# PRECISION PLANTATION MANAGEMENT

OMP-AMIS Agriculture Management Information System

# OMP-GIS©

## Thematic Mapping and Spatial Data Analysis

Desktop mapping

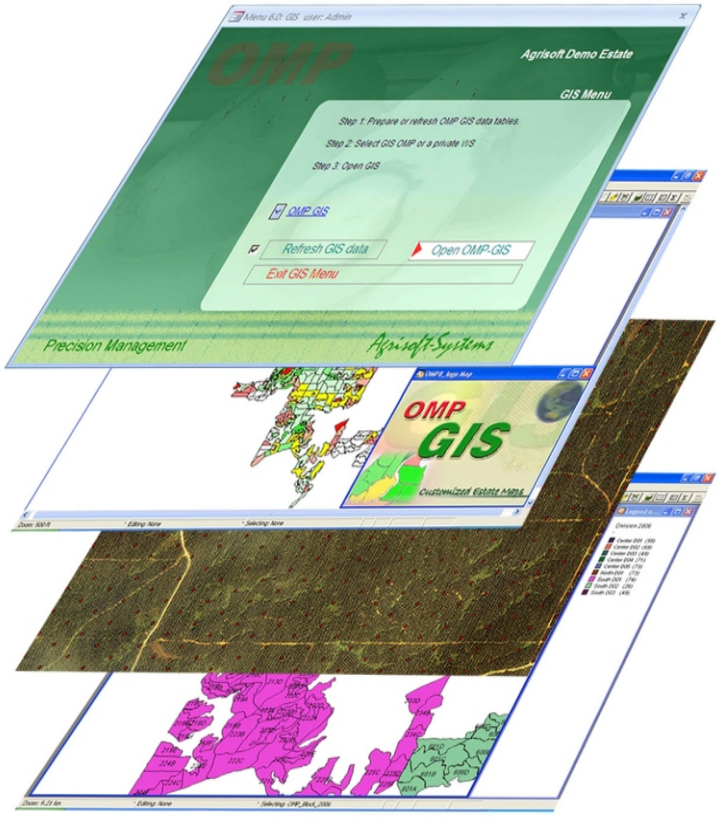
Spatial database management

Thematic mapping and geo-query

Spatial analysis

Spatial statistics

Surface modeling




Proven software for site-specific precision management in oil palm plantations

Oil palm management has become more resource and cost-ccritical after a decade of rapid area extension. Plantation managers need to focus on key issues to maintain a successful and competitive operation:

**- To achieve maximum economic yield for given location.**
**- To optimize input use efficiency.**
**- To minimize negative impact on the environment.**
**- To maintain long term sustainability with socially accepted field management practices.**
**- To document activities and impacts and prove the quality of the product.**

OMP-AMIS and OMP-GIS are suite of programs that form a comprehensive integrated agricultural management information system. OMP is designed for precision plantation management. It support managers, agronomy advisor and technical service departments in strategic and day-to-day decision making.

**OMP** Oil palm Management Programs

# OMP-GIS© Maps

*... are based on OMP-AMIS data. The complete range of field management and agronomy data can be mapped.*

*Some examples:*

**Basic concepts**

**Yield maps**

- Production
- Yield (t/ha-1)
- Bunch weight
- Bunch number
- Harvester output
- Harv. Round length
- Yield gap
- Monthly yield variations

**Leaf analysis**

- Leaf analysis results by pinnae or rachis
- Macro and micro nutrient levels
- Critical blocks
- Visual deficiency symptoms

**Soil analysis**

- Soil analysis results per sample type (circle or frond stack) and depth
- Soil suitability
- Soil texture
- Soil protection
- Erosion

**Fertilizer**

- Inorganic and organic fertilizer
- Nutrients
- Crop residues

- Recommendation
- Application
- Balance
- Monthly view

# What is the advantage of using GIS?

Implementing a geographical information system for spatial data analysis in plantations is a time consuming and demanding task.

It involves the preparation of a set of **basic maps** (production units, management zones, infrastructure), which are mostly prepared form satellite or air images and through ground surveys.

Base maps are like traditional maps in a sense that they show physical locations and features as map objects (points, lines, polygons).

This static maps are very useful for planning and site management, to locate infrastructure features, production units, or estate assets, or to calculate distances, the length of roads and drains, the size of production areas.

**Traditional GIS**(1) goes beyond the use of static maps by linking discrete map objects with attribute data, stored in a database management system.

The resulting dynamic maps show the location and spatial distribution of the related attribute data ranges.

Typical **thematic maps** for oil palm show yield data, productivity parameters, nutrient levels, soil properties, etc, as a set of discrete block areas, coloured by the data range of the value that is being mapped.

Thematic mapping produces extremely useful content maps to understand and analyse spatial variability between production units for a range of site characteristics, inputs and production parameters. It provides an answer, on '*what* happens *where* and *when*, and *how to respond*'. A GIS, linked dynamically to a back-end database, is a core tool for decision support in precision agriculture management.

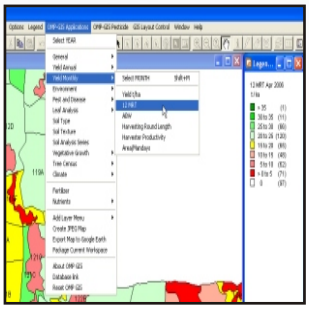
Today advanced **map analysis** goes beyond thematic mapping and geo-queries. Instead of using discrete map objects to show linked data attributes, spatial information is mapped as a continuos surface over a grid of cells.

**Grid maps** allow mathematical operations and calculations within and between map layers. The results an impressive set of new mapping options and analysis tools for *surface modeling*, *spatial data mining* and *location aware* mathematics and statistics. Advanced map analysis just begins to be used in plantation GIS.

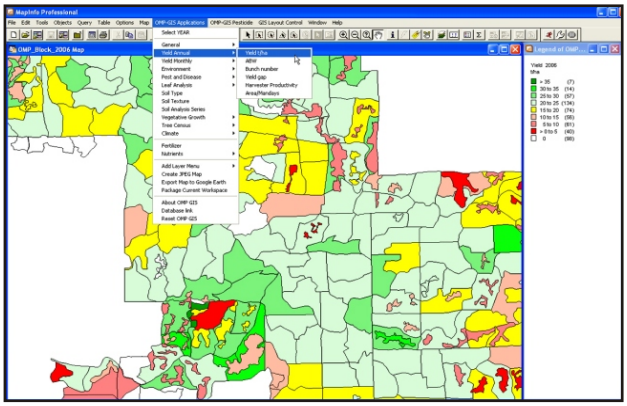
## ...with OMP-GIS

### Menu driven

OMP-GIS is fully menu driven and very easy to use. Dynamic maps are created automatically by selecting a map option from the menus.



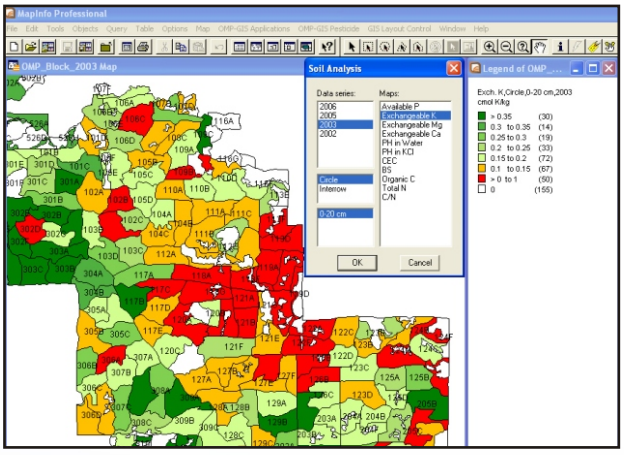
### Yield analysis



*Mapping yield data will show the spatial distribution of blocks according to productivity parameters ranges. Maps of yearly, or monthly data can be mapped.*

*Related maps show data on bunch numbers, bunch weight, yield gap, harvester productivity, harvesting round length, etc. Monthly mapping includes the mapping of 12 month rolling totals and year-to-date figures.*

### Soil analysis




*This map shows soil analysis result for exchangeable K in the circle.*

*Agronomy advisors can use maps from a range of themes, e.g. maps based on yield, site characteristics, leaf or soil analysis results or a range of sustainability and productivity indicators.*

# OMP-GIS© powerful and easy to use

OMP-GIS© was developed as an integrated desktop mapping solution for OMP-AMIS. It links a set of base maps to the GIS back-end database in OMP, which is used to organize and maintain all attribute data. All relevant data stored in OMP can be mapped to show in-field variability and spatial and temporal distribution trends.

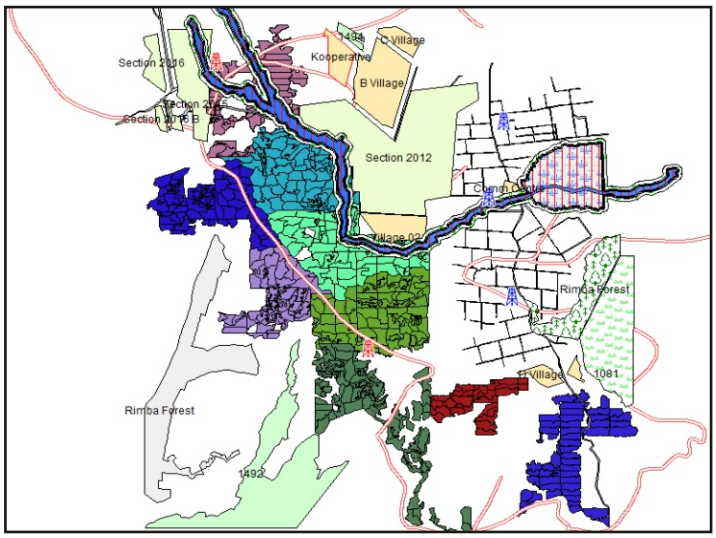
Using OMP-GIS for mapping is very easy: just select and click on a map option from the menus. The base maps will then be linked automatically to the latest data and rendered in meaningful ranges and colours. Yearly and monthly filters can be applied to all mapping themes, and several hundred *ready-to-use* maps for plantation management are available.

A layout option can be used to prepare multi map layouts and *'change over time'* map series. OMP-GIS map themes can be uploaded to Google Earth and distributed by e-mail.

All OMP-GIS maps are completely open map layers that can be further modified, rearranged and combined to highlight specific issues. OMP-GIS uses MapInfo as a cost efficient GIS platform, but all maps can be exported to other GIS data formats, like ArcView™. Point data based attribute maps from OMP-GIS are used as input maps for advanced grid based map analysis and surface modeling.

OMP-GIS is both a powerful decision support tool for managers and a comprehensive tool box for advanced GIS operations and spatial analysis modeling.

## *For example: infrastructure*

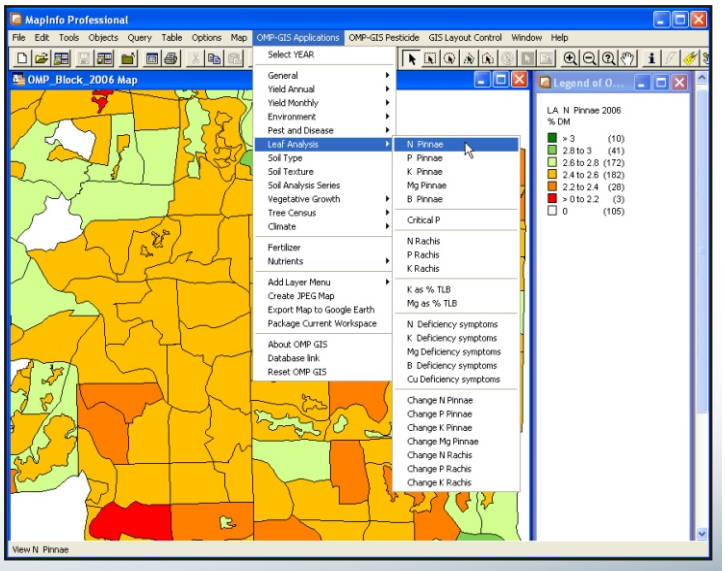



*Infrastructure layers and special management zones*

OMP-GIS is a great application to create and maintain infrastructure maps (roads, drains, buildings, power lines, management and production units). The mapping of special management zones (open water, riparian buffers, high conservation value areas, erosian zones, problem soil patches) provides valuable spatial information for site specific management where variable input and upkeep tasks are related to in-field variability.

Infrastructure map layers are linked to a back-end database, where attribute data, survey results and maintenance records can be stored and maintained.

## *For example: leaf nutrient levels*




*Indication of nutrient deficiency?*

Of the major crops, oil palm has the largest percentage of crop area under intensive fertilizer treatment, and fertilizer accounts for the greatest part of production cost.

Both nutrition programs and actual applications of mineral fertilizer and crop residues can be mapped.

Leaf analysis shows the spatial variation of nutrient status at each site sampled.

Leaf analysis provides a reliable indication of nutrient deficiency and excess, and is one decisive parameter (beside mappable deficiency symptoms, soil data, field management) to set up nutrition programs for estates.

Custom layout
- Roads
- Drains
- Buildings
- Buffers
- Custom layers
- Satellite images
- Special management zones

Climate
- Rainfall
- Raindays
- Water deficit

Tree census
- Age of tree stand
- Planted and actual density
- Mature
- Immature
- Supply
- Unplantable

Environment
- Erosion
- Ground cover
- Soil conservation
- Prev land use
- Drainage
- Pruning standards

Pest and disease**
- Pest&Diseases surveys
- Integrated pest management (IPM)
- Pesticide management

Vegetative
- Run-of areas
- Harvester access
- Petiole cross section
- Palm height
- Height increment

# Advanced map analysis

**Advanced mapping** requires special software tools designed for grid data management. *MapInfo Vertical mapper* or the more powerful *Esri Spatial Analyst* extensions, or other GIS software (*Erdas, MapCalc, Surfer8*) can be used.

**Spatial analysis** extends the basic set of discrete map features of points, lines, and polygons to surfaces that represent continuous geographic space as a set of contiguous grid cells.
Specific analysis operations include *'reclassify, overlay, proxinity, and neighbors'.*
Spatial statistics operations include '*surface modeling*' and '*spatial data mining*'.

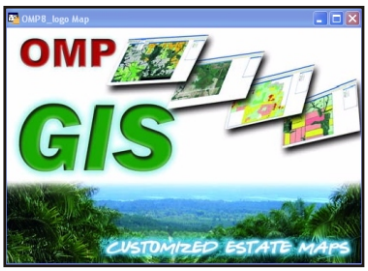
The most commonly used grid maps are topography (3D surface) and contour maps that are derived from a grid of altitude measurement points. The same input data are used to prepare slope and azimuth (orientation) maps.

'*Surface flow over elevation*' is used to identify run-off areas and deposits of nutrients and chemicals. Combining flow and slope maps is used to model erosion potential, effective buffer zones and special management areas.

The spatial analysis tools can not only be used to create new useful map layers on physical aspects, but as well for the mapping of dynamic data, like monthly yield variance, or to show yield variation as a function of N, P and K levels in the tissue or soil.

**OMP-GIS© application for** MapInfo Be Location Intelligent

**Agrisoft Systems offers advanced training for GIS operators**

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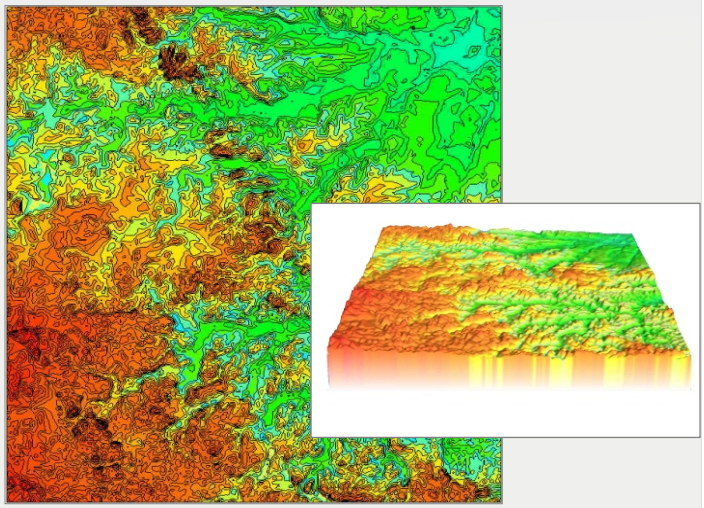
## *3D maps and topography*

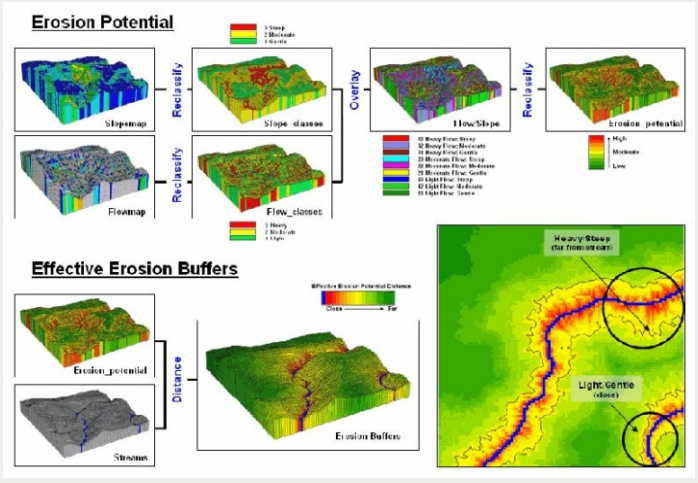
This topography layer was created by extracting altitude data for the target area from Google Earth. It is used to create 3D surface, contour, slope, azimuth and flow maps for micro area management.



## *Erosion potential and effective buffers*

This picture shows an example of map modeling. Elevation data are used to create a slope and a flow map. The slope map characterize the relative energy, the flow map the volume of water flow at a location.

The data are reclassified into slope class and flow class maps to create a new overlay map of erosion potential areas. This model can be easily extended by adding additional map layers, e.g. Land cover, as new variables to the equation.




*(Joseph K. Berry, 2010)*

In the lower part of the picture, similar modeling methods were applied to map effective erosion buffers along a river that vary in size depending on the erosion potential of the neighboring area.

[1]*For detail information, see Joseph K. Berry (www.innovativegis.com)*