

Supporting Agriculture Development in Ghana with Geospatial Technologies

CERSGIS - Center for Remote Sensing and Geographic Information Services
GMV - Remote Sensing Applications and Services Division



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Addressing Challenges

- **Low agricultural productivity and food insecurity**
- **Environmental degradation**
- **High energy costs combined with other infrastructure deficits have lowered productivity**
- **Urban Sprawl**
- **Low uptake of earth observation data for agricultural development**



Introduction

- ✓ **Agriculture remains the largest income-generating activity in Africa**
- ✓ **Requirement for achieving the MDGs of halving poverty by 2015**
- ✓ **Although agricultural performance has improved it is based on area expansion – not sustainable**
- ✓ **Agricultural productivity must increase because farm yields are among the lowest in the world**

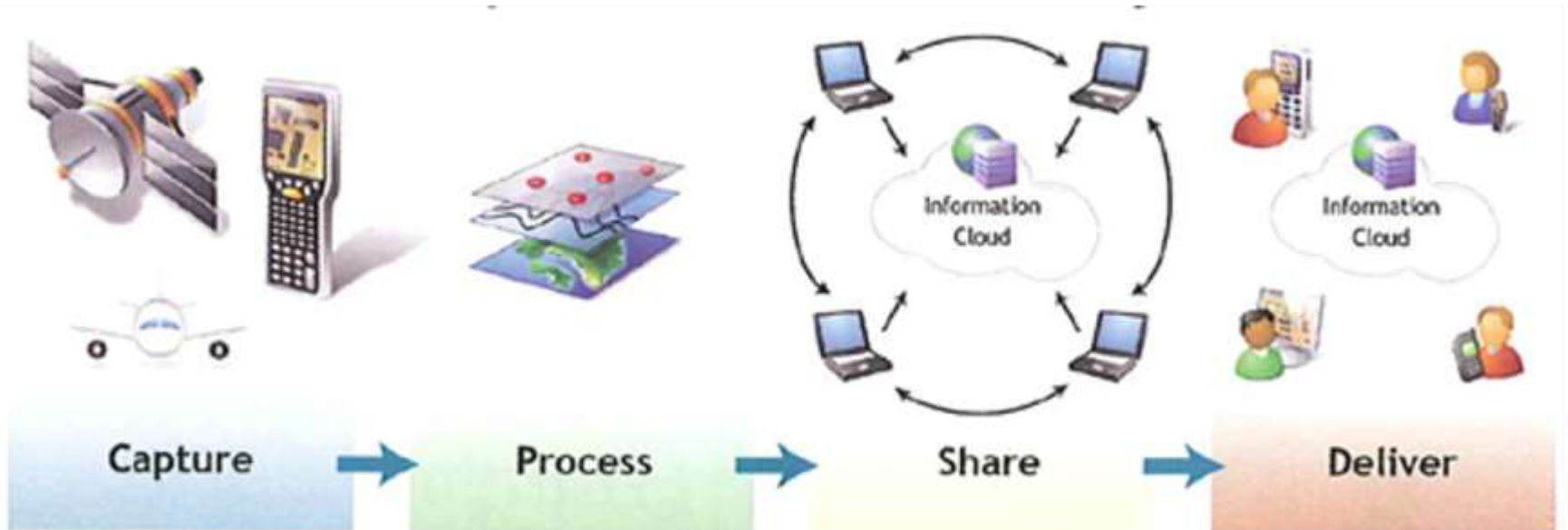
Areas for sustained growth

- ✓ **Improving agricultural policy and institutions**
- ✓ **Improving agricultural productivity**
- ✓ **Reducing rural vulnerability and insecurity**
- ✓ **Linking the farmer to markets**

The missing link is INFORMATION



the most critical resource for agriculture development



Addressing food security

- ✓ **Food security information is critical for Sustainable Development in Africa**
- ✓ **Information on crop development, yield and production forecasts is as critical for food security analysis.**
- ✓ **Availability, timeliness and good quality data is vital**

Open space platforms for Ag-Dev



COPERNICUS AND ITS SENTINELS

Observing our planet for a safer world. The European Earth Observation Programme Copernicus provides geo-information products and services based on satellite imagery.

SENTINEL-1A/1B	SENTINEL-2A/2B	SENTINEL-3A/3B	SENTINEL-5P	SENTINEL-4	SENTINEL-5
<ul style="list-style-type: none"> • Synthetic Aperture Radar (SAR) satellite • Provides all-weather, day/night imagery • Key for disaster management, agriculture, and urban planning 	<ul style="list-style-type: none"> • Multi-spectral satellite • Provides vegetation indices (e.g., NDVI) • Key for agriculture, forestry, and land use monitoring 	<ul style="list-style-type: none"> • Ocean Color and Temperature (OCT) satellite • Provides sea surface temperature and chlorophyll-a • Key for marine resource management and climate change 	<ul style="list-style-type: none"> • Polar-orbiting satellite • Provides atmospheric composition and trace gases • Key for air quality and climate change monitoring 	<ul style="list-style-type: none"> • Multi-spectral satellite • Provides high-resolution imagery for urban planning and disaster management 	<ul style="list-style-type: none"> • Multi-spectral satellite • Provides high-resolution imagery for land use and agriculture



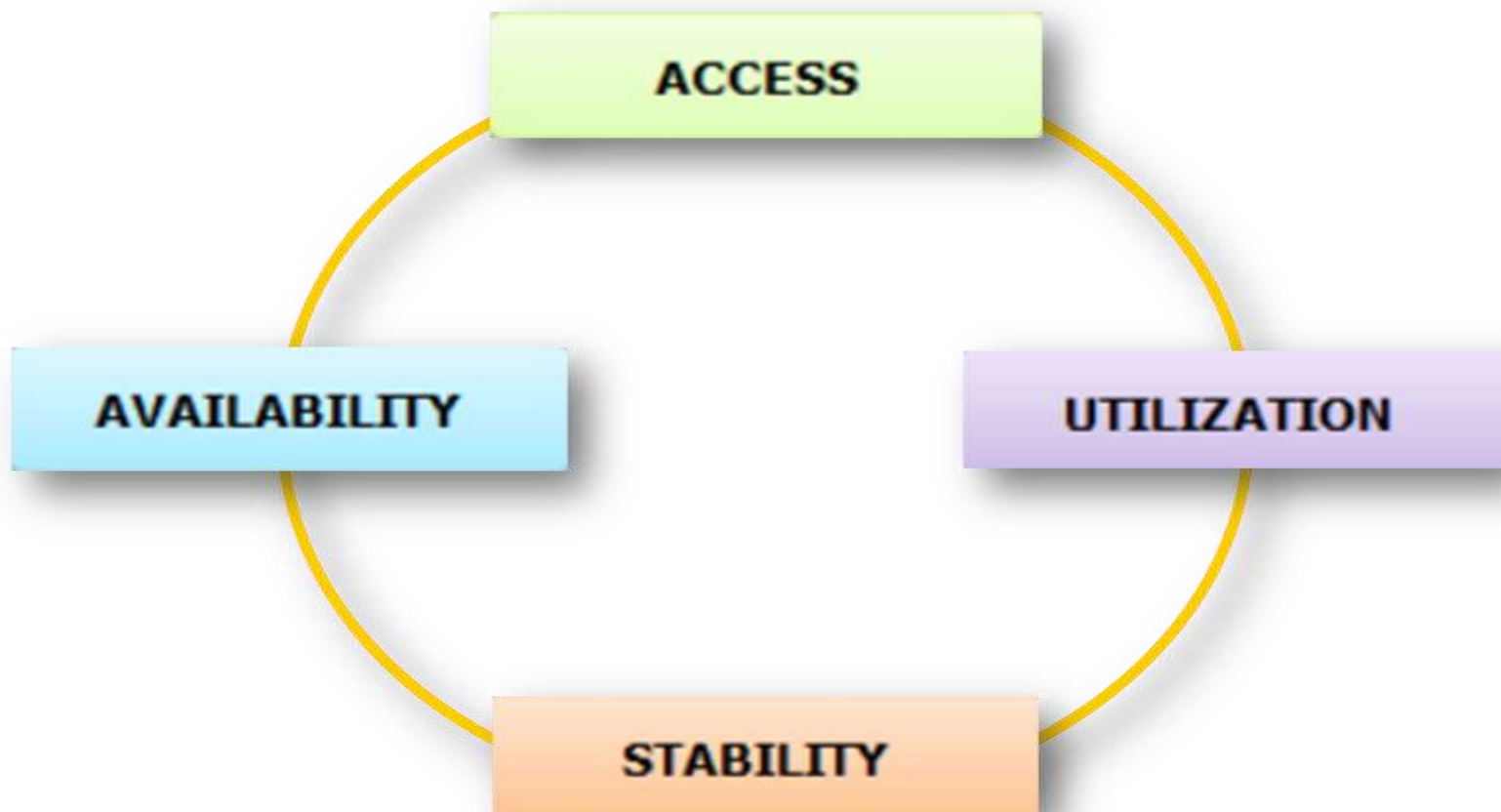
proba
VEGETATION

Small Satellite for
Global Vegetation Monitoring

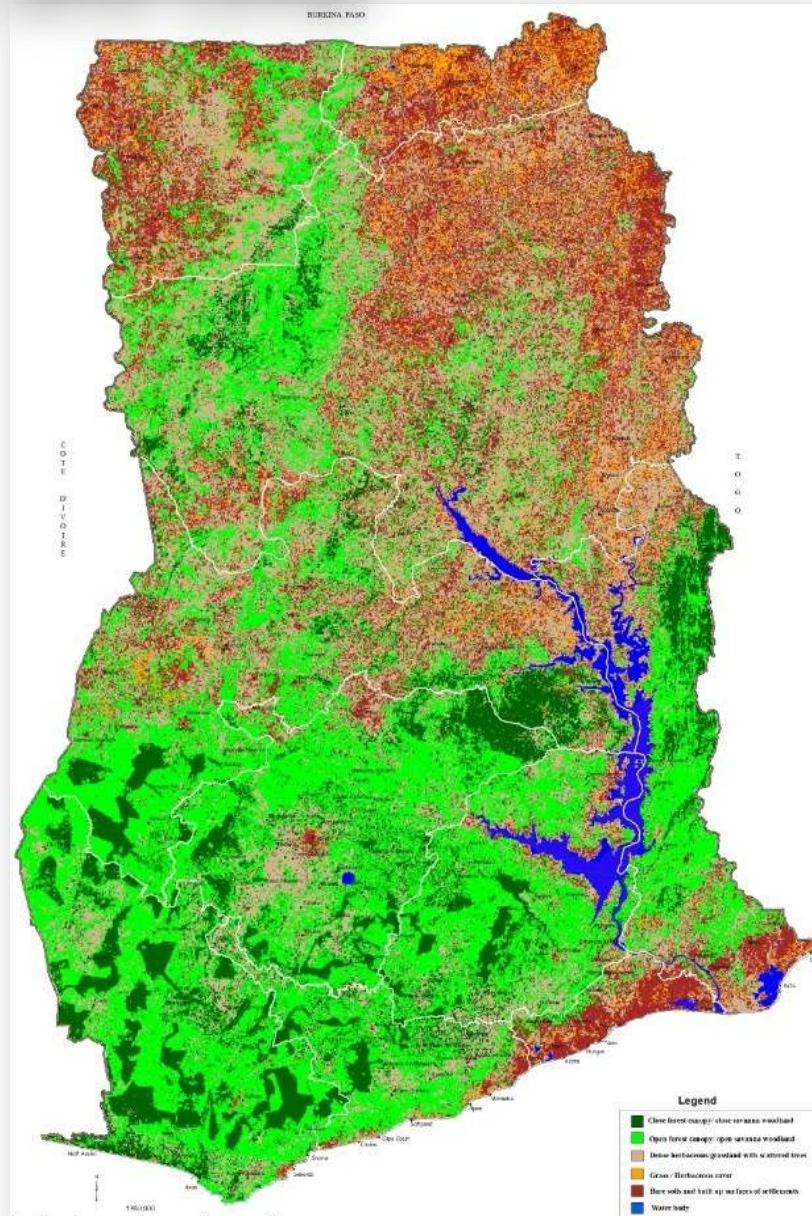
Data availability and utility for Ag-Dev in Africa

- ✓ Regular and timely information for large geographic areas
- ✓ Near real-time data on vegetation development and rainfall
- ✓ Potential for assessment of vegetation anomalies
- ✓ Unique source of data for agriculture development
- ✓ Input for modelling crop development and yield forecast
- ✓ Covers spatial and temporal scales
- ✓ Assess and measure spatial and temporal changes
- ✓ Potential for evidence-based early warning

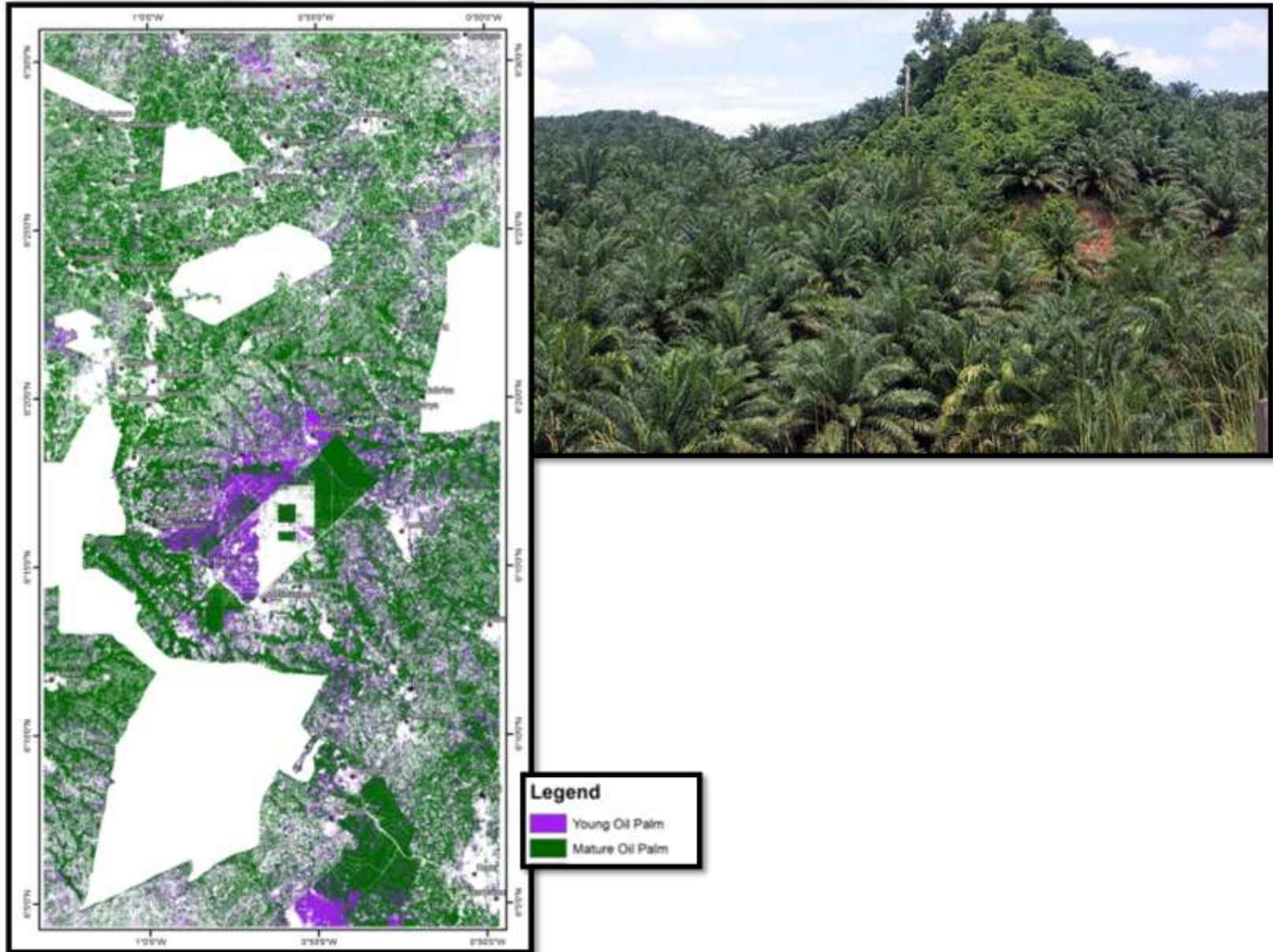
Food Security: a multi-dimensional concept



Mapping land cover

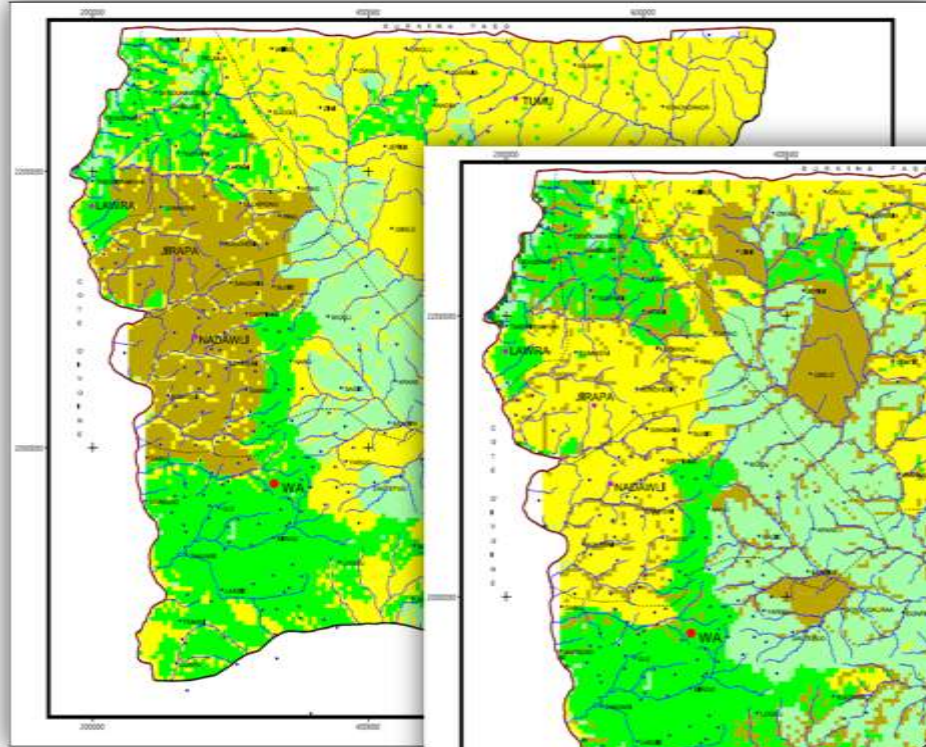


Mapping the oil palm landscape

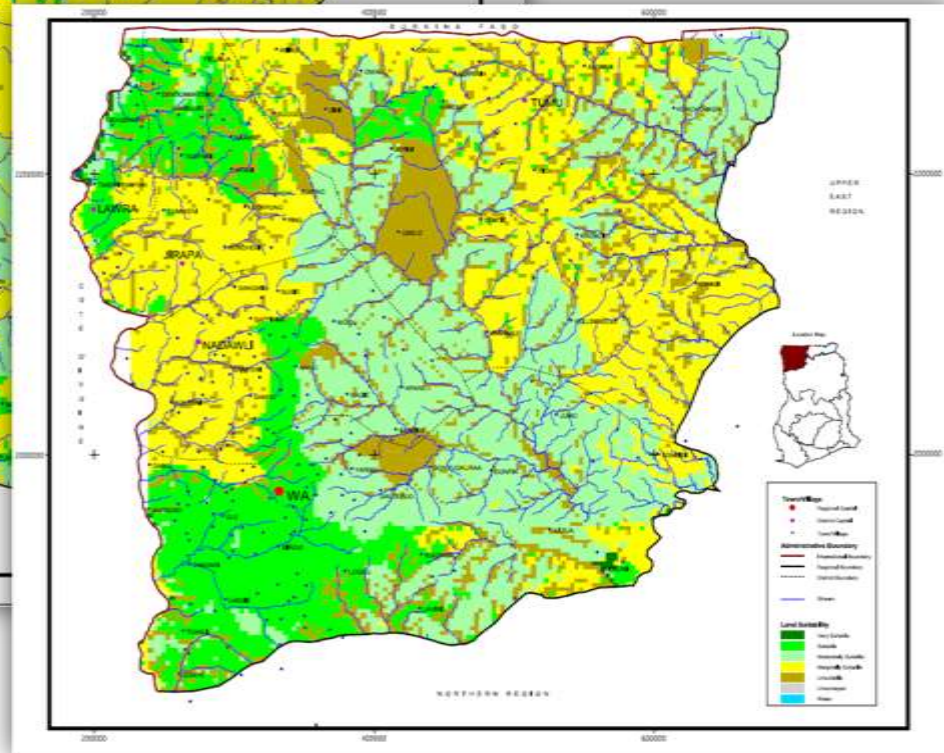


Modeling land suitability

Cowpea



Millet



Geospatial Portal

demand for geospatial data

open access to geospatial data

minimize duplication

efficient data maintenance

build and maintain partnerships



Metadata service



Map service



D-support service

GHANA AGRICULTURE
Online GIS Platform



HOME

DATA

AGRIC COMMERCE

INTERACTIVE MAP

SAMPLE MAP

CONTACT US



Transforming Ghana's Agriculture with Geospatial Technologies.

DATA COLLECTION



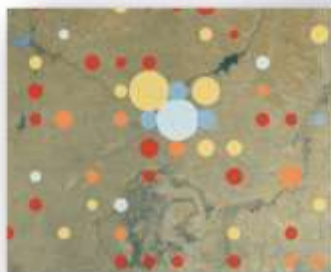
BASELINE INDICATORS



KEY PERFORMANCE INDICATORS



M&E ONLINE



GEOSPATIAL DATA CYCLE & AGRICULTURE

Agriculture Data Analysis Flow

GEOSPATIAL DATA, GROUND TRUTH, MODELS, SIGNATURES,
CALIBRATION, MODELING, SIMULATION...

COLLECTION

PROCESSING

EXPLOITATION

INTEGRATION

TAILORED /
CUSTOM
PRODUCTS

Feedback, Lessons learnt

SERVICE CHAIN

Data Harvesting

Basic Data

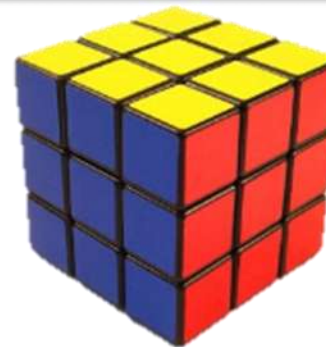
Value Added Products



- Agroclimatic data
- Satellite images
- Field data
- User data, local knowledge
- Crop models...



- Processed imagery
- Overall crop condition
- Agroclimatic variables
- Data integration...



- Derived data and indicators
- Area based statistics
- Data service;
 - LULC maps
 - Agricultural statistics
 - Crops identification
 - Acreage
 - Agricultural land monitoring
 - Early warnings
 - Harvest progress monitoring
- ...



Agricultural SDI-DSS

Data Integration and Services Platform

- Summarized & comparative data
- Trends & time series
- Time series analysis
-



Users

- Analysis
- Monitoring
- Decision Making
- Practices Improvement
- Users feedback, crowdsourcing

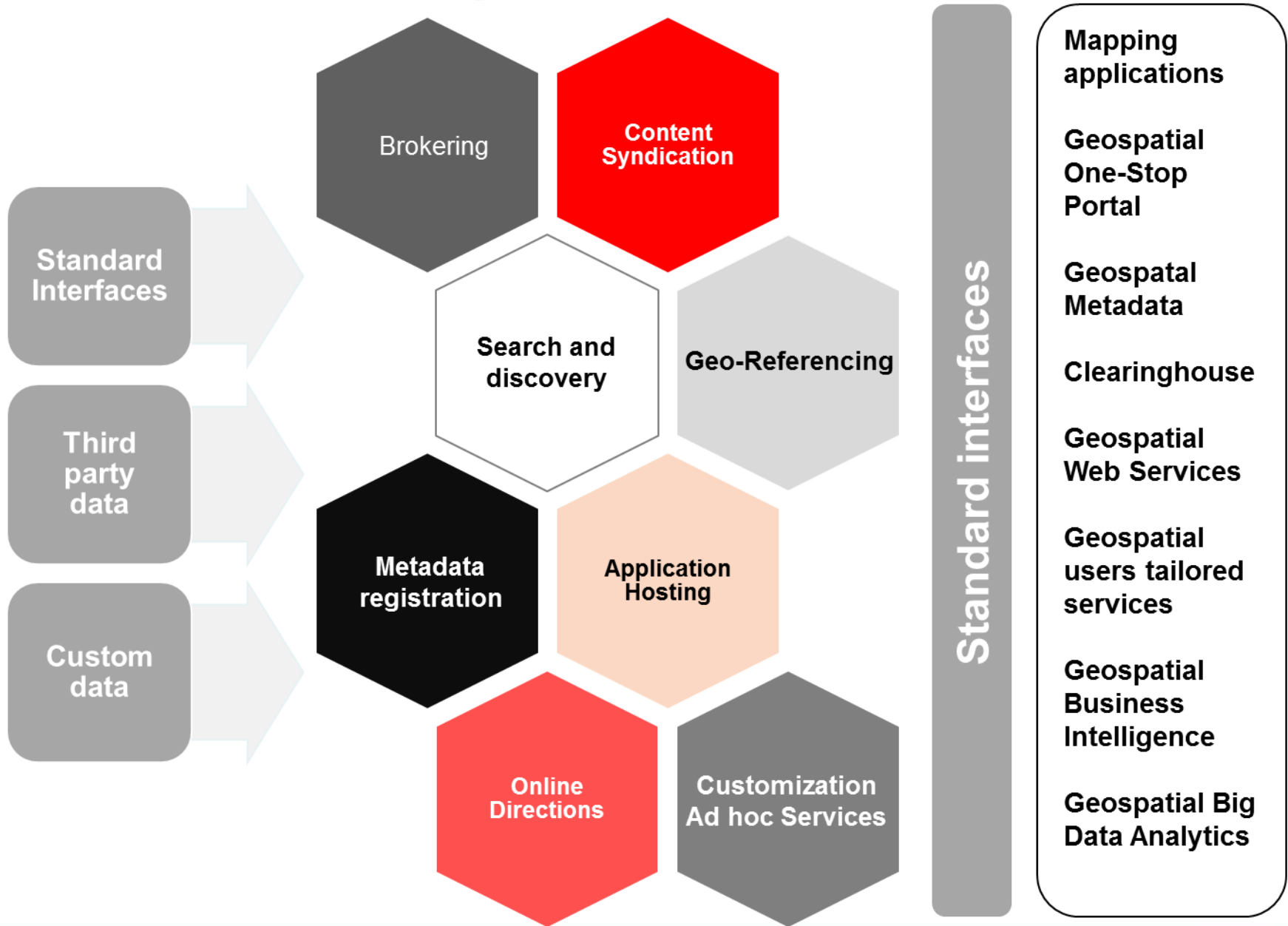
OGC[®]
Making location count.

AfriGeoSS



Copernicus

eAgriculture SDI - DSS



OVERALL VALUE

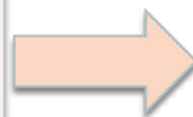
AGRICULTURAL SECTOR

Grain & Storage	Credit & Insurance	Agricultural Extension	Agricultural statistics	Retail
<p>Crop identification per silo / supply region</p> <p>Quality & yield monitoring</p> <p>Budget and logistics planning</p>	<p>Real time management of crop collateral, finance and insurance compliance</p> <p>Enhanced risk and cost crop finance / insurance products</p>	<p>NRT data on all farms performance</p> <p>Advanced in season diagnostic</p> <p>Improved advice</p> <p>Cost optimization</p>	<p>Value added data</p> <p>Crop estimation</p> <p>Price risk management</p> <p>Acreage</p> <p>Yield indication</p>	<p>Data for logistics, sale of inputs</p> <p>Widely available</p> <p>Precision farming data</p>

FARM; Large, medium & small holders

New Field or Zone Based Products

- Per farm/zone data stream images and data
- Crop performance maps
- Cost optimization and yield improvement
- Wholesale supply/license of per hectare product to clients
- Integrated weather data
- Achieves: finance / insurance compliance
- Global best practice, sustainable and environmentally friendly agriculture

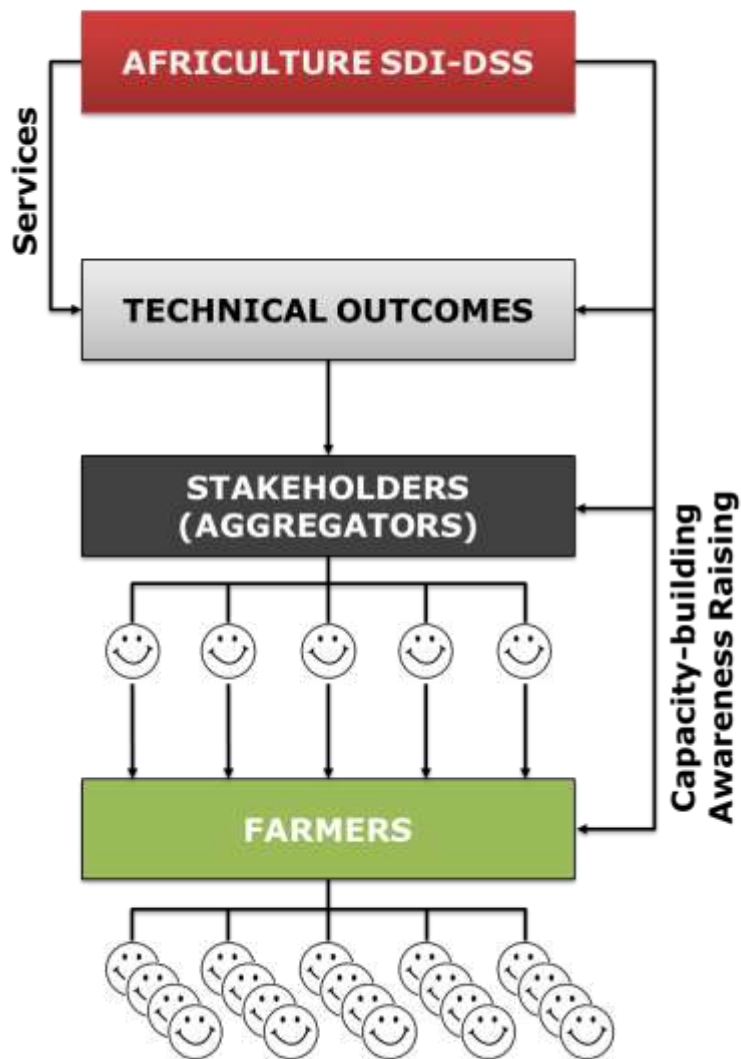


Outcome/impact

- Enhanced ability to service farmers, manage risk and increase production
- New products and derivatives
- New income stream
- Leading innovation based on proven technology jump
- Leveraged access to AG lending
- Real time & historical analysis

AGENTS, OUTCOMES & IMPACTS

AGENTS



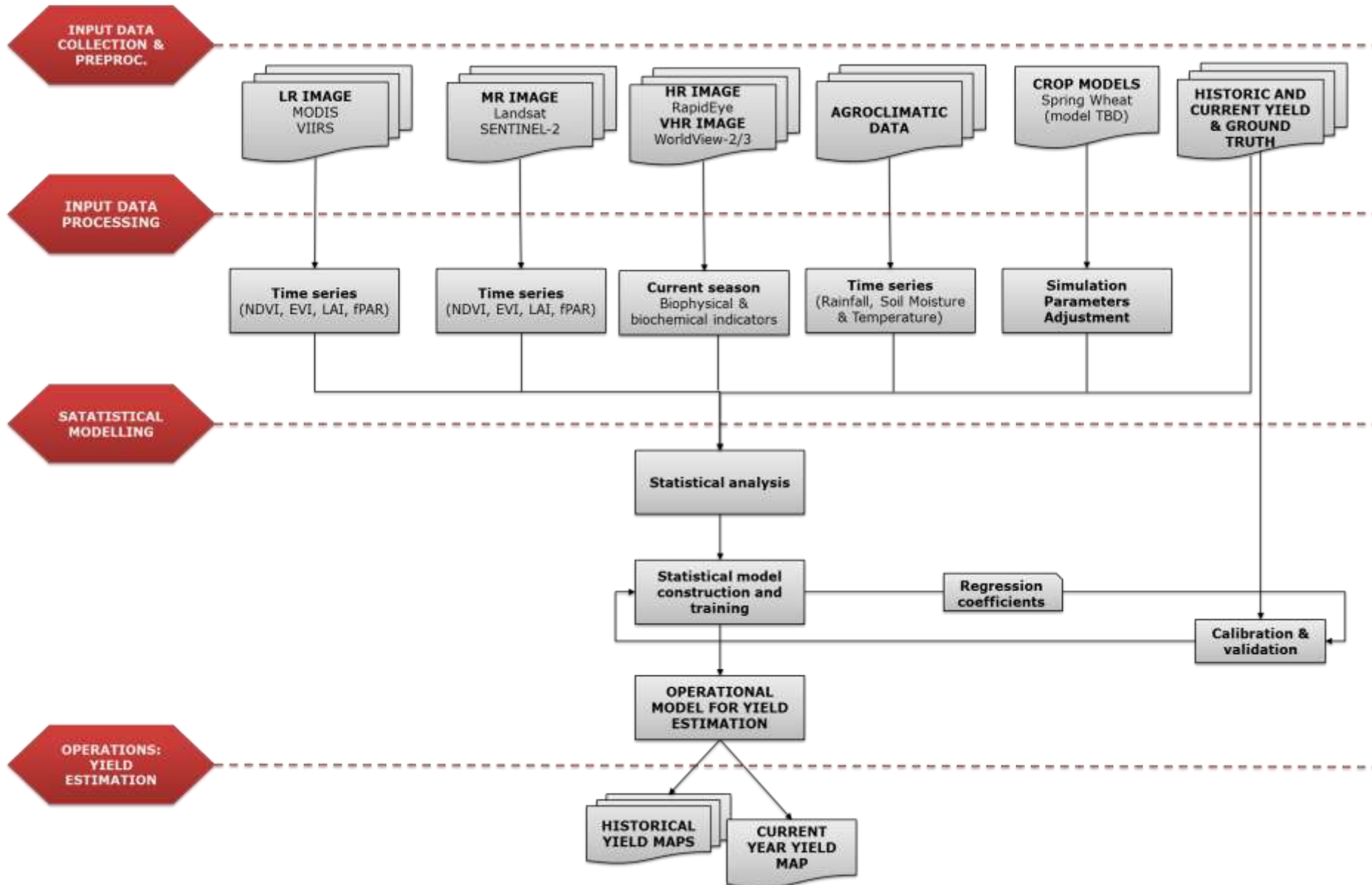
OUTCOMES

- ✓ ICT based digital agriculture geo-enabled services deployed
- ✓ Scalable and interoperable ICT platform, ready to deploy new custom services
- ✓ Apply models based on geo-technology, satellites, weather and field data
- ✓ Improved agricultural data production, sharing, management, discovery and dissemination
- ✓ Leverage the uptake of digital agriculture
- ✓ Leverage the uptake of Agricultural Production Risk Management
- ✓ Stakeholders engagement

IMPACTS

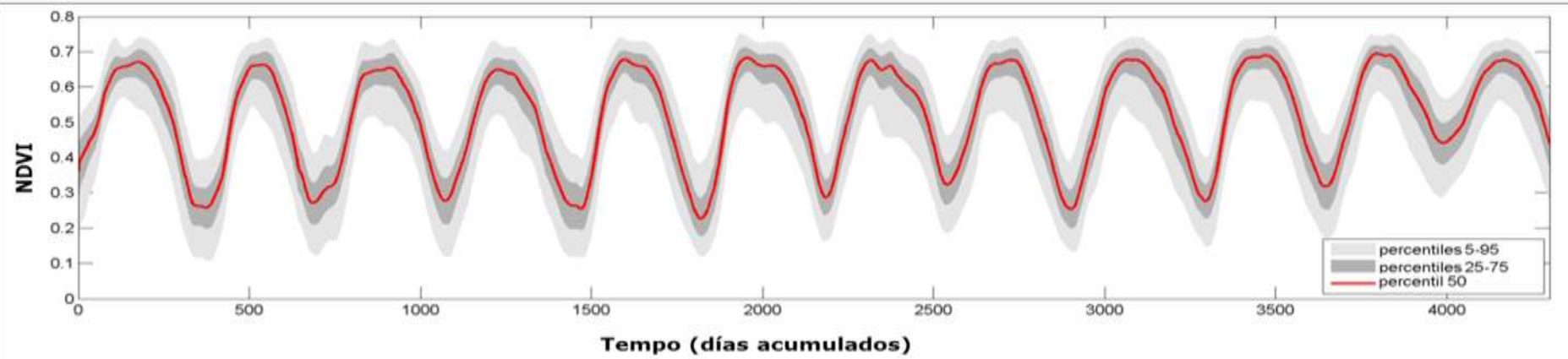
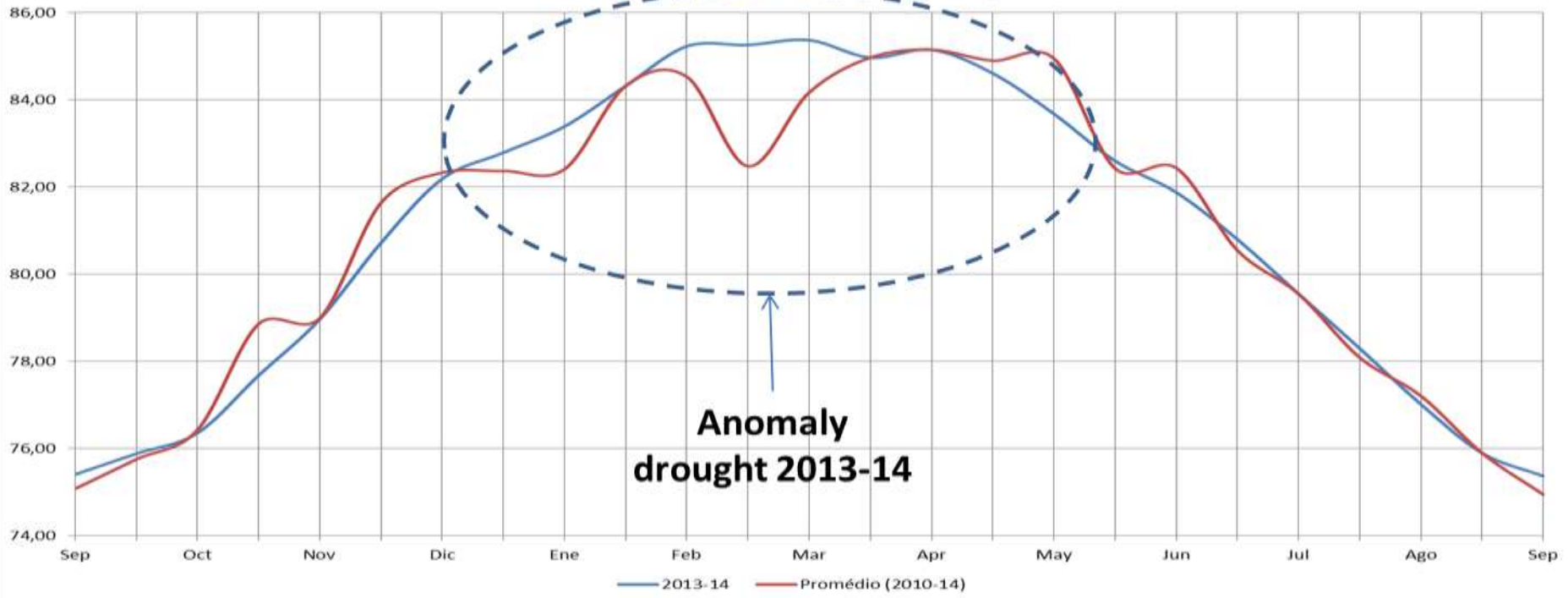
- ✓ Food security and agricultural income reinforced through early warning and ease to use weather and remote sensing based data in support of smart farming
- ✓ Ability to produce timely, accurate and reliable agricultural statistics in support of policy making and assessment
- ✓ Readiness for downstream value added services, e.g. agricultural extension and farmers advice
- ✓ Readiness for Agricultural Insurance uptake, leveraging AG micro-insurance and agricultural lending (financial inclusion = production improvement)

AGRICULTURAL STATISTICS

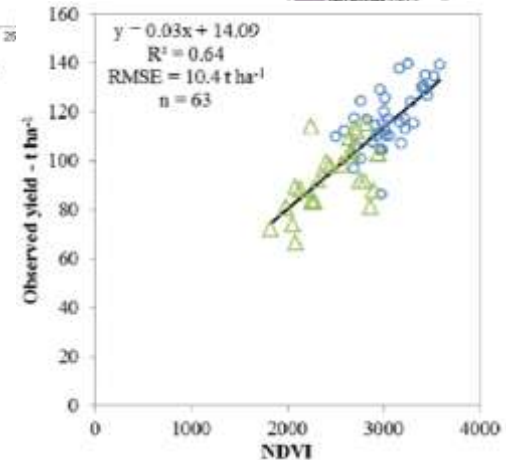
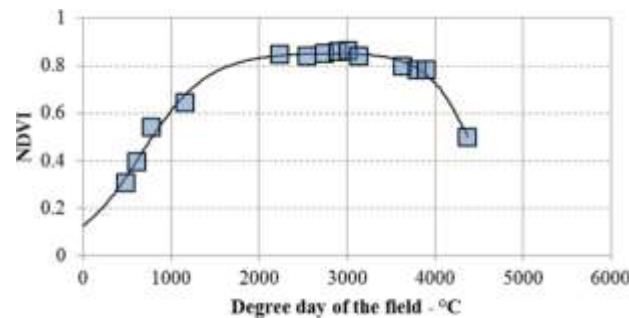
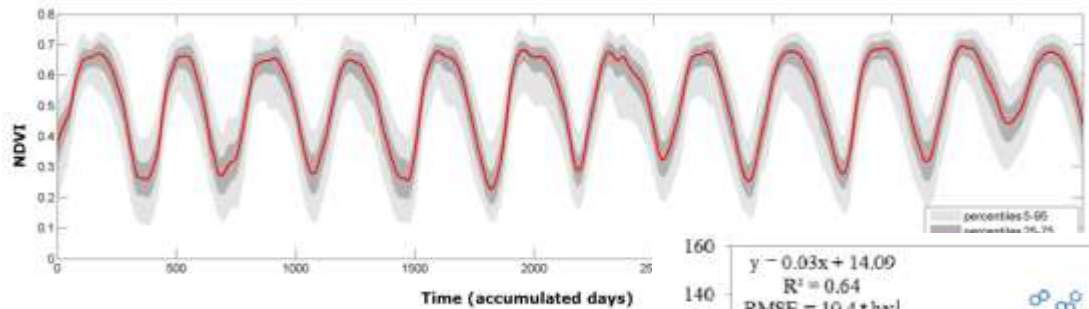
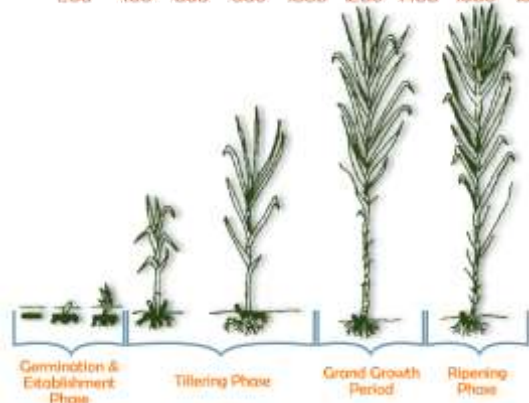
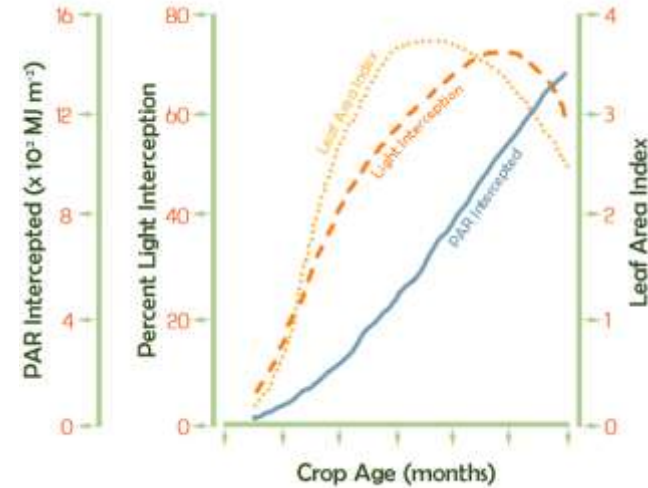
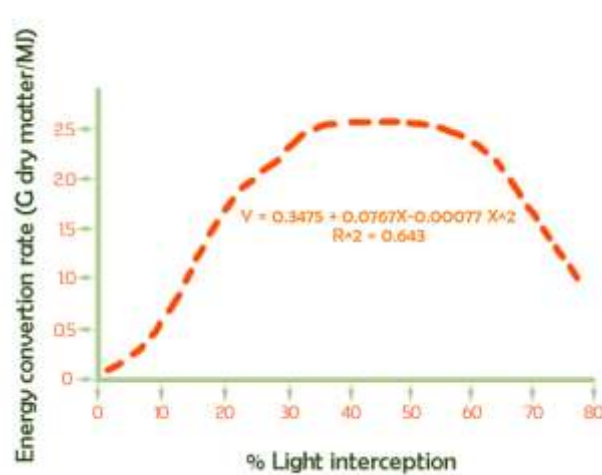
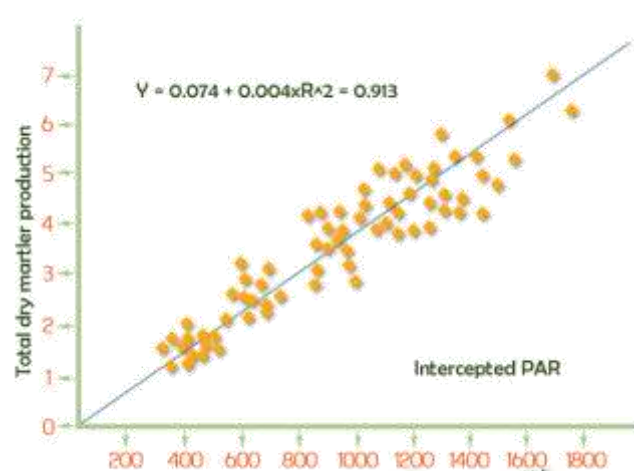


EARLY WARNINGS, INDEX INSURANCE...

MODIS NDVI (Terra) (MOD44 - 16-dias): São Paulo



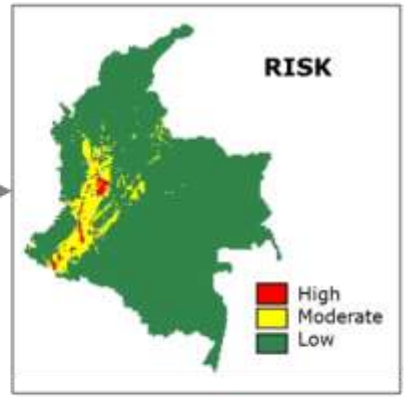
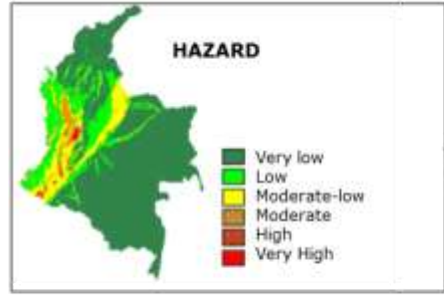
OPTIMUM HARVEST TIME ESTIMATION



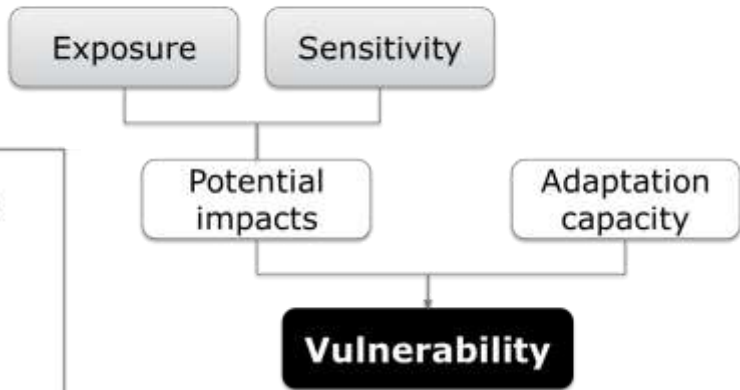
The **optimum harvest time** estimated by composing the maturation curve based on the combined analysis of multitemporal satellite imagery and agroclimatology

SPATIOTEMPORAL PRODUCTION RISK ASSESSMENT

$Risk = Hazard \times Vulnerability$



Components Vulnerability



PROBABILITY	Frequent	Blue	Yellow	Orange	Red	Red	EXPOSURE DEGREE
	Likely	Blue	Yellow	Orange	Orange	Red	
	Possible	Blue	Blue	Yellow	Orange	Orange	
	Unlikely	Green	Blue	Blue	Yellow	Yellow	
	Low	Green	Green	Blue	Blue	Blue	
		Negligible	Minor	Moderate	Significant	Severe	
							INTENSITY

SATELLITE BASED PRESCRIPTION MAPS



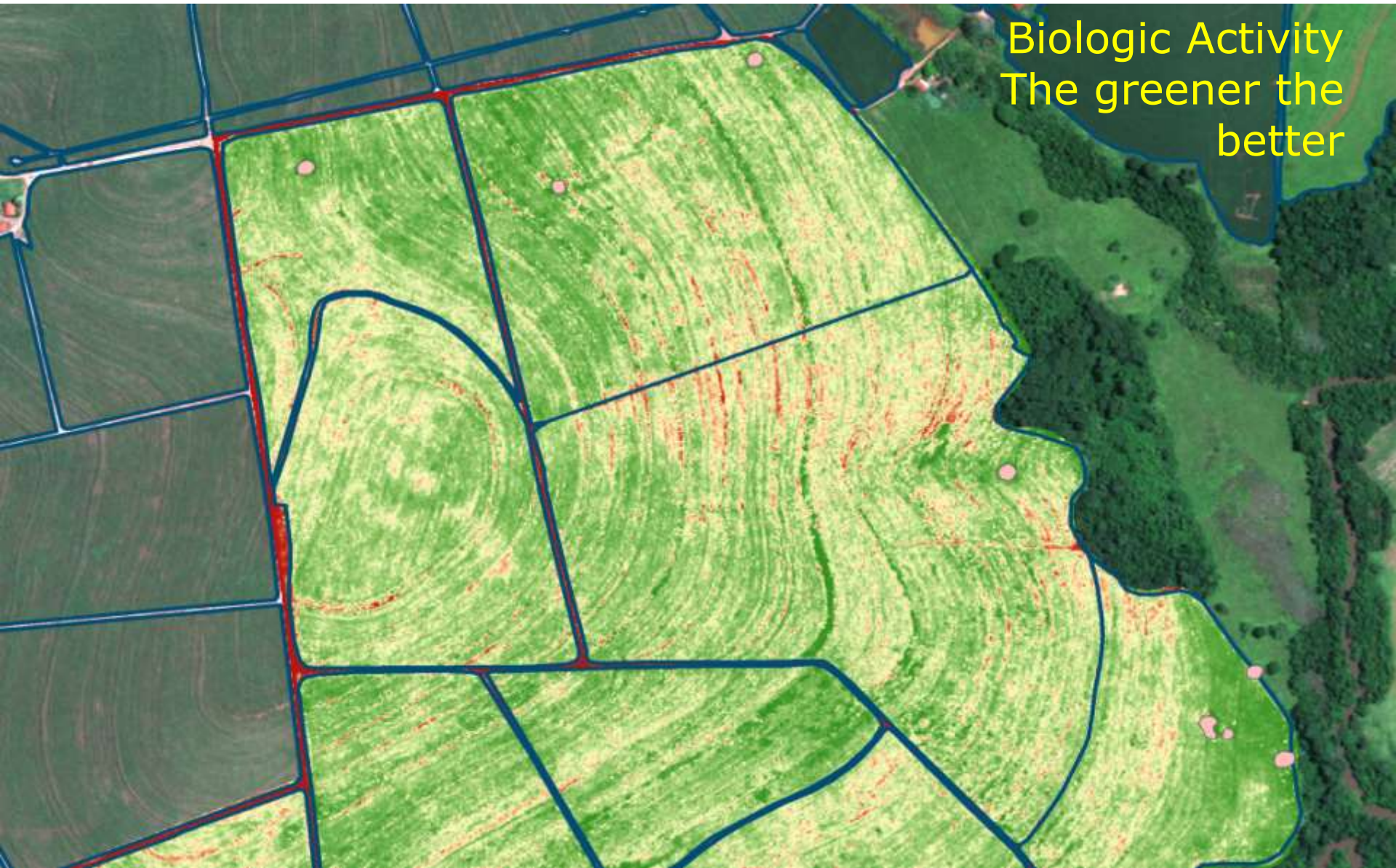
True Color

SATELLITE BASED PRESCRIPTION MAPS



Parcel delineation

SATELLITE BASED PRESCRIPTION MAPS



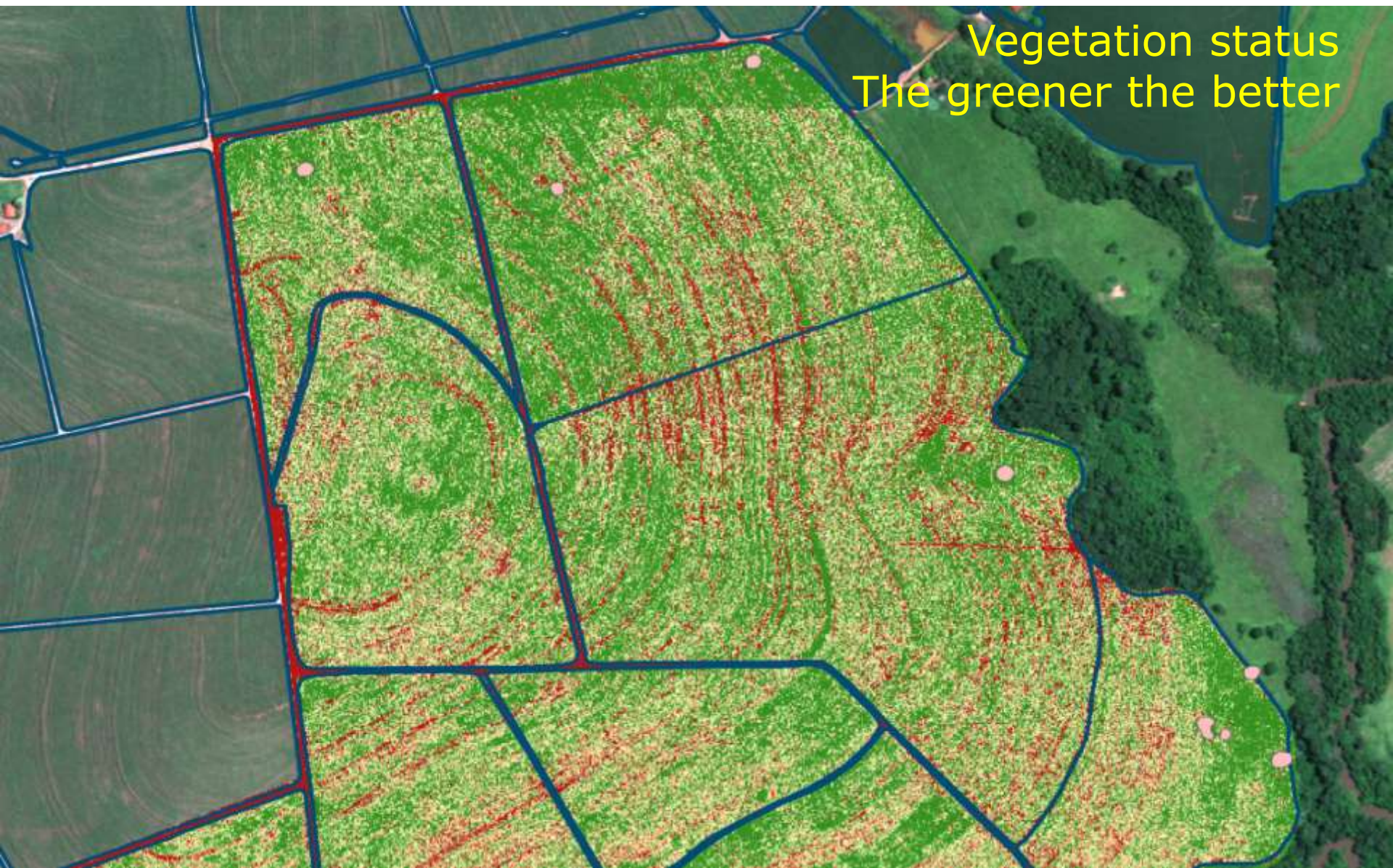
Biologic Activity
The greener the
better

SATELLITE BASED PRESCRIPTION MAPS



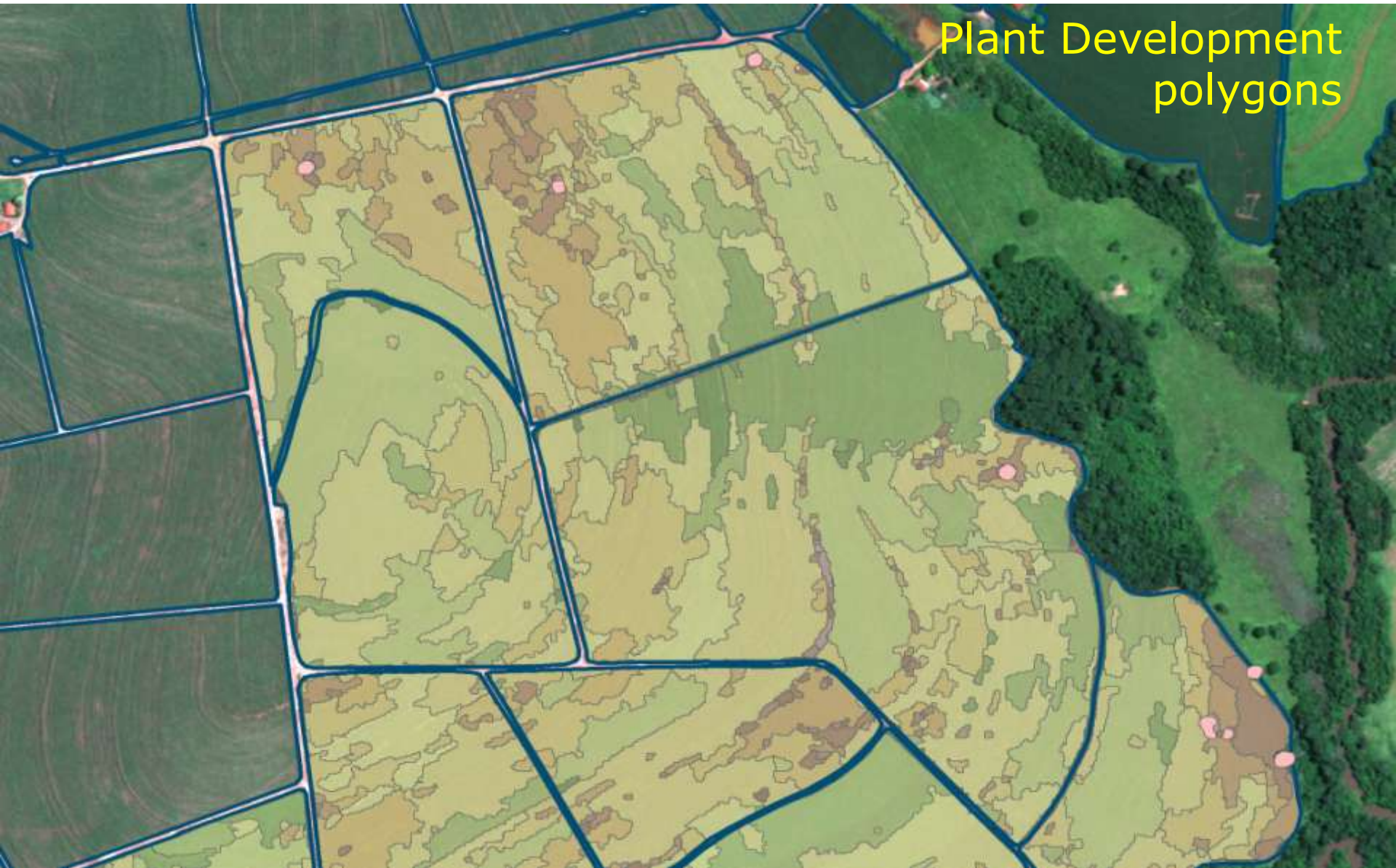
Plant Development
The greener the
better

SATELLITE BASED PRESCRIPTION MAPS

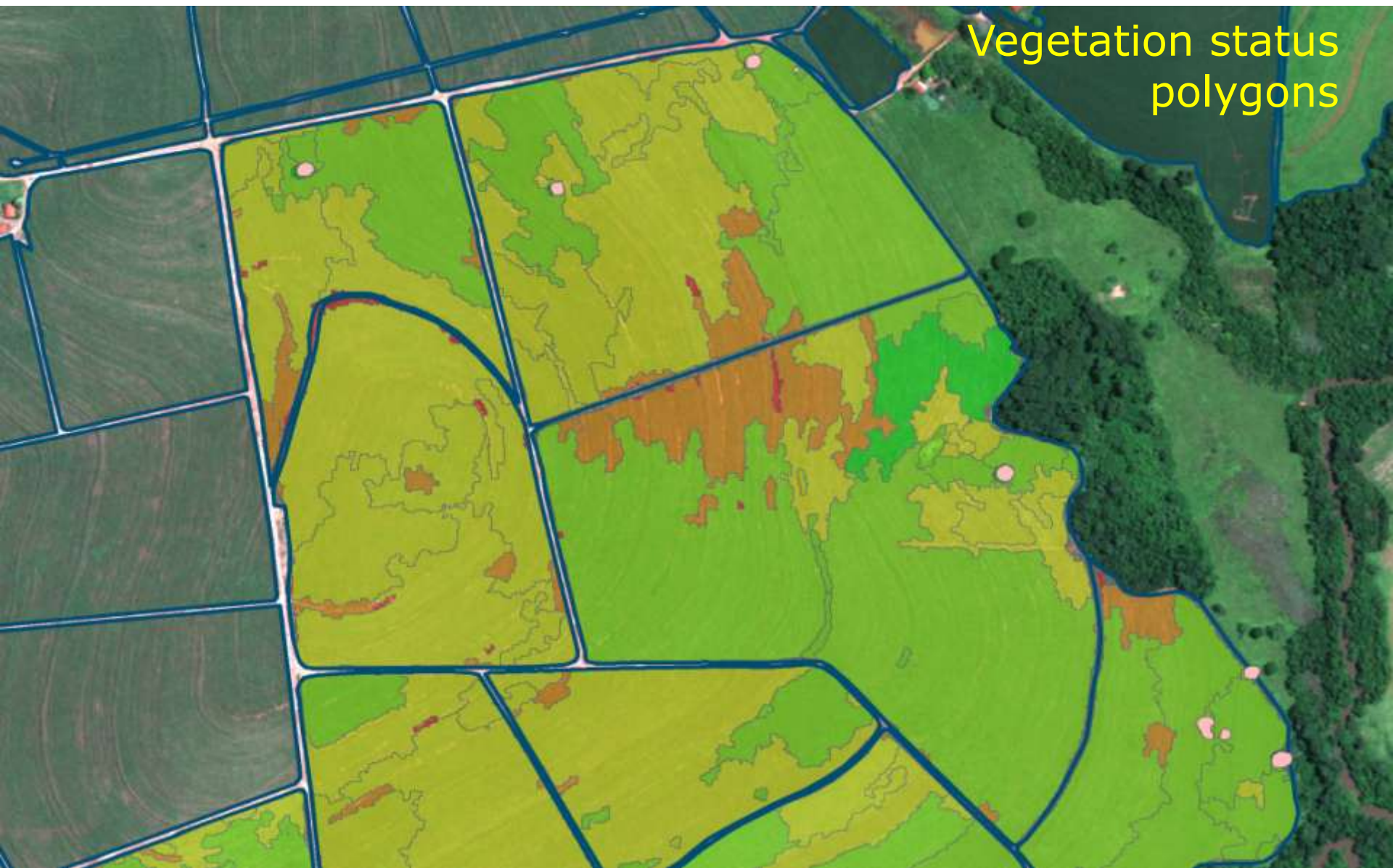


Vegetation status
The greener the better

SATELLITE BASED PRESCRIPTION MAPS

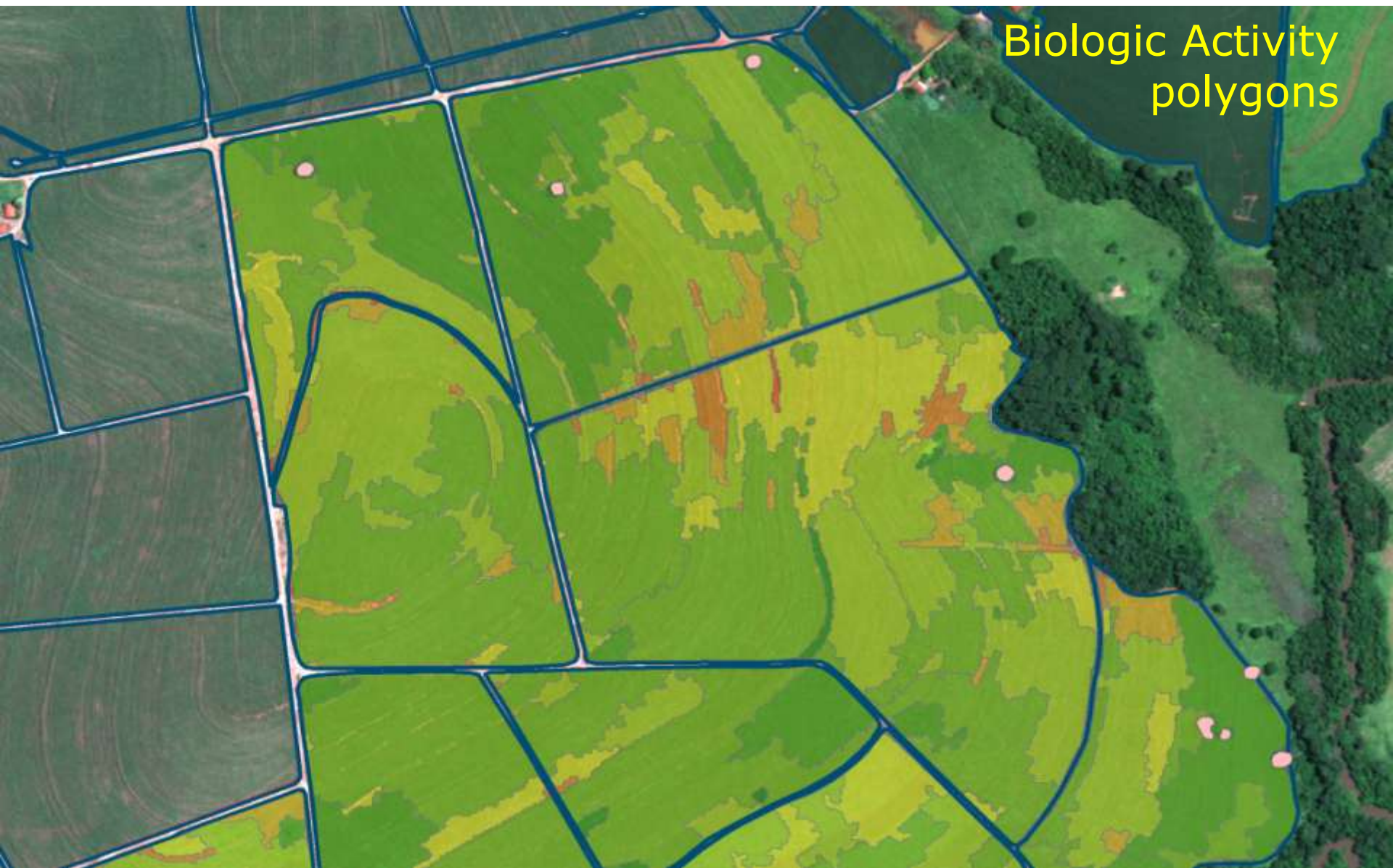


SATELLITE BASED PRESCRIPTION MAPS



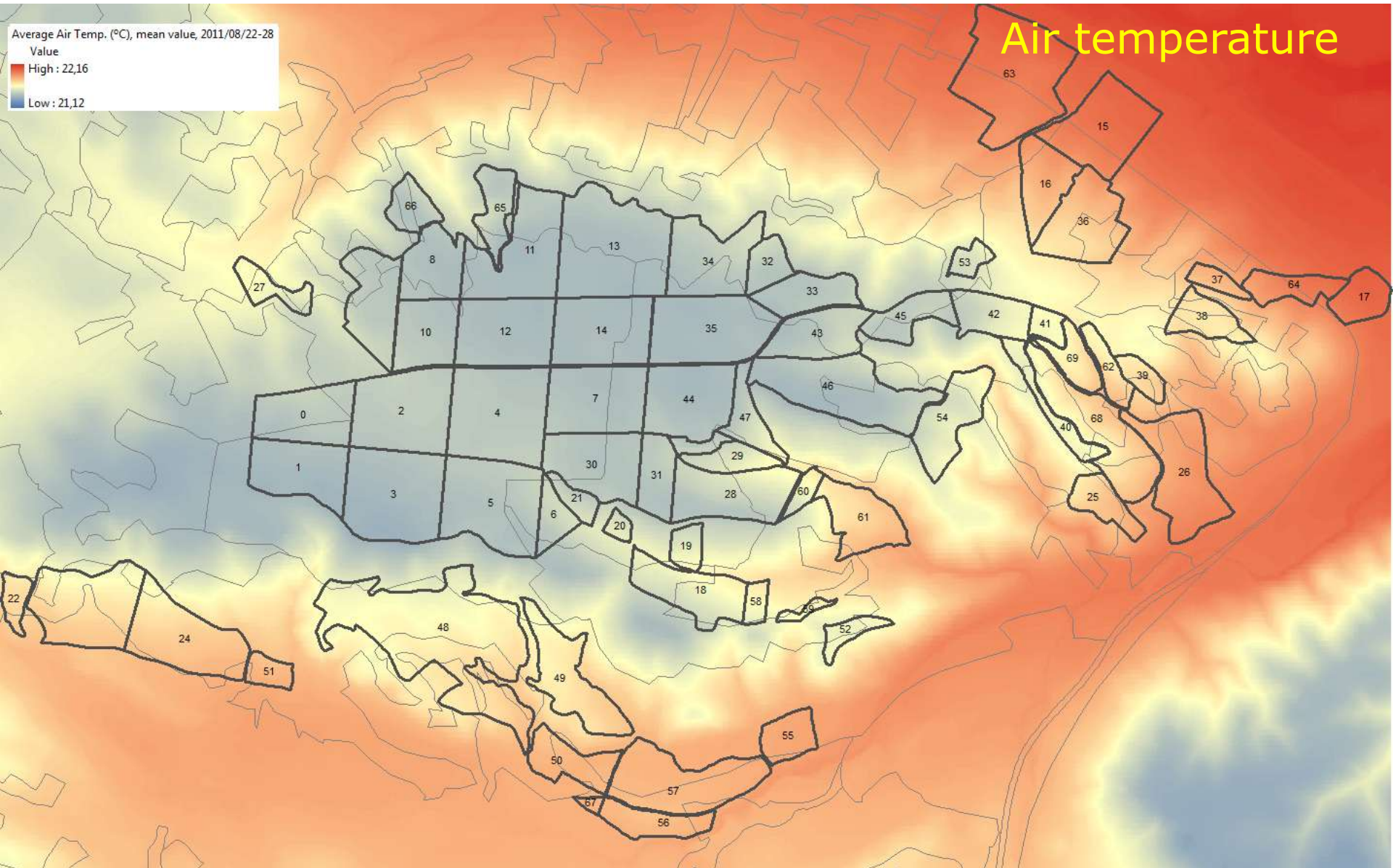
Vegetation status polygons

SATELLITE BASED PRESCRIPTION MAPS



Biologic Activity polygons

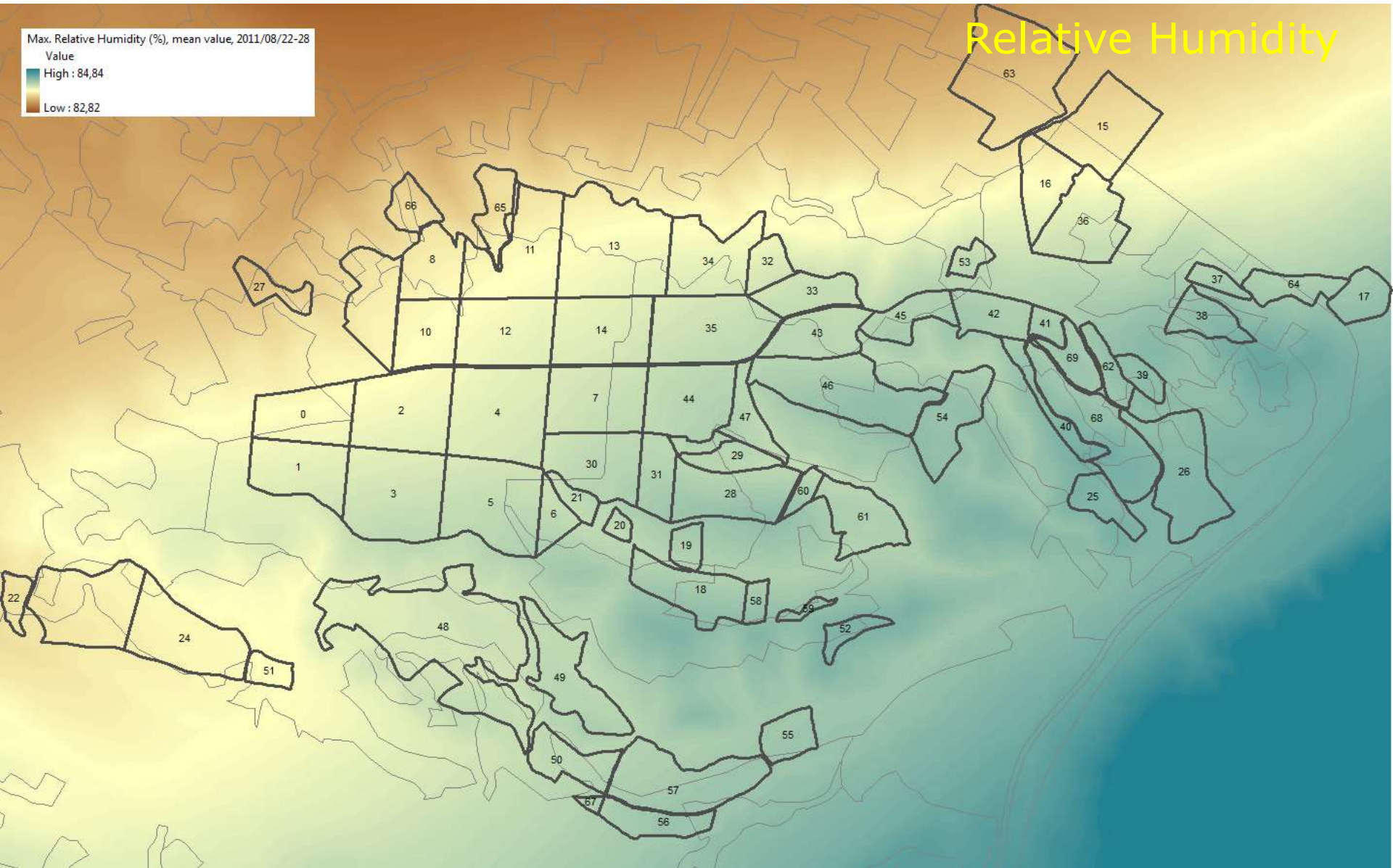
WEATHER INFORMATION INTEGRATION



WEATHER INFORMATION INTEGRATION

Max. Relative Humidity (%), mean value, 2011/08/22-28
Value
High : 84,84
Low : 82,82

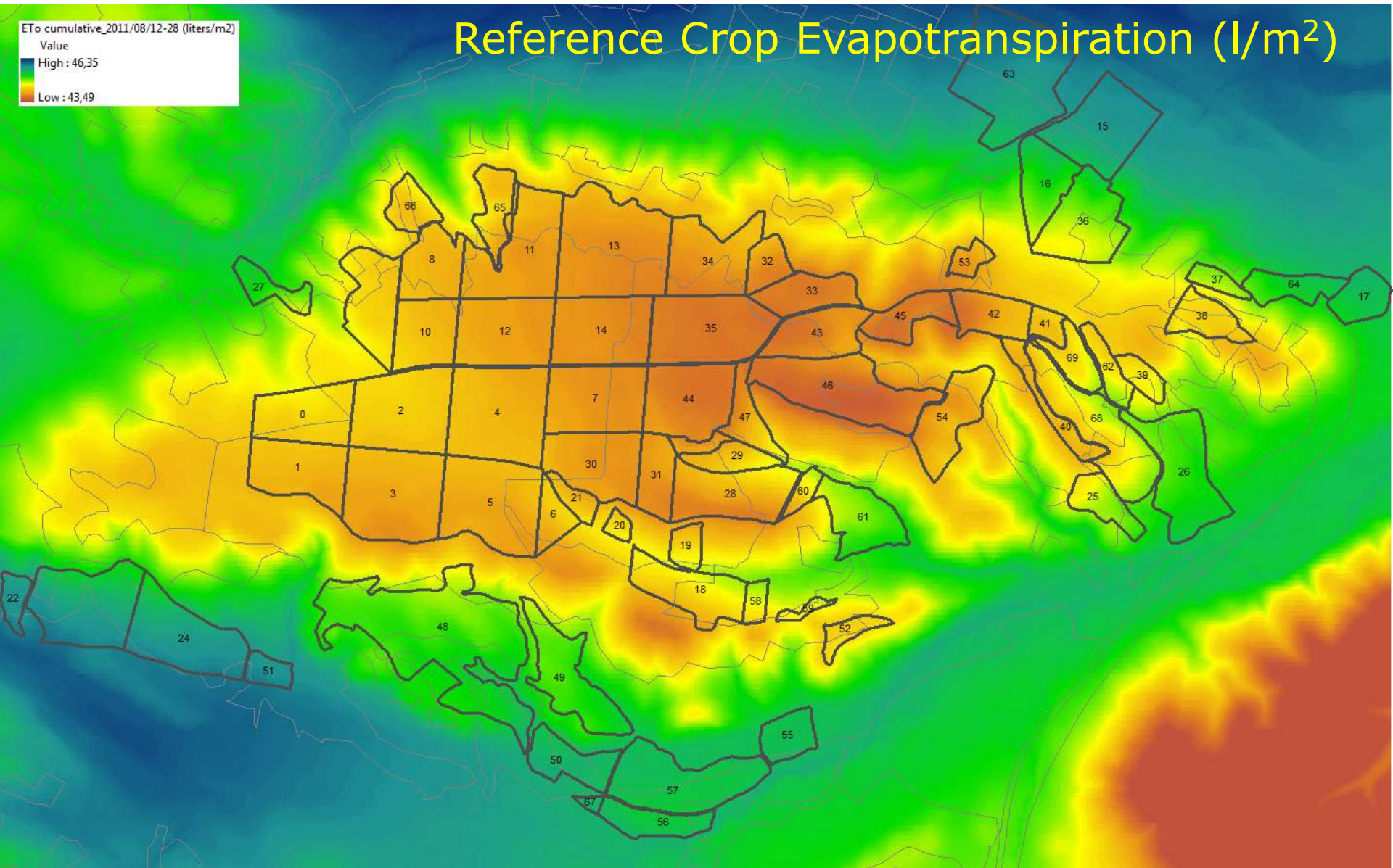
Relative Humidity



WEATHER INFORMATION INTEGRATION

Reference Crop Evapotranspiration (l/m^2)

ETo cumulative_2011/08/12-28 (liters/m²)
Value
High : 46,35
Low : 43,49





Thank You

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