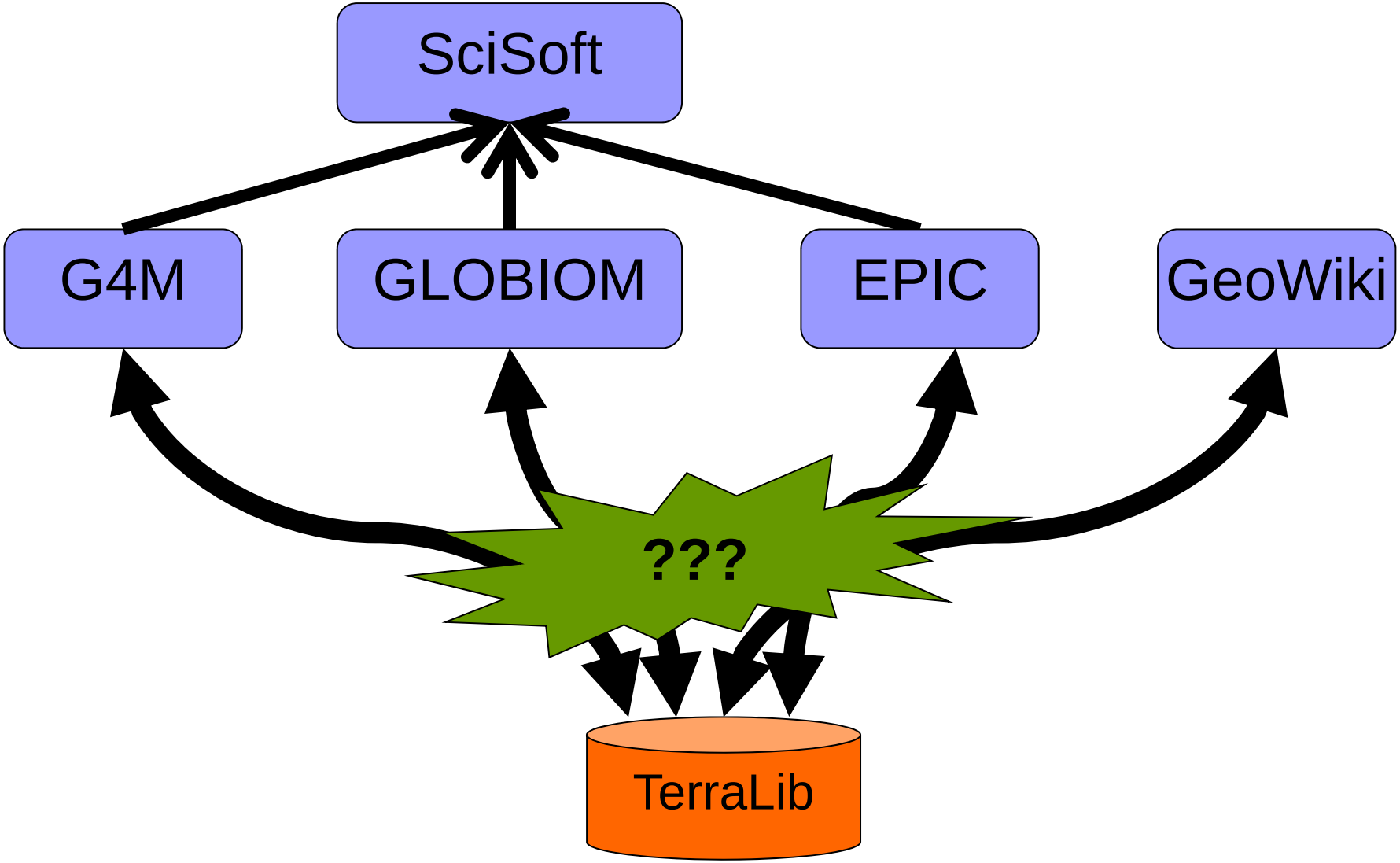
MINISTÉRIO DA CIÊNCIA E TECNOLOGIA
INSTITUTO NACIONAL DE PESQUISAS ESPACIAIS

Strategy for tool integration

Pedro Ribeiro de Andrade

São José dos Campos, 2012

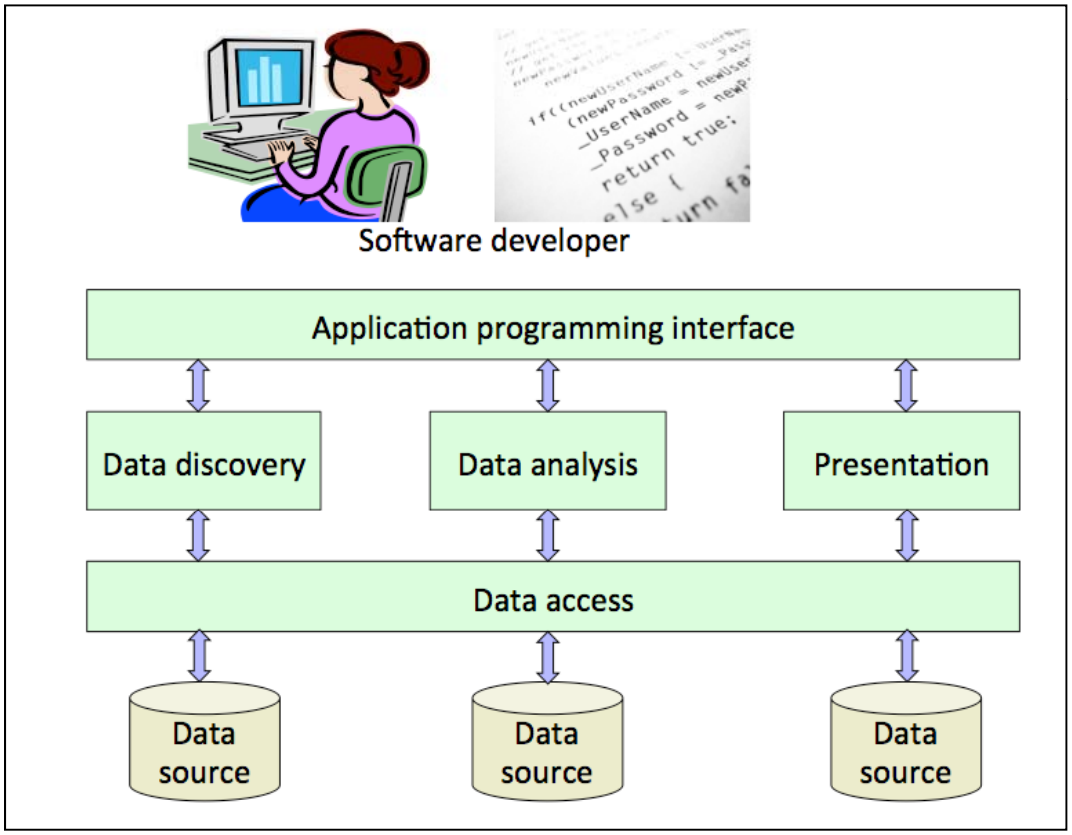
Integration between TerraLib and IIASA tools



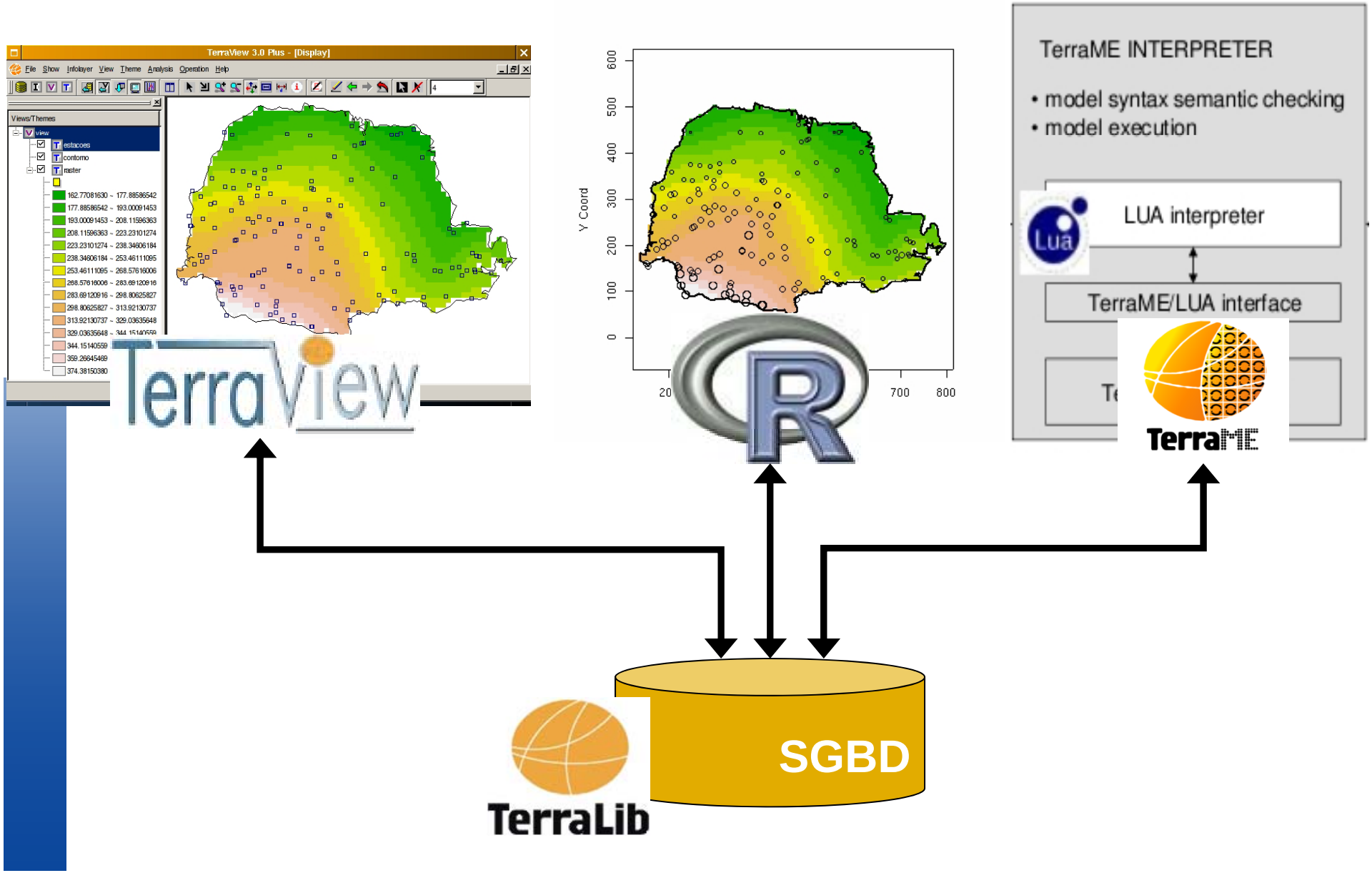
Software: Open source GIS

TerraLib 4 ➔TerraLib 5

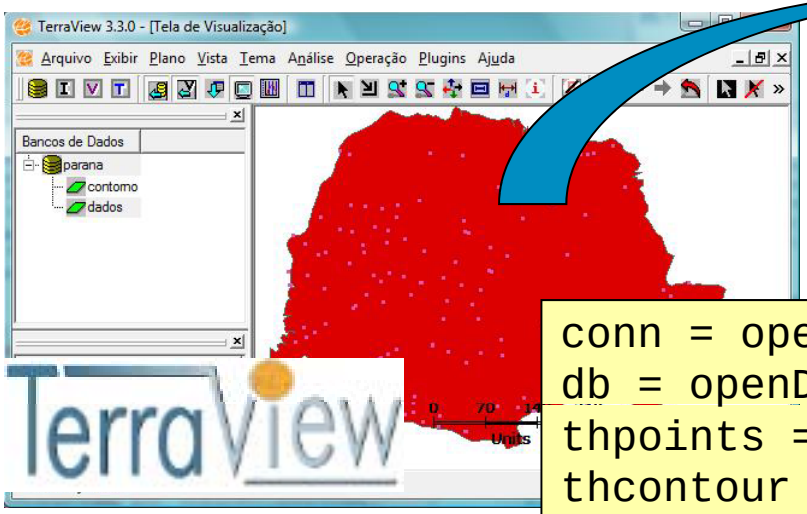
- very large databases
- different data sources
- heterogeneous formats
- spatiotemporal data

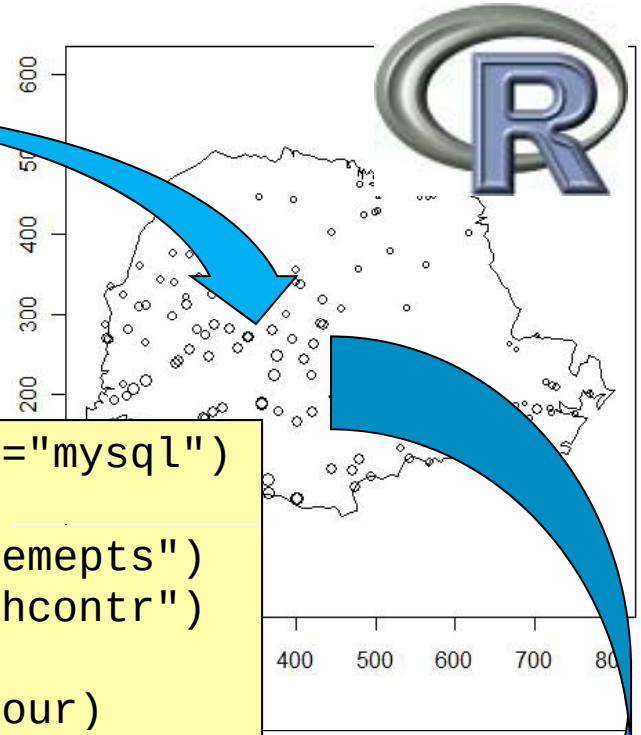


TerraLib Family –implementeed in version 4

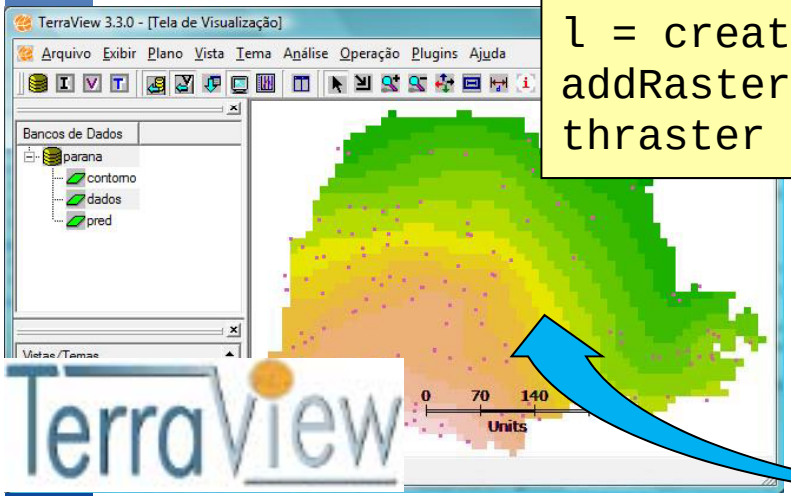


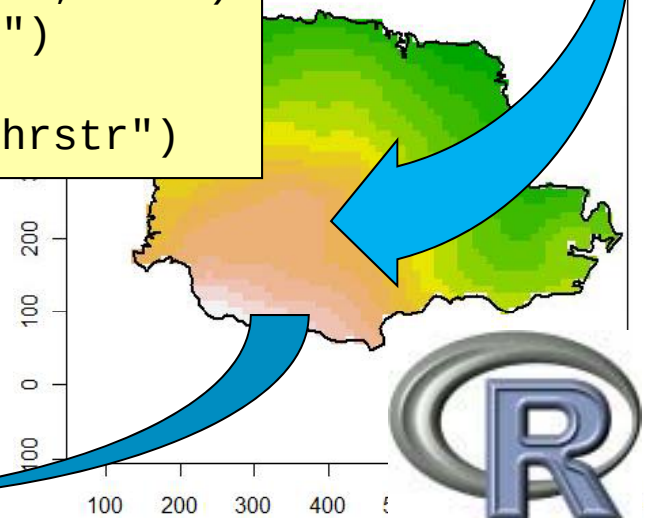
aRT Package



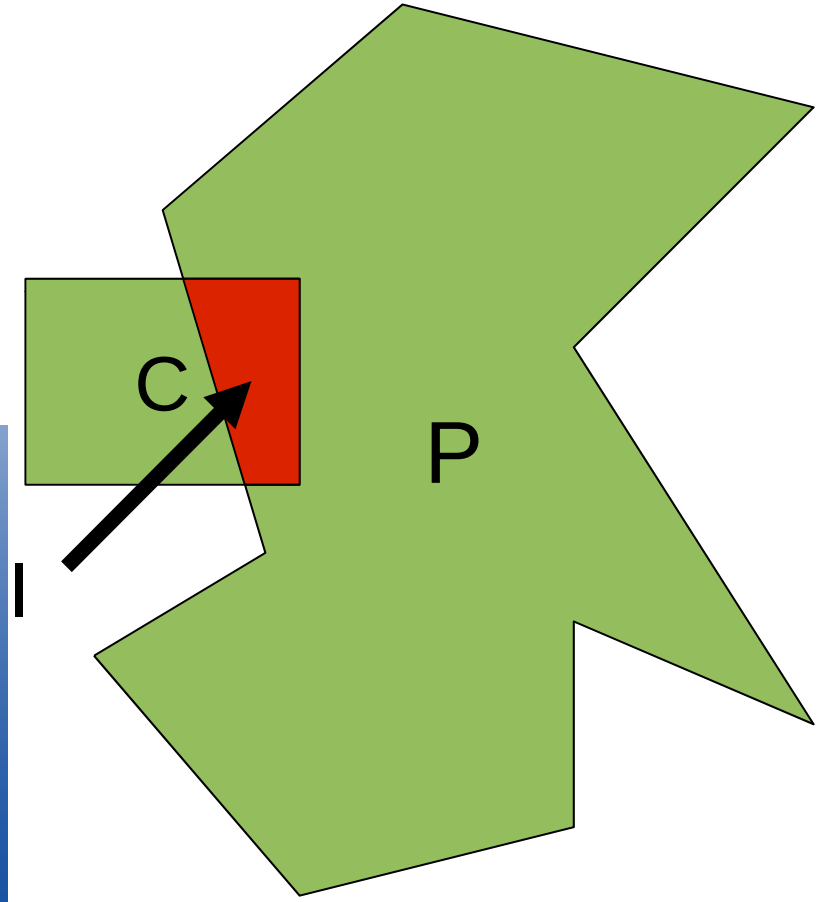



```
conn = openConn(u="art",dbms="mysql")
db = openDb(conn, "dbname")
thpoints = openTheme(db, "themepts")
thcontour = openTheme(db, "thcontr")
points = getPoints(thpoints)
contour = getPolygons(thcontour)
data = getData(thpoints)
raster = krige(points, contour, data)
l = createLayer(db, "lraster")
addRaster(l, raster)
thraster = createTheme(l, "thrstr")
```





Intersection area



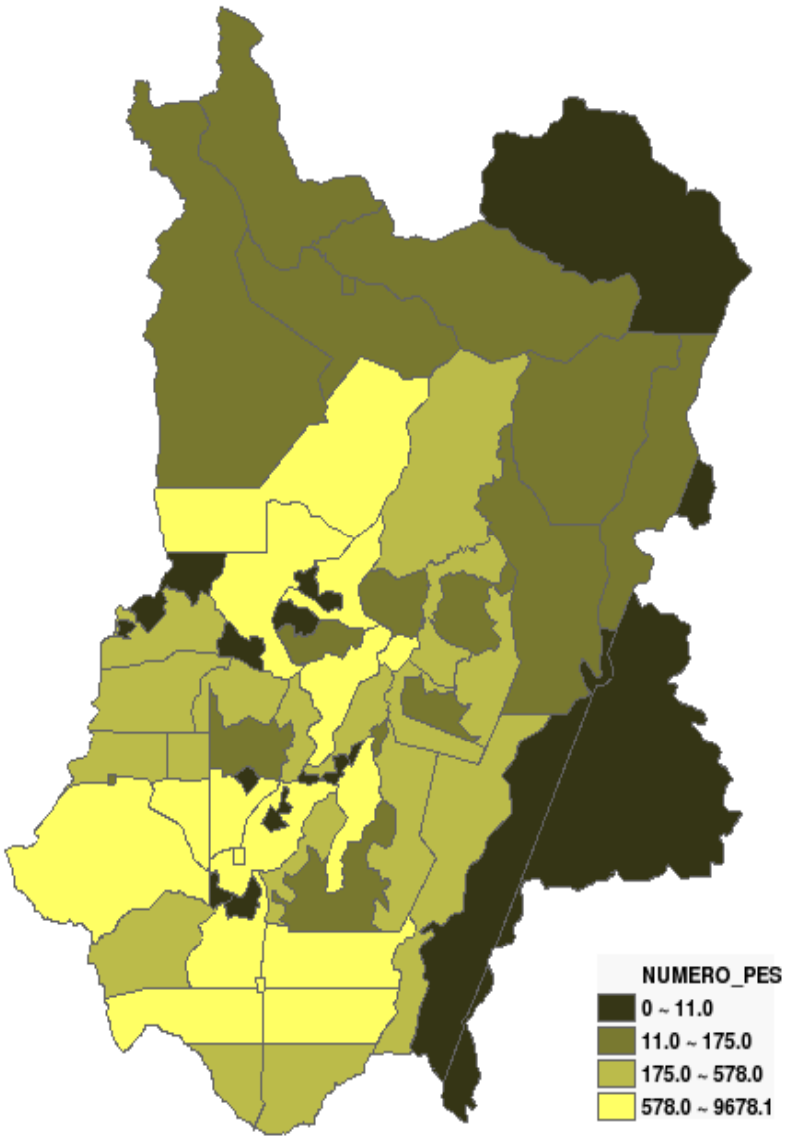
Average:

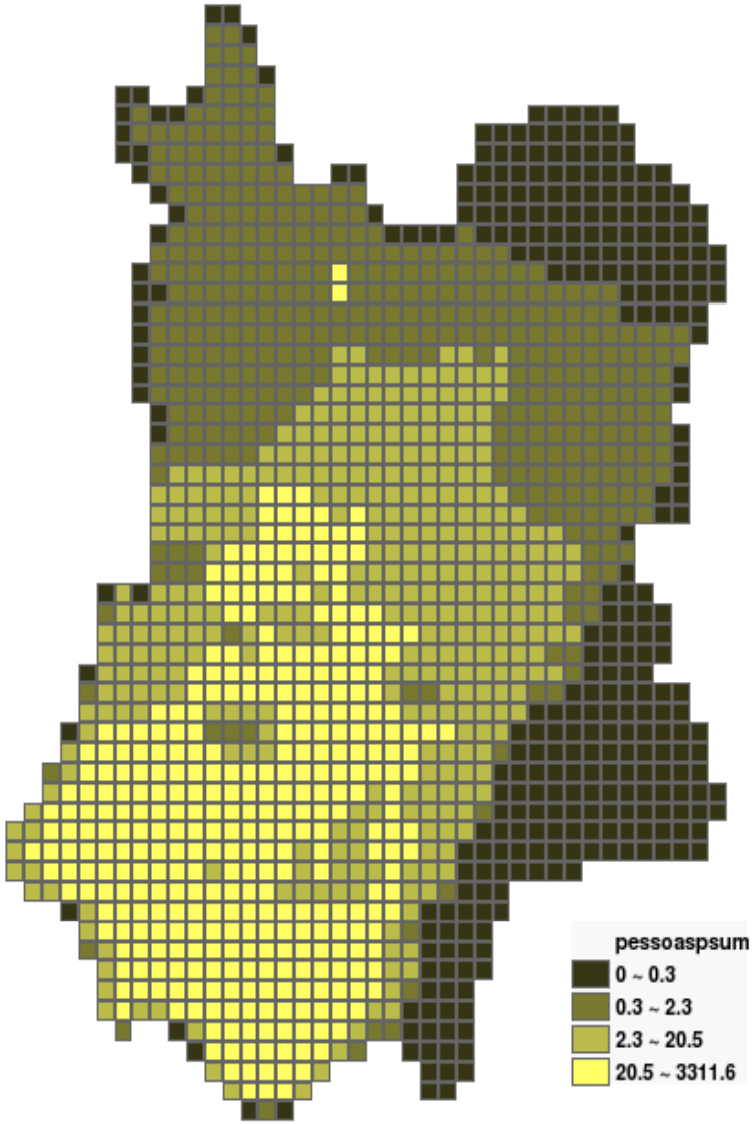
$$f(C) = \sum_{I=P\cap C\neq\emptyset} f(P)\frac{a(I)}{a(C)}$$

Sum:

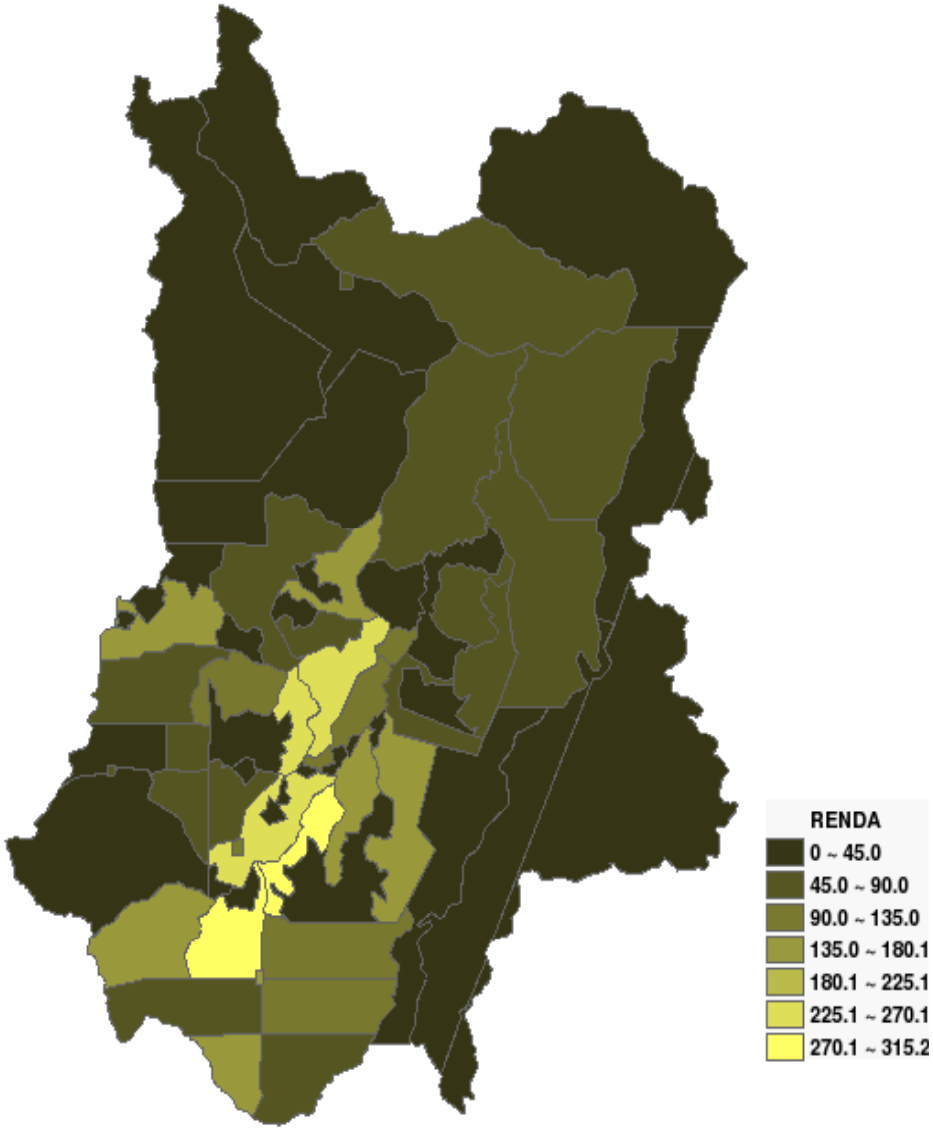
$$f(C) = \sum_{I=P\cap C\neq\emptyset} f(P)\frac{a(I)}{a(P)}$$

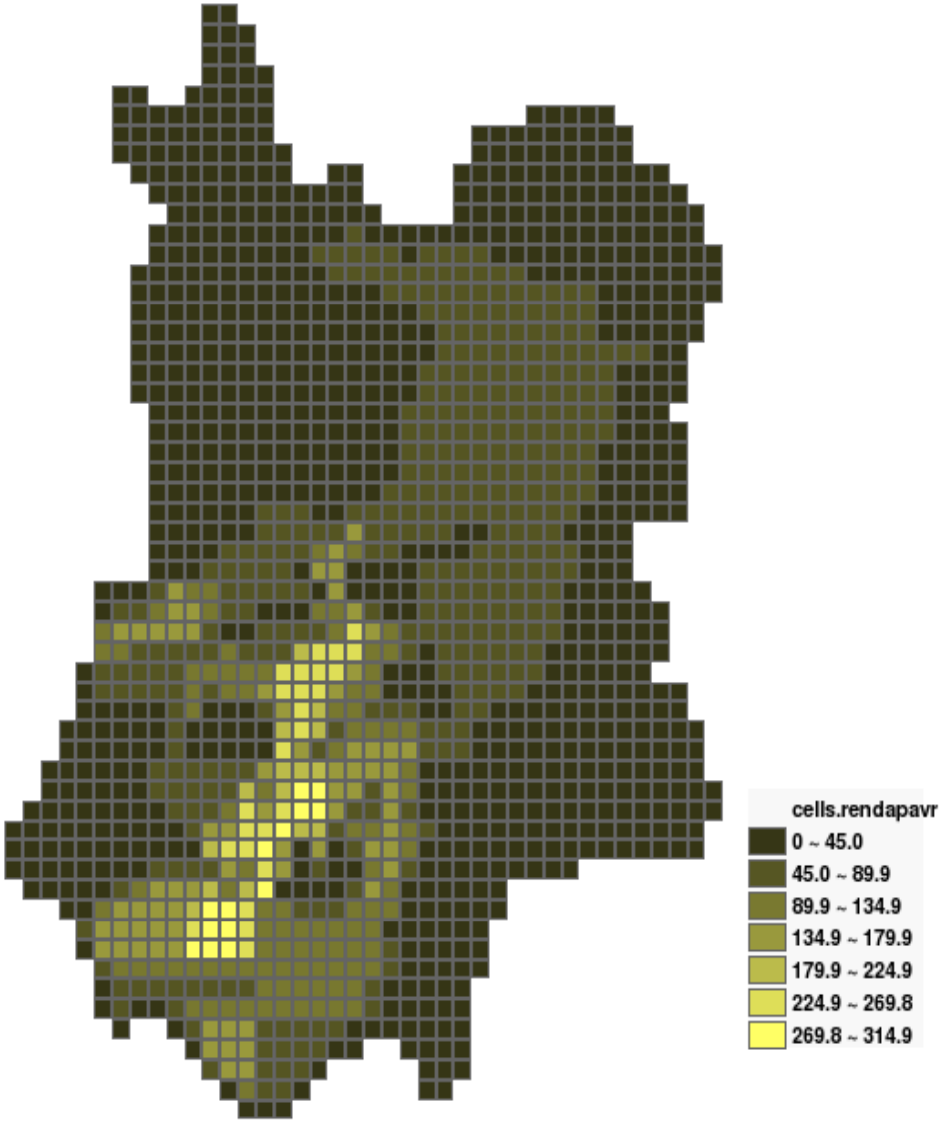
Sum (population)





Average (income per capita)

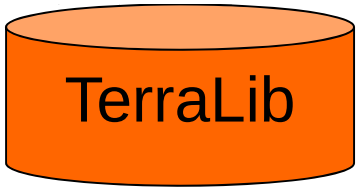




Database

www.dpi.inpe.br/~giovana/tmp/redd/database.html

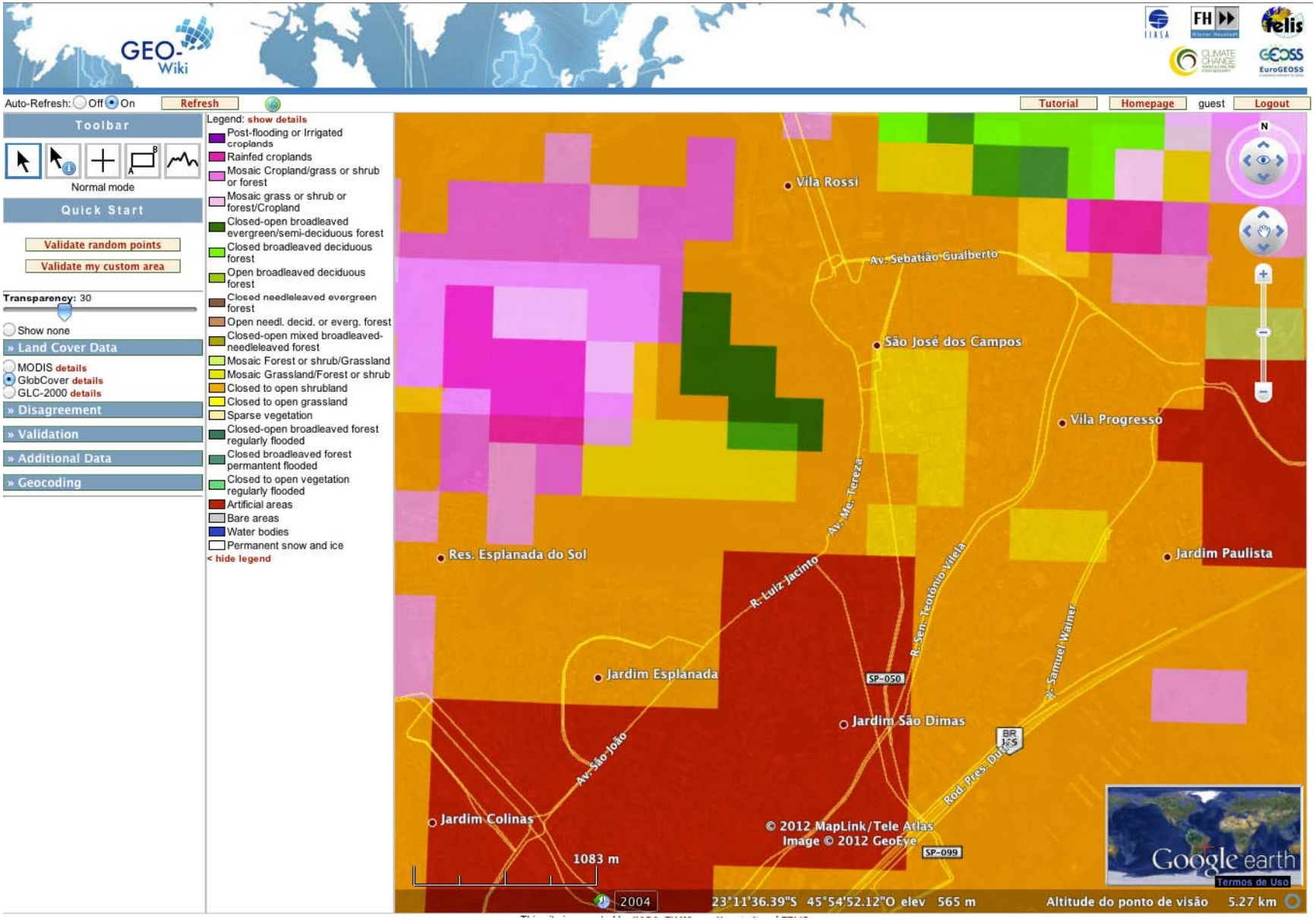
Attribute	Description	Type	Source
DEFOR_2002	Percentage of new clear-cut deforestation in 2002	Land Use	PRODES Raster 90m
DEFOR_2003	Percentage of new clear-cut deforestation in 2003	Land Use	PRODES Raster 90m
DEFOR_2004	Percentage of new clear-cut deforestation in 2004	Land Use	PRODES Raster 90m
DEFOR_2005	Percentage of new clear-cut deforestation in 2005	Land Use	PRODES Raster 90m
DEFOR_2006	Percentage of new clear-cut deforestation in 2006	Land Use	PRODES Raster 90m
DEFOR_2007	Percentage of new clear-cut deforestation in 2007	Land Use	PRODES Raster 90m
DEFOR_2008	Percentage of new clear-cut deforestation in 2008	Land Use	PRODES Raster 90m
ACUM_1997	Percentage of accumulated clear-cut deforestation until 1997	Land Use	PRODES Raster 90m
ACUM_2002	Percentage of accumulated clear-cut deforestation until 2002	Land Use	PRODES Raster 90m
ACUM_2007	Percentage of accumulated clear-cut deforestation until 2007	Land Use	PRODES Raster 90m
ACUM_2008	Percentage of accumulated clear-cut deforestation until 2008	Land Use	PRODES Raster 90m
CENSO96_PASTAGEM	Percentage of estimated pasture in 1996, from CENSUS data spatialized using PRODES data	Land Use	IBGE CENSUS Municipality, PRODES Raster 90m
CENSO96_TEMPORARIA	Percentage of estimated temporary agriculture in 1996, from CENSUS data spatialized using PRODES data	Land Use	IBGE CENSUS Municipality, PRODES Raster 90m
CENSO96_PERMANENTE	Percentage of estimated permanent agriculture in 1996, from CENSUS data spatialized using PRODES data	Land Use	IBGE CENSUS Municipality, PRODES Raster 90m
CENSO96_FLORESTA	Percentage of estimated planted forest in 1996, from CENSUS data spatialized using PRODES data	Land Use	IBGE CENSUS Municipality, PRODES Raster 90m
CENSO96_NUSADO	Percentage of estimated non-used areas in 1996, from CENSUS data spatialized using PRODES data	Land Use	IBGE CENSUS Municipality, PRODES Raster 90m
CENSO06_PASTAGEM	Percentage of estimated pasture in 2006, from CENSUS data spatialized using PRODES data	Land Use	IBGE CENSUS Municipality, PRODES Raster 90m
CENSO06_TEMPORARIA	Percentage of estimated temporary agriculture in 2006, from CENSUS data spatialized using PRODES data	Land Use	IBGE CENSUS Municipality, PRODES Raster 90m
CENSO06_PERMANENTE	Percentage of estimated permanent agriculture in 2006, from CENSUS data spatialized using PRODES data	Land Use	IBGE CENSUS Municipality, PRODES Raster 90m



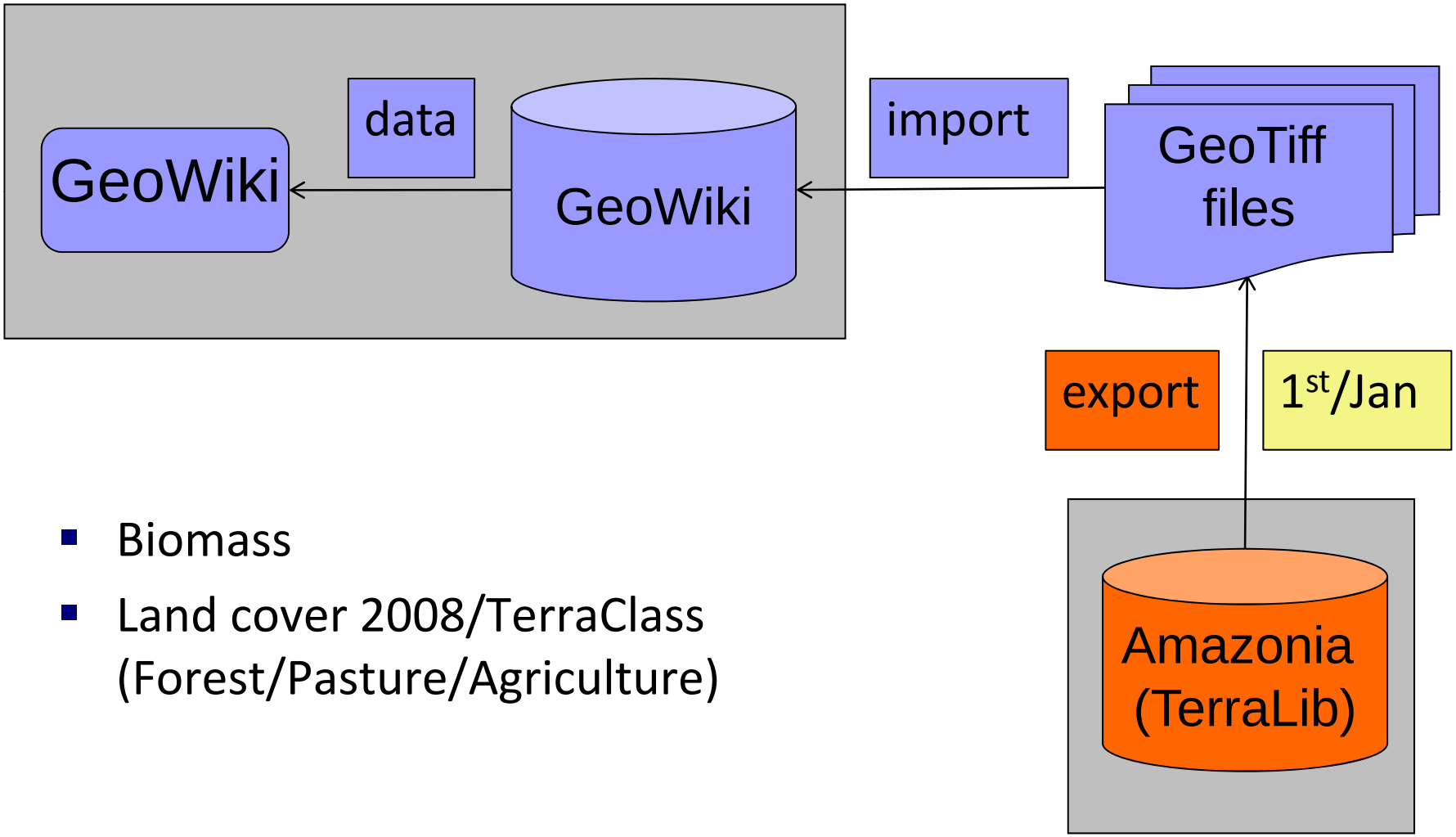
Strategy for integration

- First Step: generate the data for IIASA (1st January 2013)
- Second Step: develop TerraLib drivers to allow visualizing IIASA databases
- Third Step: improve TerraLib drivers to allow writing IIASA databases

GeoWiki

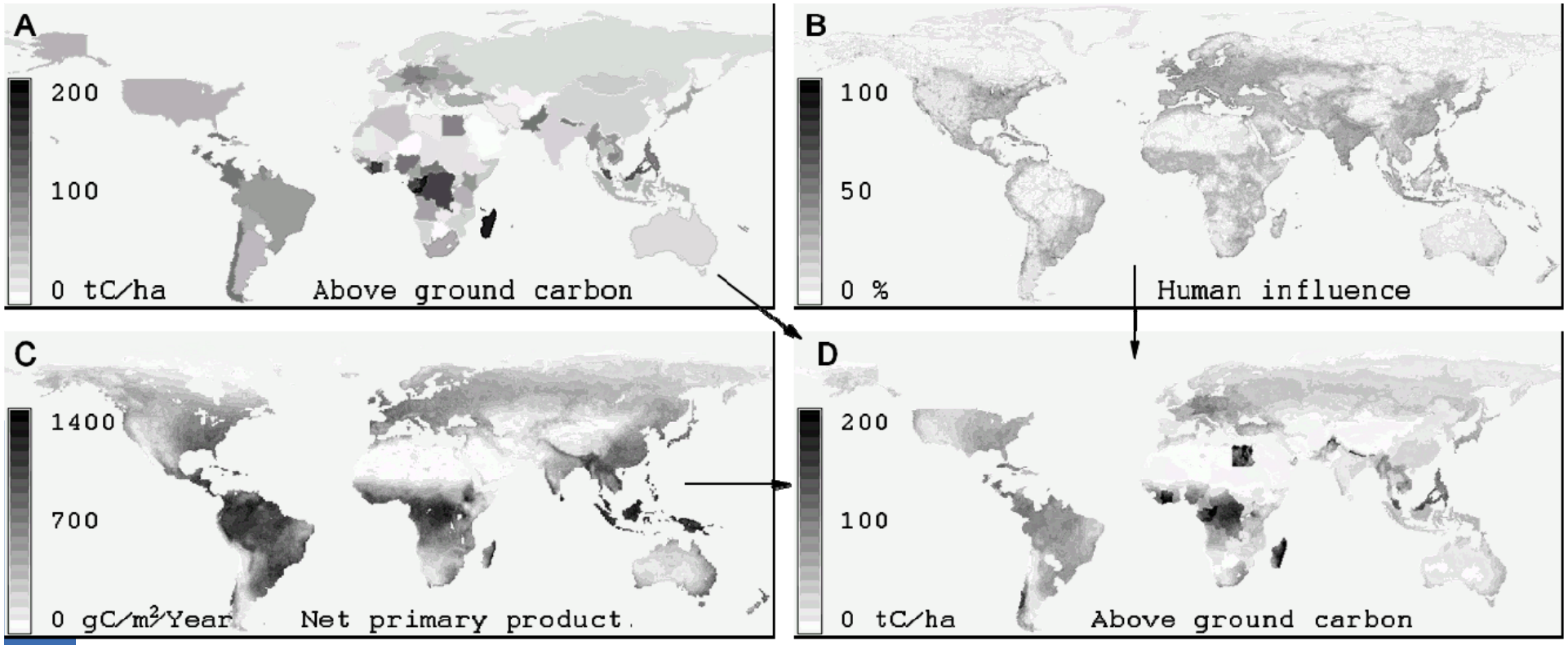

GEO-Wiki
Auto-Refresh: Off On
Refresh
Tutorial
Homepage
guest
Logout
Toolbar
Normal mode
Quick Start
Validate random points
Validate my custom area
Transparency: 30
Show none
» Land Cover Data
MODIS details
GlobCover details
GLC-2000 details
» Disagreement
» Validation
» Additional Data
» Geocoding
Legend: show details
Post-flooding or Irrigated croplands
Rainfed croplands
Mosaic Cropland/grass or shrub or forest
Mosaic grass or shrub or forest/Cropland
Closed-open broadleaved evergreen/semi-deciduous forest
Closed broadleaved deciduous forest
Open broadleaved deciduous forest
Closed needleleaved evergreen forest
Open needl. decid. or everg. forest
Closed-open mixed broadleaved-needleleaved forest
Mosaic Forest or shrub/Grassland
Mosaic Grassland/Forest or shrub
Closed to open shrubland
Closed to open grassland
Sparse vegetation
Closed-open broadleaved forest regularly flooded
Closed broadleaved forest permantent flooded
Closed to open vegetation regularly flooded
Artificial areas
Bare areas
Water bodies
Permanent snow and ice
< hide legend
Vila Rossi
Av. Sebatião Gualberto
São José dos Campos
Vila Progresso
Av. Me. Tereza
Res. Esplanada do Sol
R. Luiz Jacinto
R. Sen. Teotônio Vilela
Jardim Paulista
Jardim Esplanada
SP-050
Jardim São Dimas
Av. Samuel Walner
Av. São João
Jardim Colinas
© 2012 MapLink/Tele Atlas
Image © 2012 GeoEye
SP-099
1083 m
Google earth
Termos de Uso
2004
23°11'36.39"S 45°54'52.12"O elev 565 m
Altitude do ponto de visão 5.27 km

Data for GeoWiki



- Biomass
- Land cover 2008/TerraClass (Forest/Pasture/Agriculture)

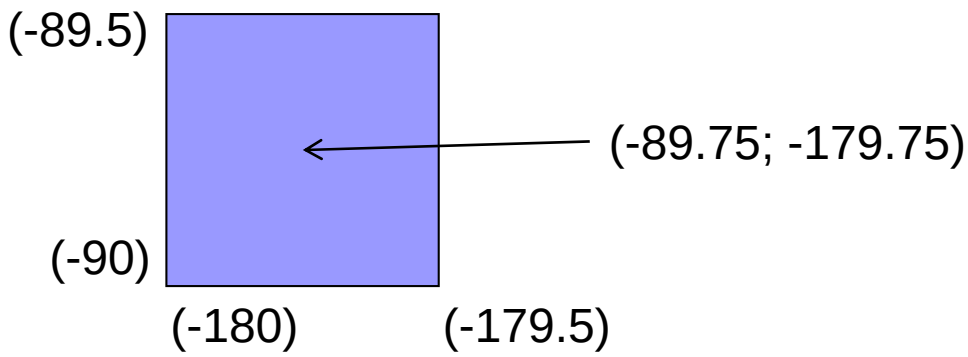
G4M



G4M is a model to assess afforestation-deforestation-forest management decisions

G4M

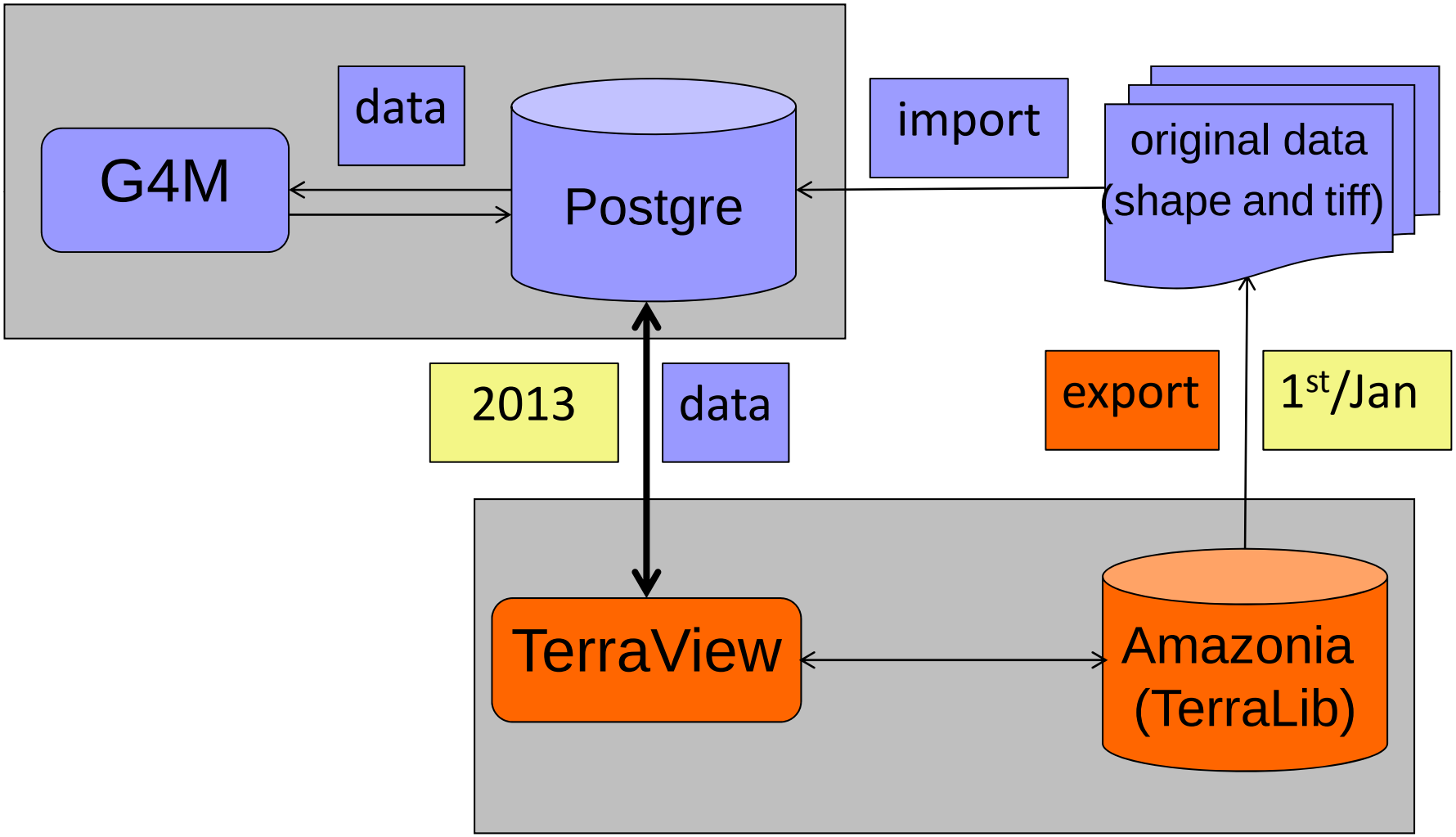
- Annual increment of biomass, CO2 emissions, harvesting cost
- Spatial resolution: 30 arcmin (259200 cells)
- Temporal resolution: 1 year
- C++, with **Postgre without spatial extension**
- Table wigh: x (real), y (real), country id and other attributes



Data for G4M

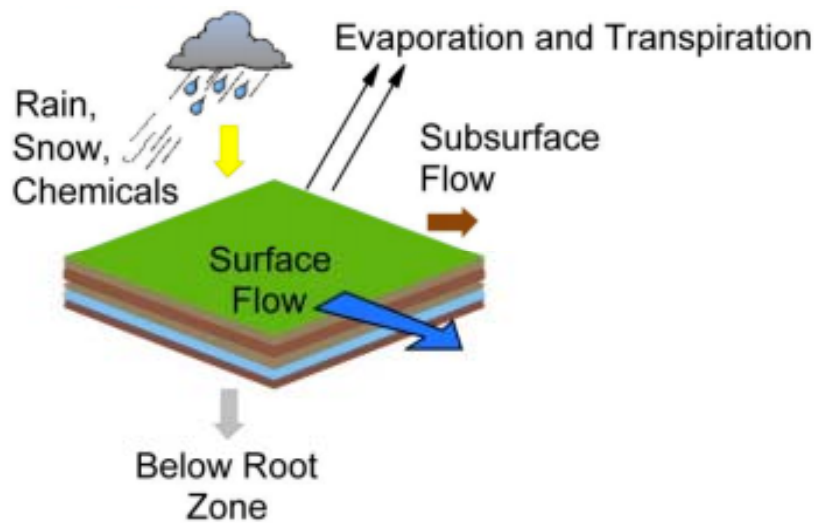
- Percentage of accumulated deforestation until 2008
- Percentage of planted forest in 1996 and 2006
- Euclidean distance to the nearest paved road, nearest non-paved road, nearest mineral deposit, and nearest road in 2006
- Price of wood land in 2002
- Percentage of integral protection conservation units in 2006
- GDP in 2002
- Value of rural credit in 1996 and 2006
- Percentage of conservation units in 2002
- Priority municipalities in control of deforestation in 2007
- Percentage of total area of settlements in 1996 and 2006
- Density of population in 1996 and 2006
- Strength of connections to ports, to Sao Paulo, Rio de Janeiro, nearest capital in the Legal Amazonia, and Recife through roads network in 2006
- PVM GDD0 and GDD5 Indexes, as well as seasonal and humidity index
- Total urban and rural populations in 1996 and 2006
- Percentage of indigenous land areas in 1996 and 2006

G4M


data
G4M
Postgre
import
original data
(shape and tiff)
2013
data
export
1st/Jan
TerraView
Amazonia
(TerraLib)

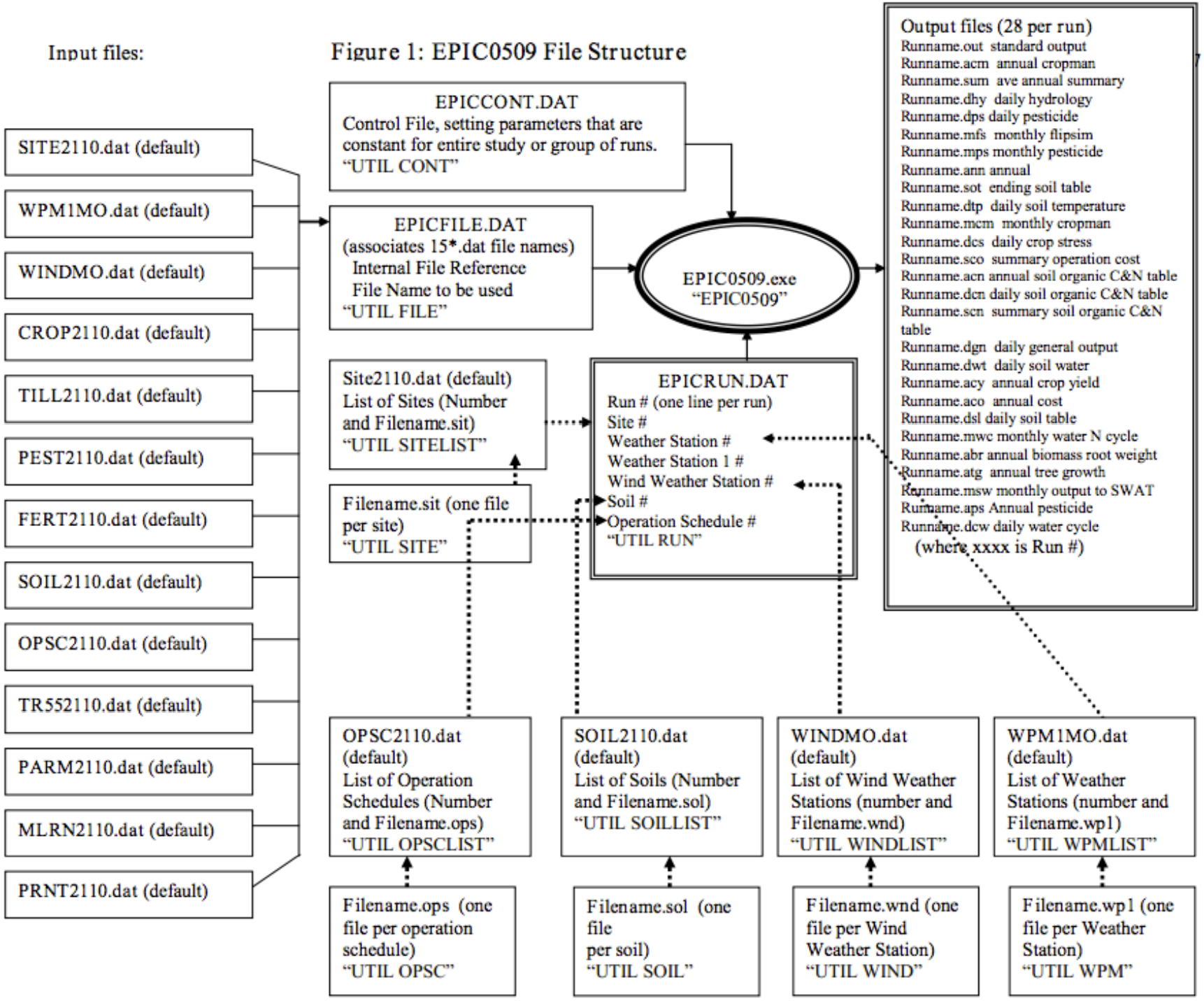
EPIC

- Environment Policy Integrated Climate (EPIC) Model
- Developed by Texas AgriLife Research & Extension Center
- Written in FORTRAN
- No spatial scale
- Temporal scale: 1 day

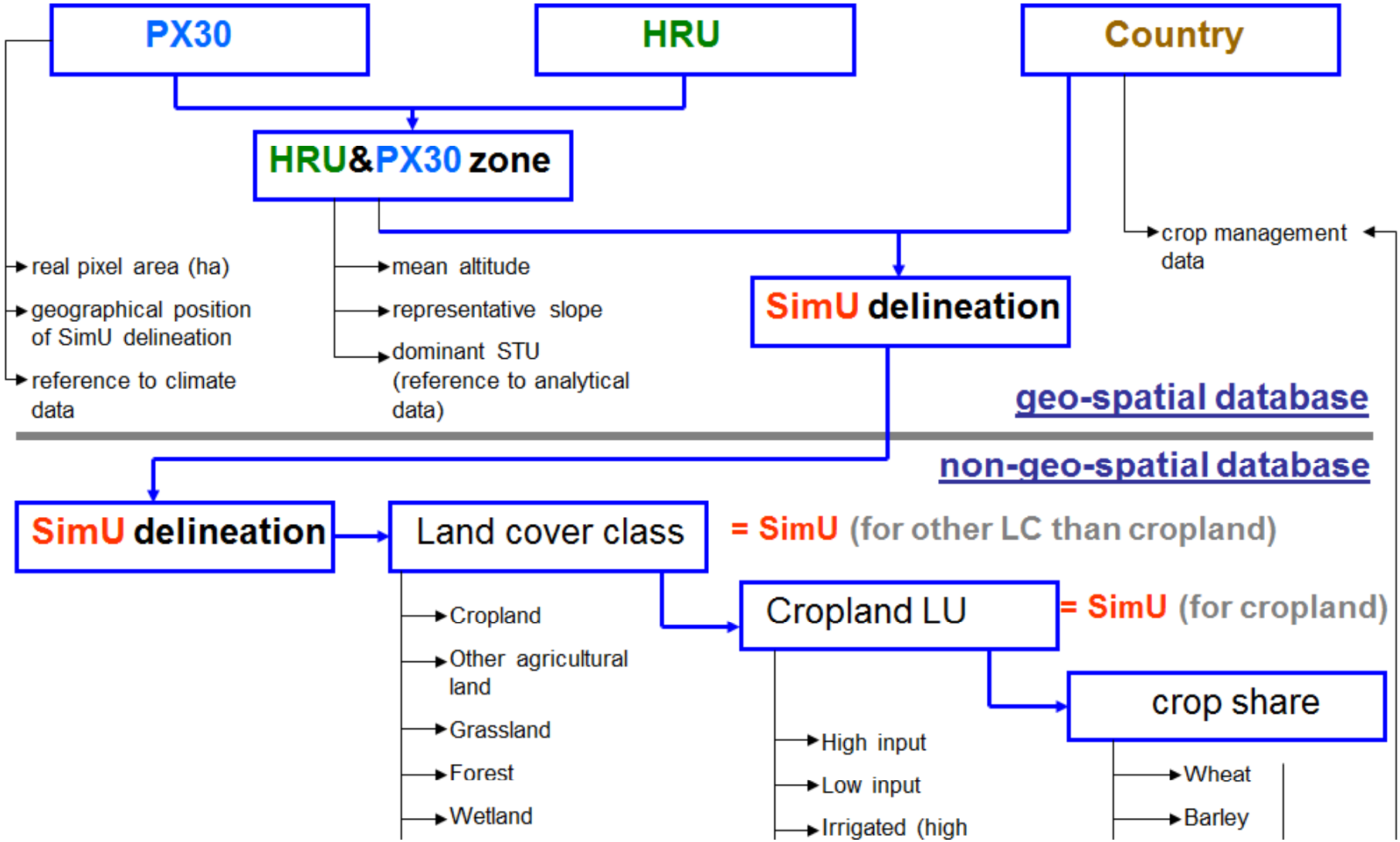


Input files:

Figure 1: EPIC0509 File Structure



Simulation Units



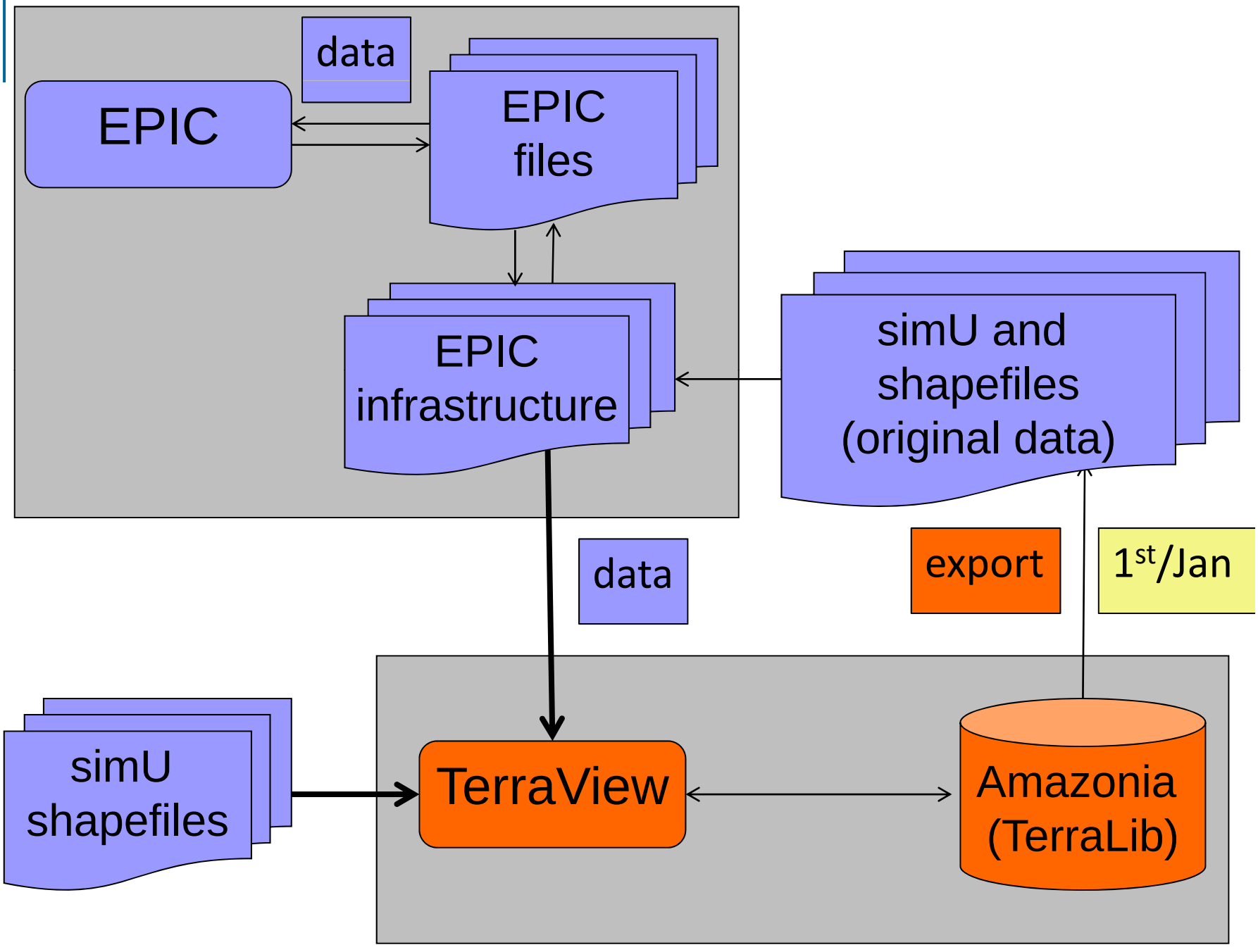
Data to EPIC

Spatially explicit

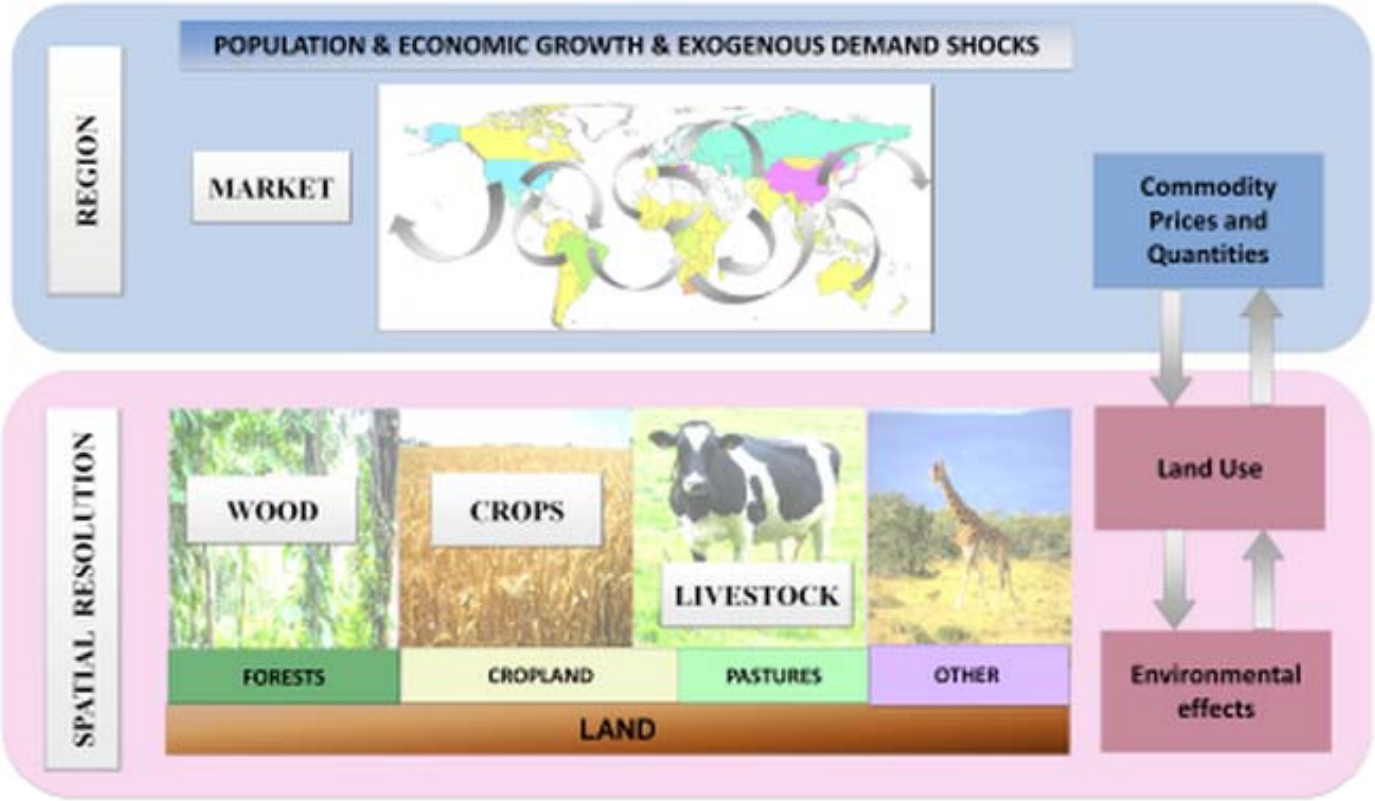
- Pasture, agriculture, forest, forest plantation (TerraClass)
- Total area of sugarcane 2002-2007
- Percentage of degraded forest in 2007
- Humidity index
- Regional climate data (daily wheather, solar radiation, precipitation, humidity, ...) - grided

By municipalities (shapefile)

- Average summer/winter/autumn/spring precipitation
- Average summer/winter/autumn/spring temperature
- Percentage of high/low/very low fertility soils – other soil maps?
- Minimum temperature
- Fertilizers


data
EPIC
EPIC
files
EPIC
infrastructure
simU and
shapefiles
(original data)
data
export
1st/Jan
simU
shapefiles
TerraView
Amazonia
(TerraLib)

GLOBIOM



- land use competition between the major land-based production sectors
- 18 crops, pasture, forest

Data to GLOBIOM

Data related to years 2000, 2005, and 2010 (data will be adapted for such years when data is not available, such as TerraClass for 2008):

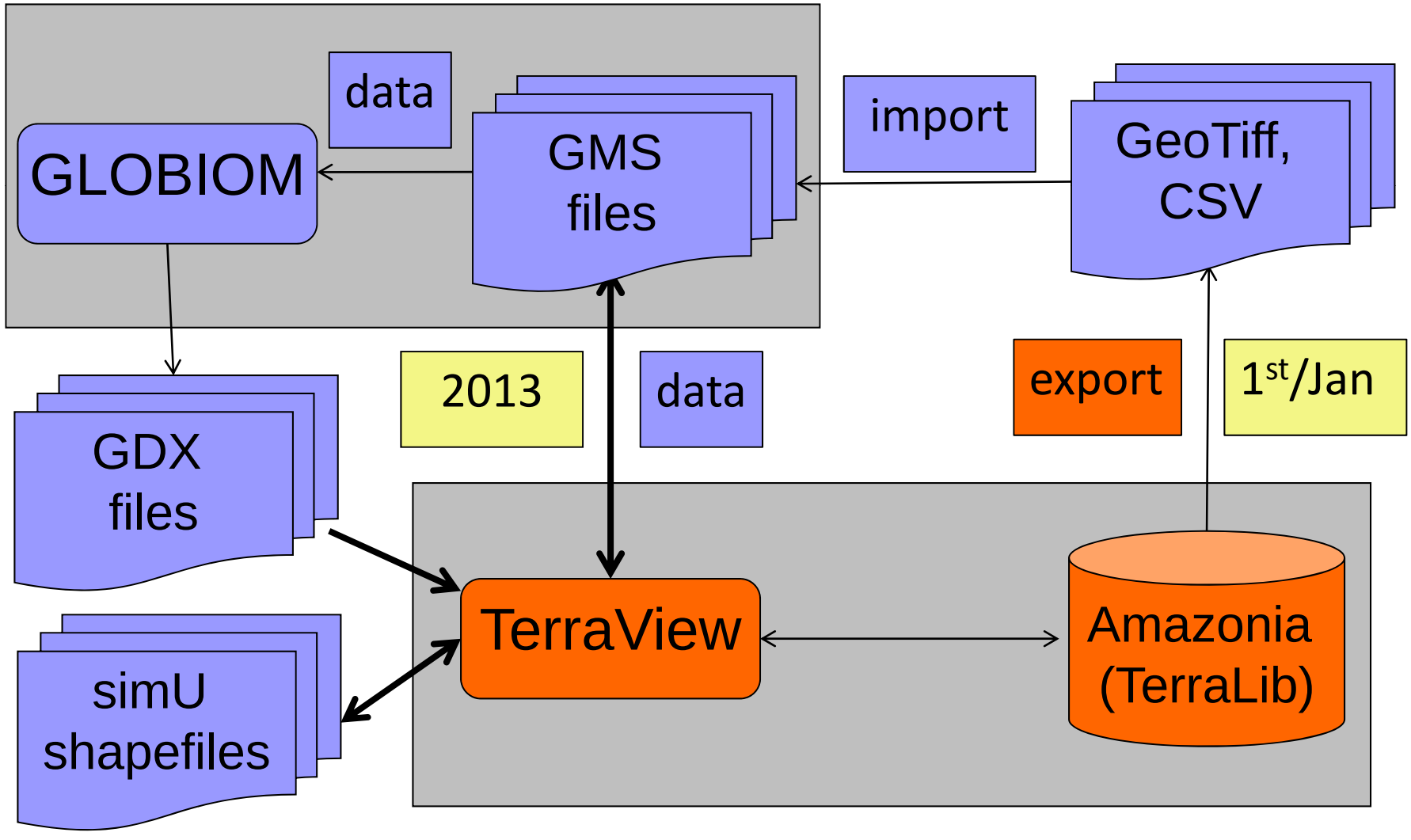
- Pasture, agriculture, forest, forest plantation, selective logging (permanent/ temporal agriculture could also be used for the Brazilian model)
- Density of population
- Transportation costs from the center of the SimU to the nearest port, to the nearest capital, and to São Paulo (time and distance)
- Percentage of protected (integral protection and sustainable use)/indigenous/legal reserve areas (remove the protected areas and compute a percentage according to the bioma)

Data to GLOBIOM

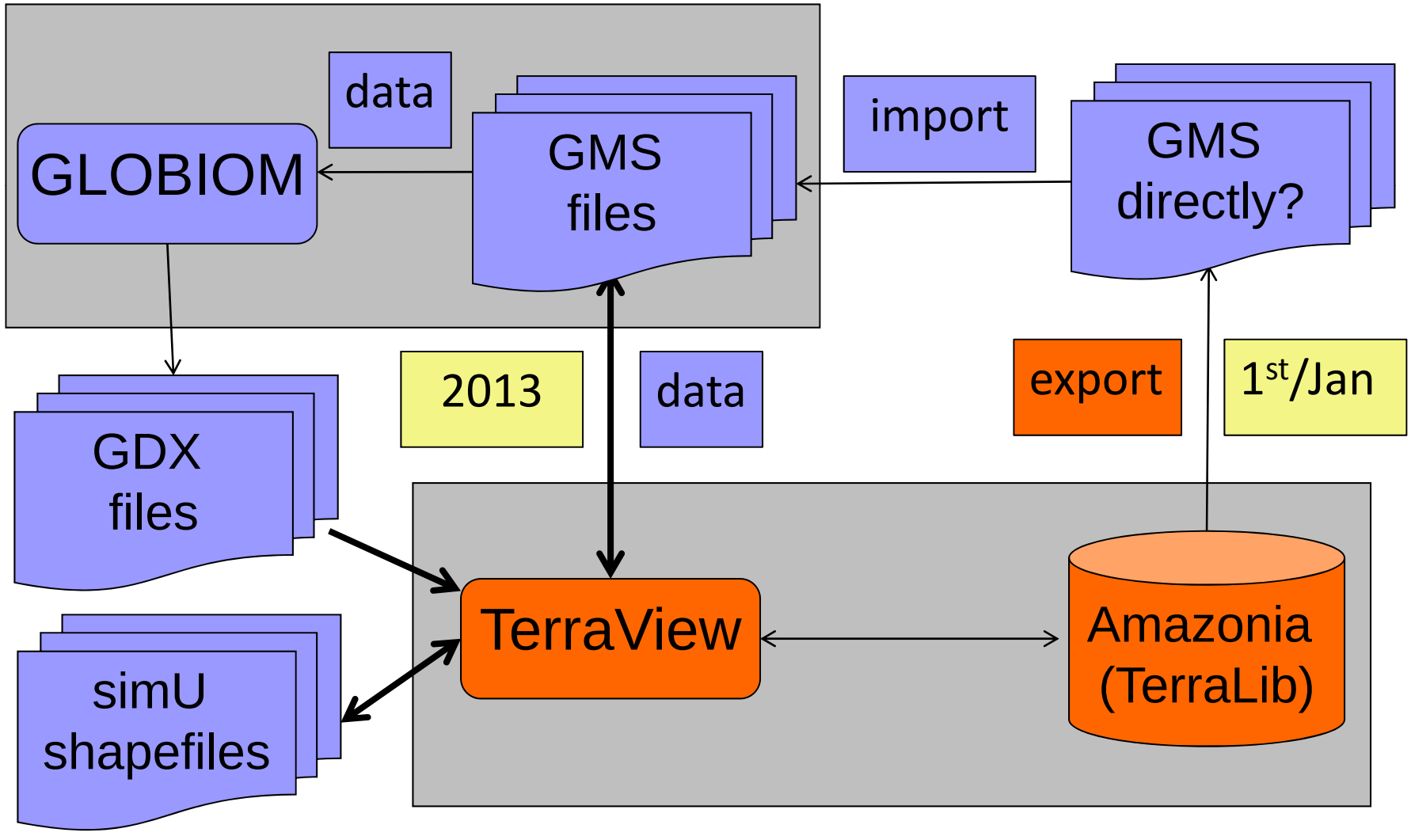
Data related to years 2000, 2005, and 2010 (data will be adapted for such years when data is not available, such as TerraClass for 2008):

- Prices of cattle/soybean/sugarcane
- Number and value of fines
- Price of land (clean land and forest)
- Number/area of small/medium/large properties
- Technological factors (Number of tractors, ...)
- Number of cattle
- GDP
- Municipalities on the black list
- Rural and urban population
- sidra.ibge.gov.br for productivity, price, and land use of each of almost 18 uses (take a look)

GLOBIOM Integration



GLOBIOM Integration



Final Remarks and future steps

1. Computational environment ready to generate the data at chronos.dpi.inpe.br
2. Review the attribute list to generate a final version.
3. Compare generated land use/cover from different sources to investigate the agreement between them:
   1. spatialized census data for 1996/2006
   2. TerraClass for 2008
   3. MMA/Funcate 2002
   4. IBGE 2009
   5. GLC (200)