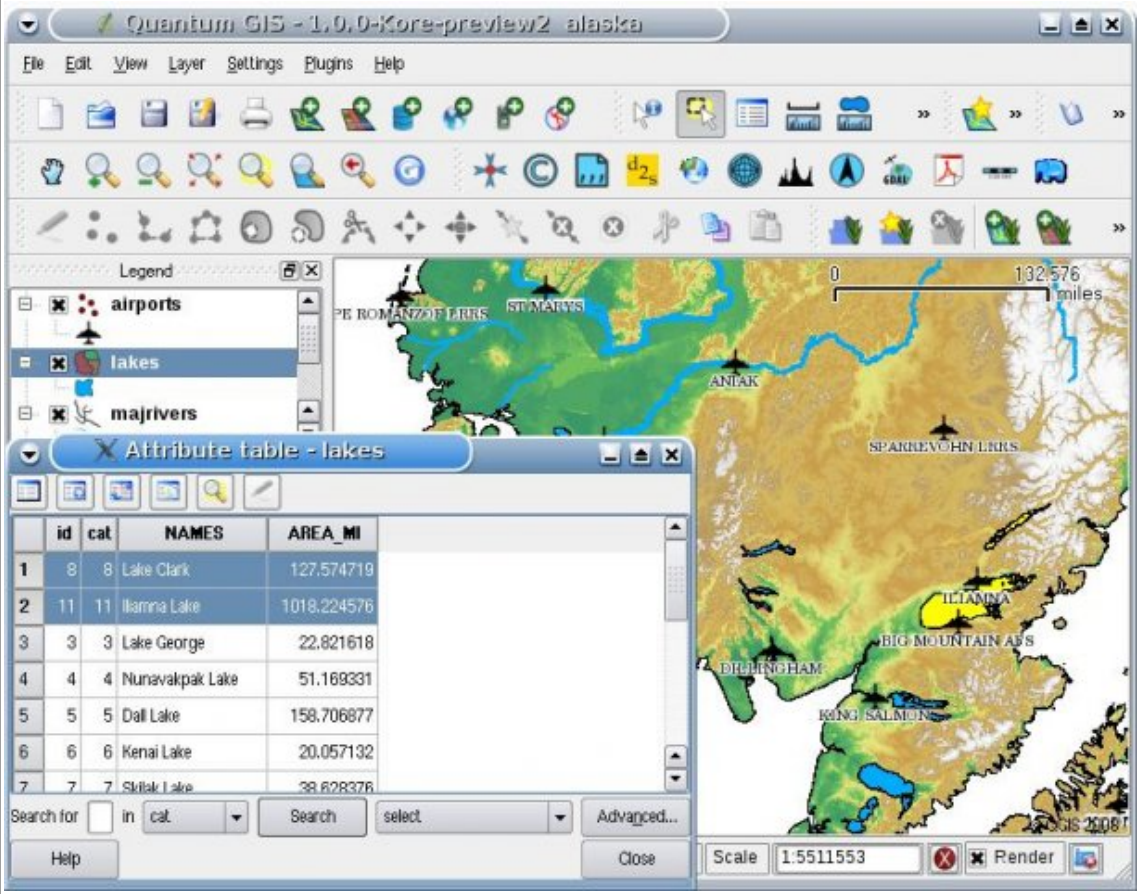


GUIDOS: other features…

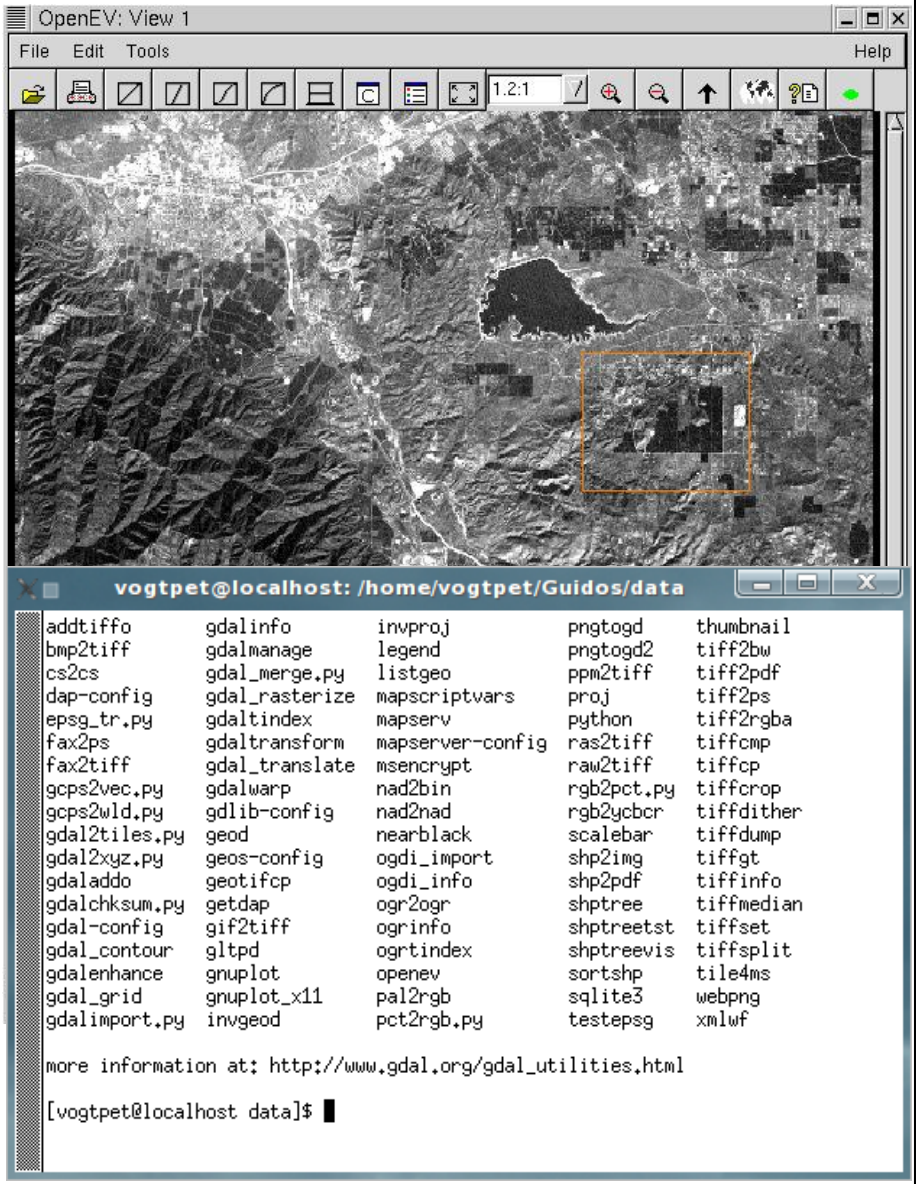
Vogt: Guidos-MSPA, ECONNECT workshop, 2009/11/05

GUIDOS LiveCD GUIDOS installer → **GUIDOS portable**

Quantum GIS: raster, vector, WMS, OpenStreetMap, WFS, GRASS, ESRI, GML, POSTGIS, GPS-tools, etc.



FWTOOLS/OpenEV/GDAL: re-project, merge, convert, … & display in raster/vector-viewer

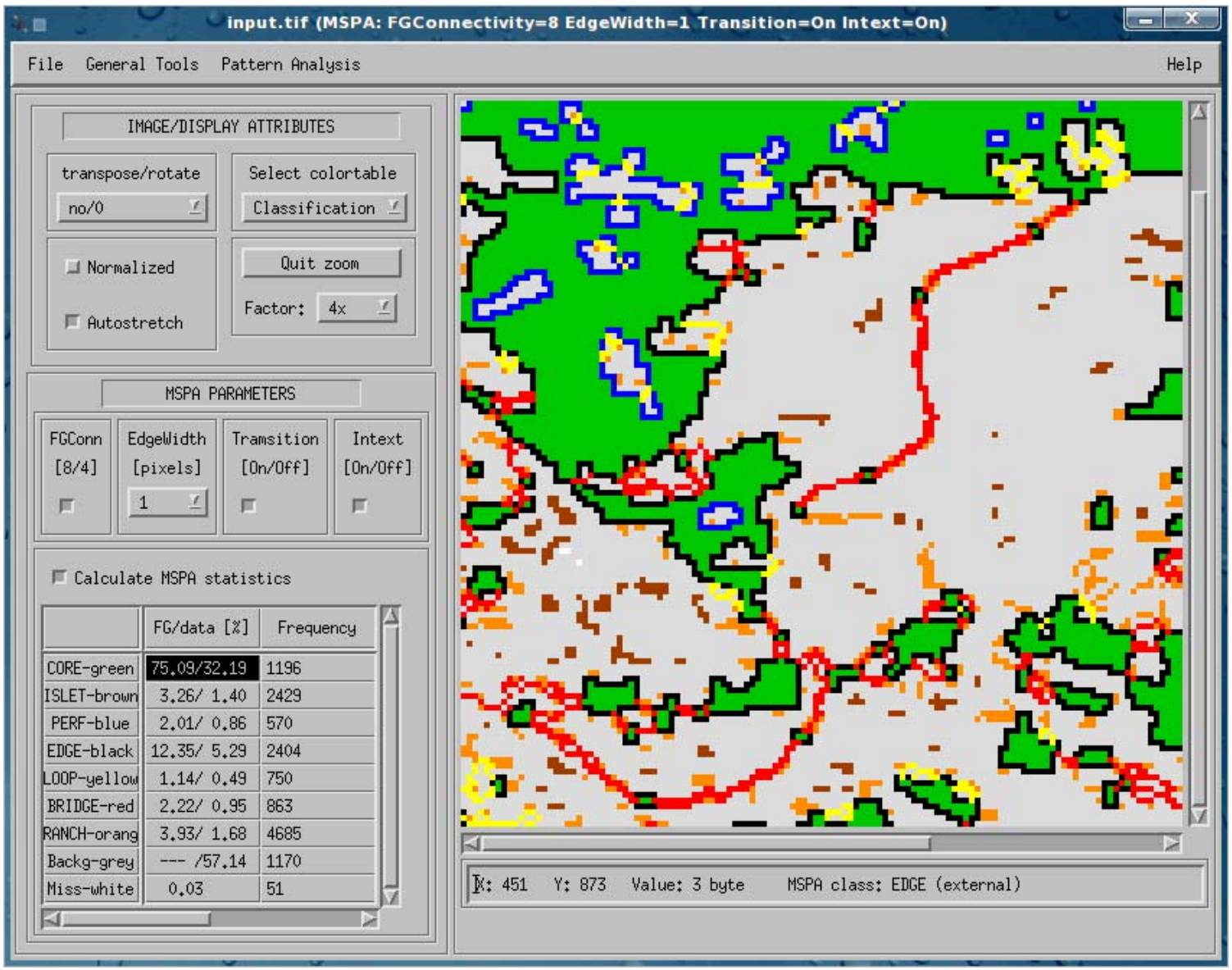


GUIDOS: MSPA-software

Vogt: Guidos-MSPA, ECONNECT workshop, 2009/11/05

Free download:

http://forest.jrc.ec.europa.eu/download/software/guidos



Key features:

- MSPA & IP-tools
- Distance maps
- Statistics
- Connectivity
- Gdal, kml-export
- GIS-environment,…

Used by:

International Association for Landscape Ecology

LandScope America BETA

EBONE European Biodiversity Observation Network

econnect ? Restoring the web of life

Contact:
Peter.Vogt@jrc.ec.europa.eu