



LATIN AMERICA
GEOSPATIAL
FORUM

**THEME: STRENGTHENING GEOSPATIAL
COLLABORATION FOR SUSTAINABLE GROWTH**

10-12 NOVEMBER, 2015 | HILTON REFORMA, CIUDAD DE MÉXICO

GEOSPATIAL TOOLS APPLIED ON AGRICULTURE

Prof. Dr. Claudio Leones Bazzi
Technological Federal University of Paraná



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Precision Agriculture Research Team

Western State University of Paraná

(Doctor Degree Program of Agriculture Engineer)

Technological Federal University of Paraná

(Master Degree Program of Computer Technology Applied to Agribusiness)



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Precision Agriculture Research Team

Coordinators:

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Precision Agriculture Research Team

Partners:

Farmers:

West of Paraná

Cascavel

Céu Azul

Serranópolis

Others (Financial support):

Embrapa

Capes

CNPq

Araucária Foundation



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Infra:

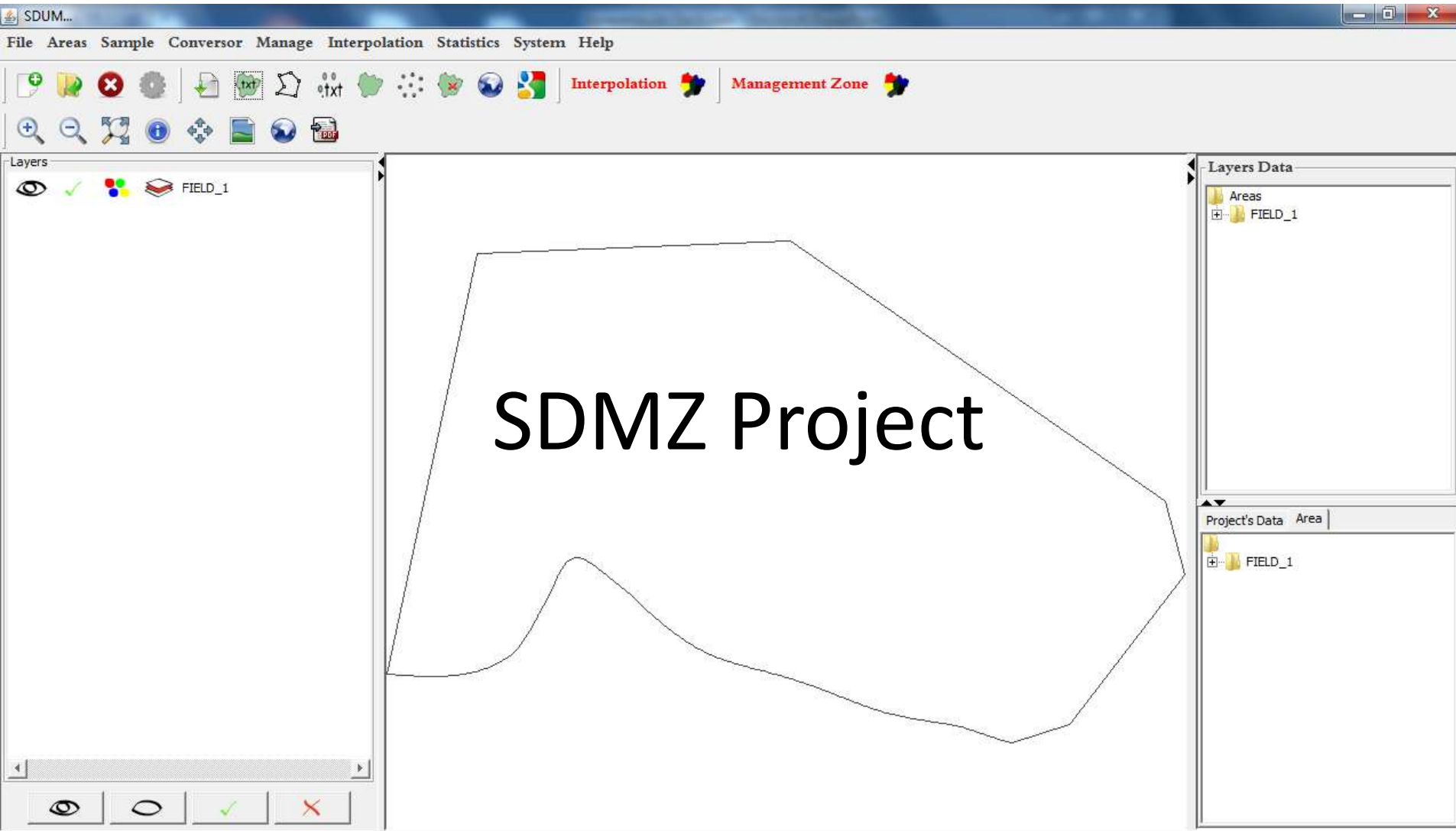
- 1 Tractor;
- 1 Seed Drill;
- 2 green Seeker;
- 1 EM38;
- 2 Chlorophyll meter;
- 2 Yield Monitor;
- 3 GPS;
- 10 Computers.



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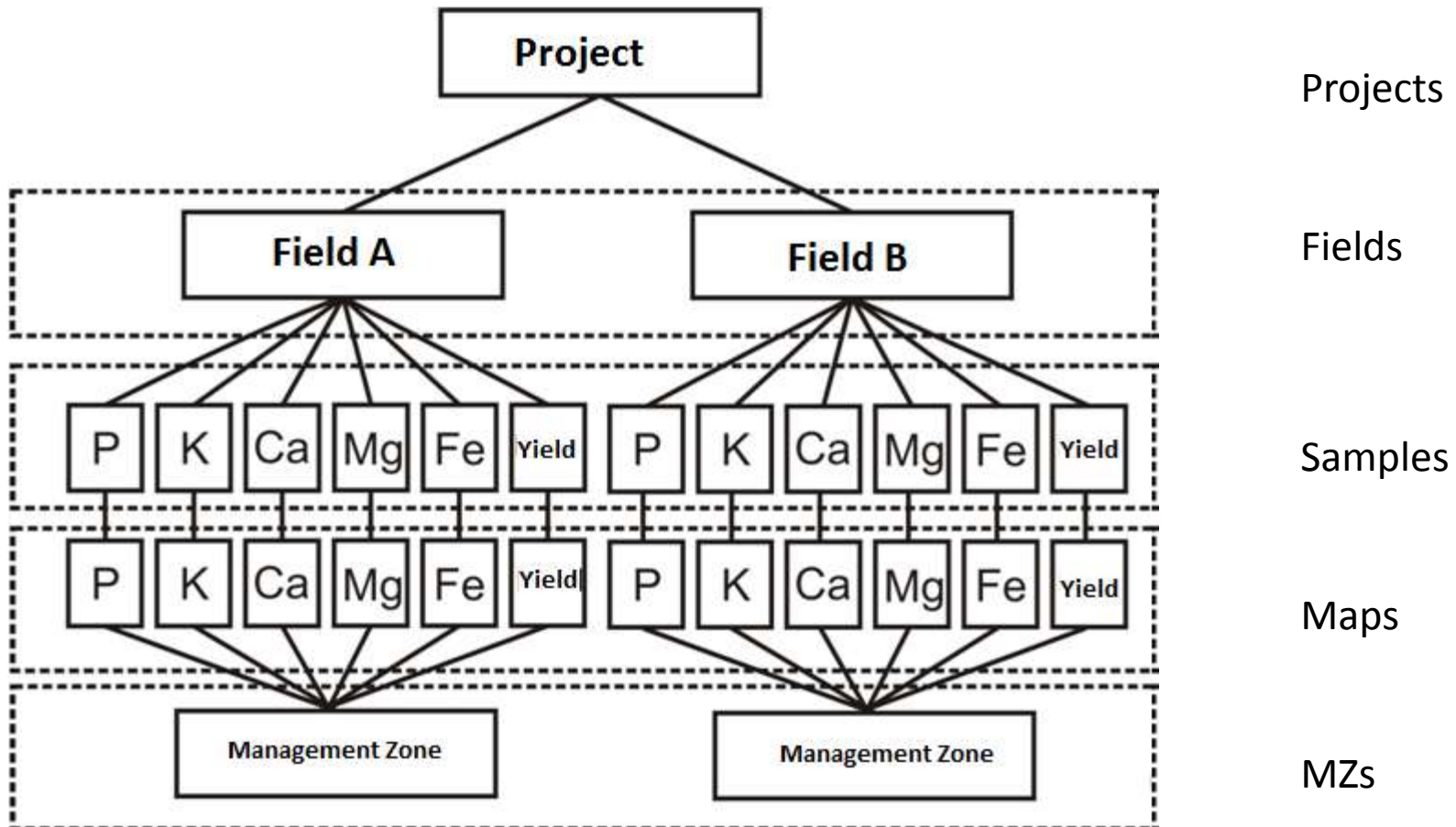


Objectives SDMZ

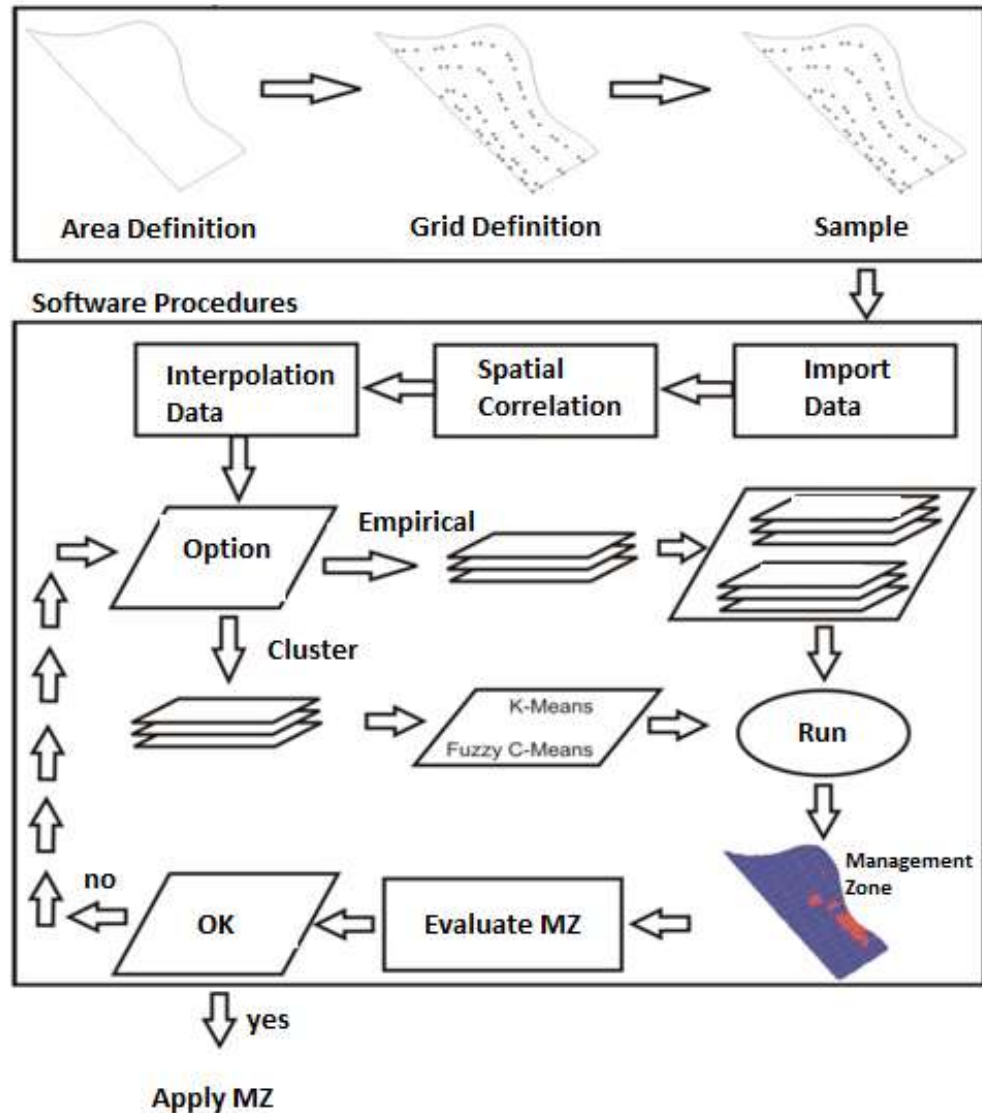
- Easy management data;
- Create thematic maps;
- Generate Management Zones;
 - K-Means;
 - Fuzzy C-Means;
 - Empirical Methods;
- Evaluate Management Zones;
 - Anova;
 - Reduction of Variance
- Other Functions



Structure



Methodology



SDUM... File Areas Sample Conversor Manage Interpolation Statistics System Help

Interpolation Management Zone

Areas Management

Area's Data

Id	Name	Project	Soil type	Table Name
	FIELD_1	Project-Davis	ARGILOSO	tb_area_field_1

```

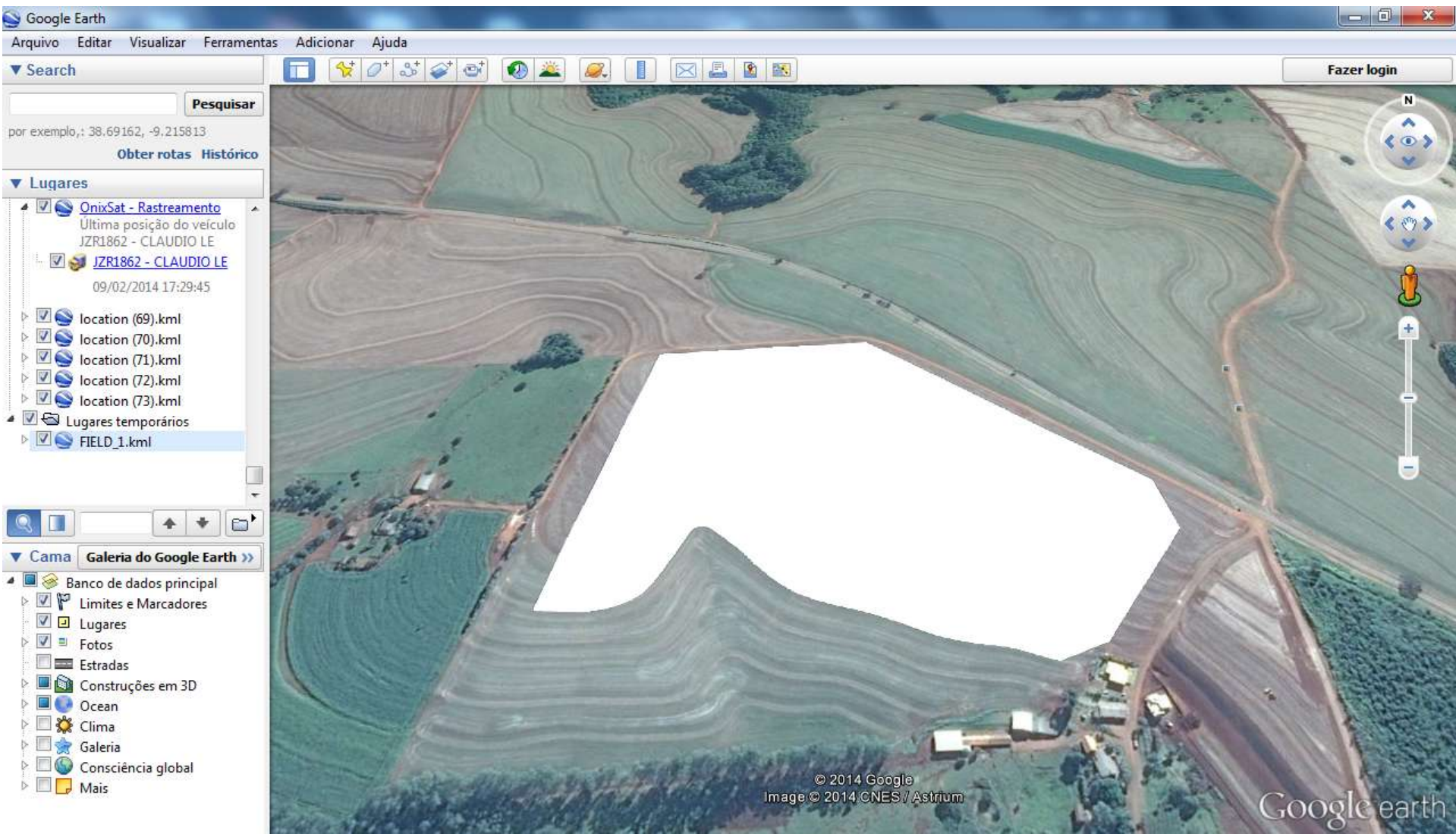
lat    long
-25.11061867    -53.83507028
-25.1075649261475    -53.8344116210938
-25.1074722634031    -53.8321470484206
-25.1093597412109    -53.8294219970703
-25.109899520874    -53.8292770385742
-25.1109808488224    -53.8301105567454
-25.11112175    -53.83053202
-25.1111239    -53.83056758
  
```

File Data

File path: D:\Projetos_SDUM\Project-Davis\arqs\Contorno.txt

Columns: 2 Separator: TAB Generate Grid Sam... Longitude: long Latitude: lat

Save reports Header



Google Earth

Arquivo Editar Visualizar Ferramentas Adicionar Ajuda

▼ Search

Pesquisar

por exemplo, : 38.69162, -9.215813

Obter rotas Histórico

▼ Lugares

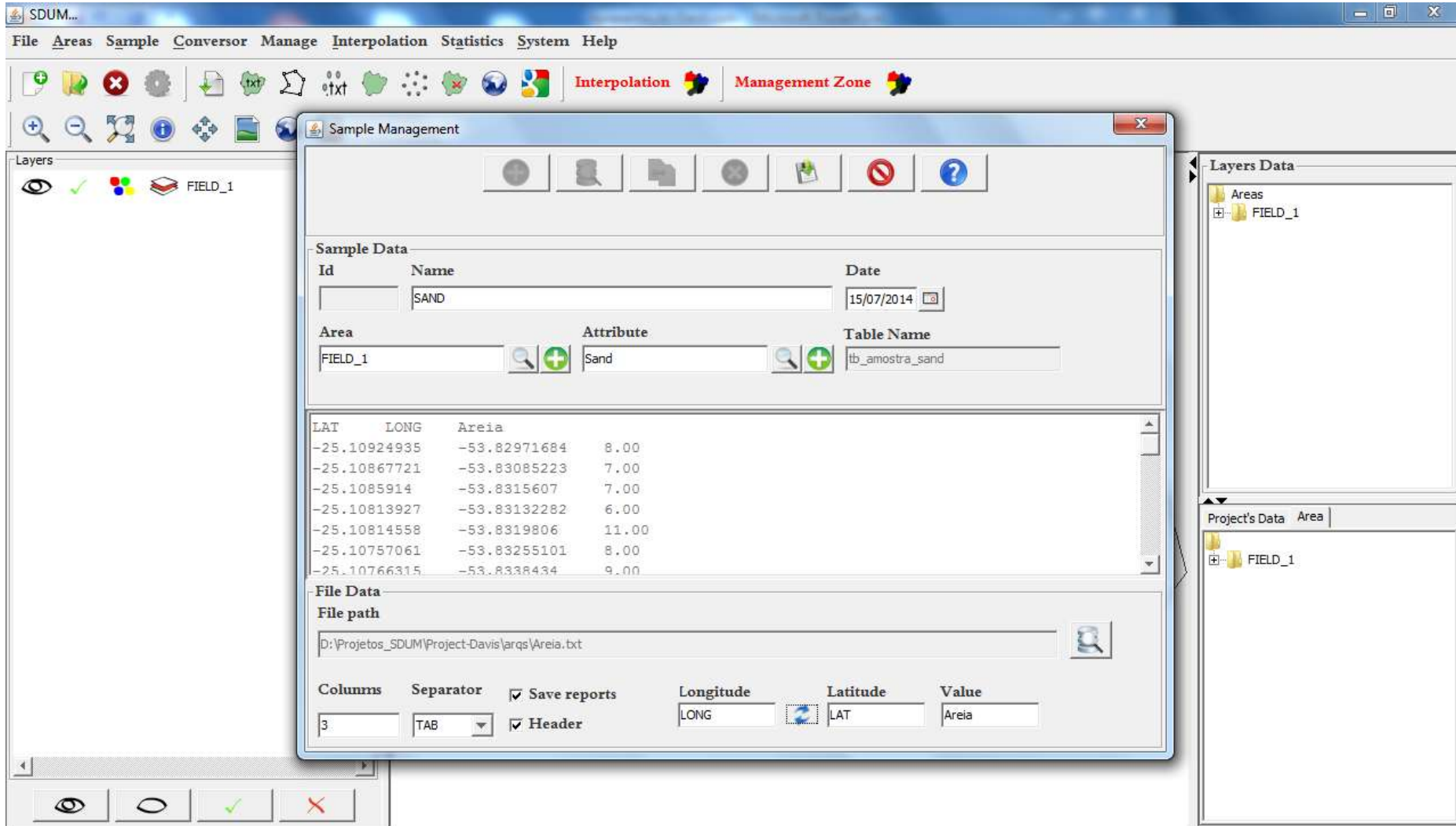
- OnixSat - Rastreamento
Última posição do veículo
JZR1862 - CLAUDIO LE
- JZR1862 - CLAUDIO LE
09/02/2014 17:29:45
- location (69).kml
- location (70).kml
- location (71).kml
- location (72).kml
- location (73).kml
- Lugares temporários
- FIELD_1.kml

▼ Cama Galeria do Google Earth >>

- Banco de dados principal
- Limites e Marcadores
- Lugares
- Fotos
- Estradas
- Construções em 3D
- Ocean
- Clima
- Galeria
- Consciência global
- Mais

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Google earth



The screenshot shows the SDUM software interface with the 'Sample Management' dialog box open. The main window has a menu bar (File, Areas, Sample, Conversor, Manage, Interpolation, Statistics, System, Help) and a toolbar with various icons. The 'Sample Management' dialog box is titled 'Sample Management' and contains the following sections:

- Sample Data:**
 - Id:** [Empty field]
 - Name:** SAND
 - Date:** 15/07/2014
- Area:** FIELD_1
- Attribute:** Sand
- Table Name:** tb_amostra_sand

Below these fields is a table of sample data:

LAT	LONG	Area	
-25.10924935	-53.82971684	8.00	
-25.10867721	-53.83085223	7.00	
-25.1085914	-53.8315607	7.00	
-25.10813927	-53.83132282	6.00	
-25.10814558	-53.8319806	11.00	
-25.10757061	-53.83255101	8.00	
-25.10766315	-53.8338434	9.00	

At the bottom of the dialog box is the **File Data** section:

- File path:** D:\Projetos_SDUM\Project-Davis\arqs\Areaia.txt
- Columns:** 3
- Separator:** TAB
- Save reports**
- Header**
- Longitude:** LONG
- Latitude:** LAT
- Value:** Areaia

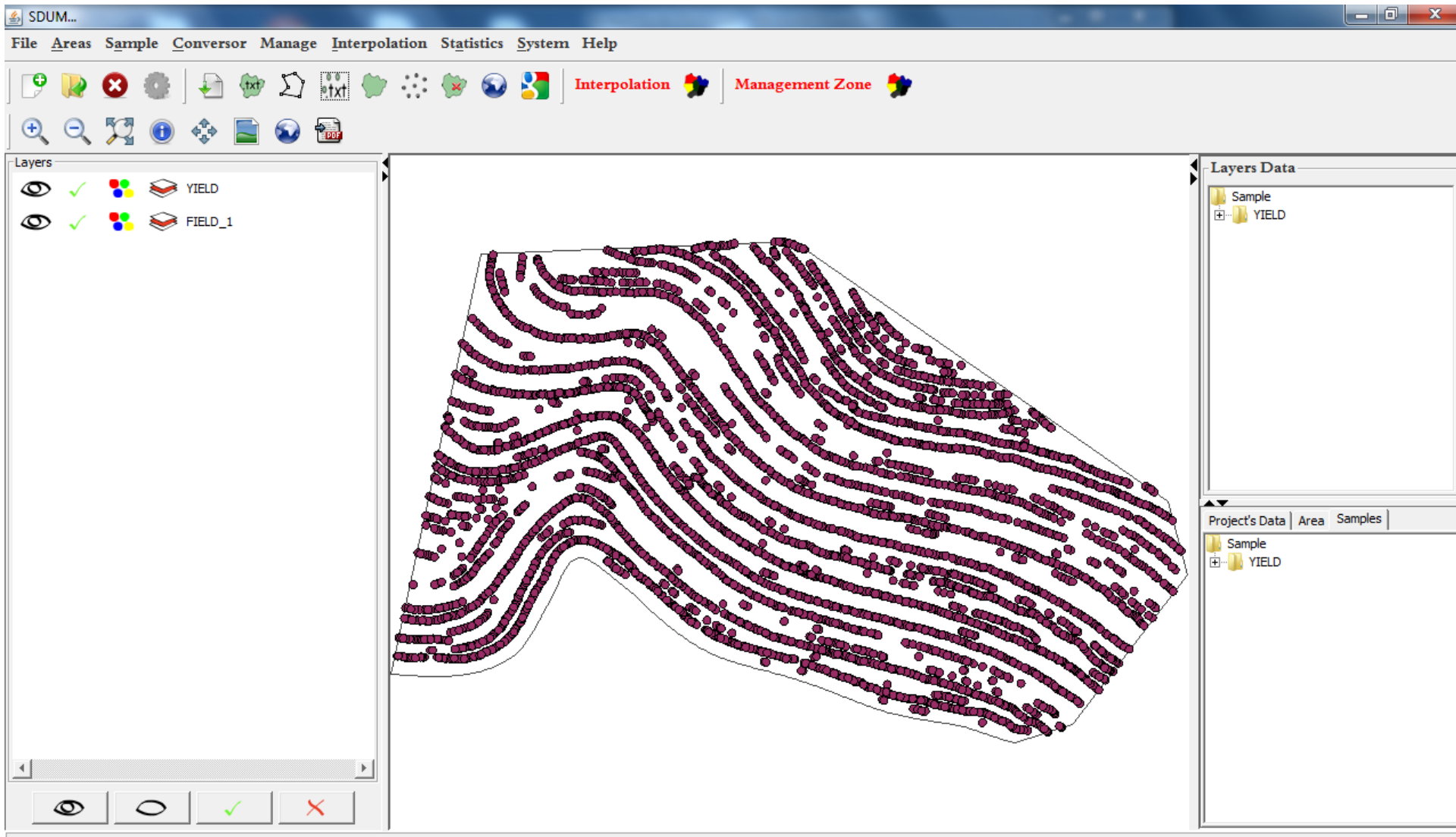
The background shows the main SDUM interface with a 'Layers' panel on the left containing 'FIELD_1' and a 'Layers Data' panel on the right also containing 'FIELD_1'. The 'Project's Data' panel at the bottom right also shows 'FIELD_1'.



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Cross Correlation - Sample Selection

Commands

Sample

- SAND
- CLAY
- SILT
- OM
- RSP_0_10
- RSP_10_20
- RSP_0_20
- DENSITY
- MICRO_POR
- MACRO_POR
- YIELD

Results

Significance Tests

Iterations Number

999

Significance

0.05

Salvar informações

All

By Name

By Attribute

ELEVAÇÃO





Cross Correlation - Sample Selection

Results

Correlation - Significance:0.05 ✕

SAND	0,12866 (*)											
CLAY	-0,10813 (*)	0,1052 (*)										
SILT	0,00575 (NS)	-0,01948 (NS)	0,02072 (NS)									
OM	0,00681 (NS)	-0,01375 (NS)	0,01145 (NS)	0,0053 (NS)								
RSP_0_10	0,02935 (NS)	0,01536 (NS)	-0,05444 (NS)	-0,01806 (NS)	0,04846 (*)							
RSP_10_20	-0,01982 (NS)	0,04915 (NS)	-0,04616 (*)	-0,0071 (NS)	0,02387 (NS)	-0,00097 (NS)						
RSP_0_20	0,00595 (NS)	0,0364 (NS)	-0,05741 (*)	-0,01447 (NS)	0,04151 (*)	0,01169 (NS)	0,0307 (NS)					
DENSITY	-0,05102 (*)	0,04646 (NS)	-0,00725 (NS)	-0,0298 (NS)	0,00938 (NS)	0,01262 (NS)	0,01249 (NS)	0,01982 (NS)				
MICRO_POR	-0,01462 (NS)	0,02779 (NS)	-0,02224 (NS)	-0,03393 (*)	0,0361 (NS)	0,01884 (NS)	0,03148 (NS)	0,02825 (NS)	-0,00572 (NS)			
MACRO_POR	0,05793 (*)	-0,07386 (*)	0,03767 (NS)	0,05197 (*)	-0,03941 (NS)	-0,03208 (NS)	-0,04081 (NS)	-0,02168 (NS)	-0,02705 (NS)	0,00213 (NS)		
ELEVATION	-0,14468 (*)	0,09557 (*)	0,02981 (NS)	0,00917 (NS)	-0,08182 (*)	-0,01167 (NS)	-0,05399 (NS)	0,05702 (*)	0,01509 (NS)	-0,05054 (*)	0,17566 (*)	
YIELD_SOYBEN	-0,02118 (NS)	-0,01431 (NS)	0,04377 (NS)	0,01481 (NS)	-0,05476 (*)	-0,04276 (*)	-0,05567 (*)	0,00855 (NS)	-0,0123 (NS)	0,03344 (NS)	0,04409 (*)	-0,0023 (NS)
	SAND	CLAY	SILT	OM	RSP_0_10	RSP_10_20	RSP_0_20	DENSITY	MICRO_POR	MACRO_POR	ELEVATION	YIELD_SOYBEN



(*) Significant (NS) No Significant

Select of Layers

1. discard of layers with autocorrelation not significant;
2. discard of layers with correlation with yield not significant;
3. order the others layers in order decreasing in relation the correlation with yield
4. discard of redundant layers

$$I_{YZ} = \frac{\sum_{i=1}^n \sum_{j=1}^n \omega_{ij} * Y'_i * Z'_j}{S \sqrt{m_{Y'}^2 * m_{Z'}^2}}$$



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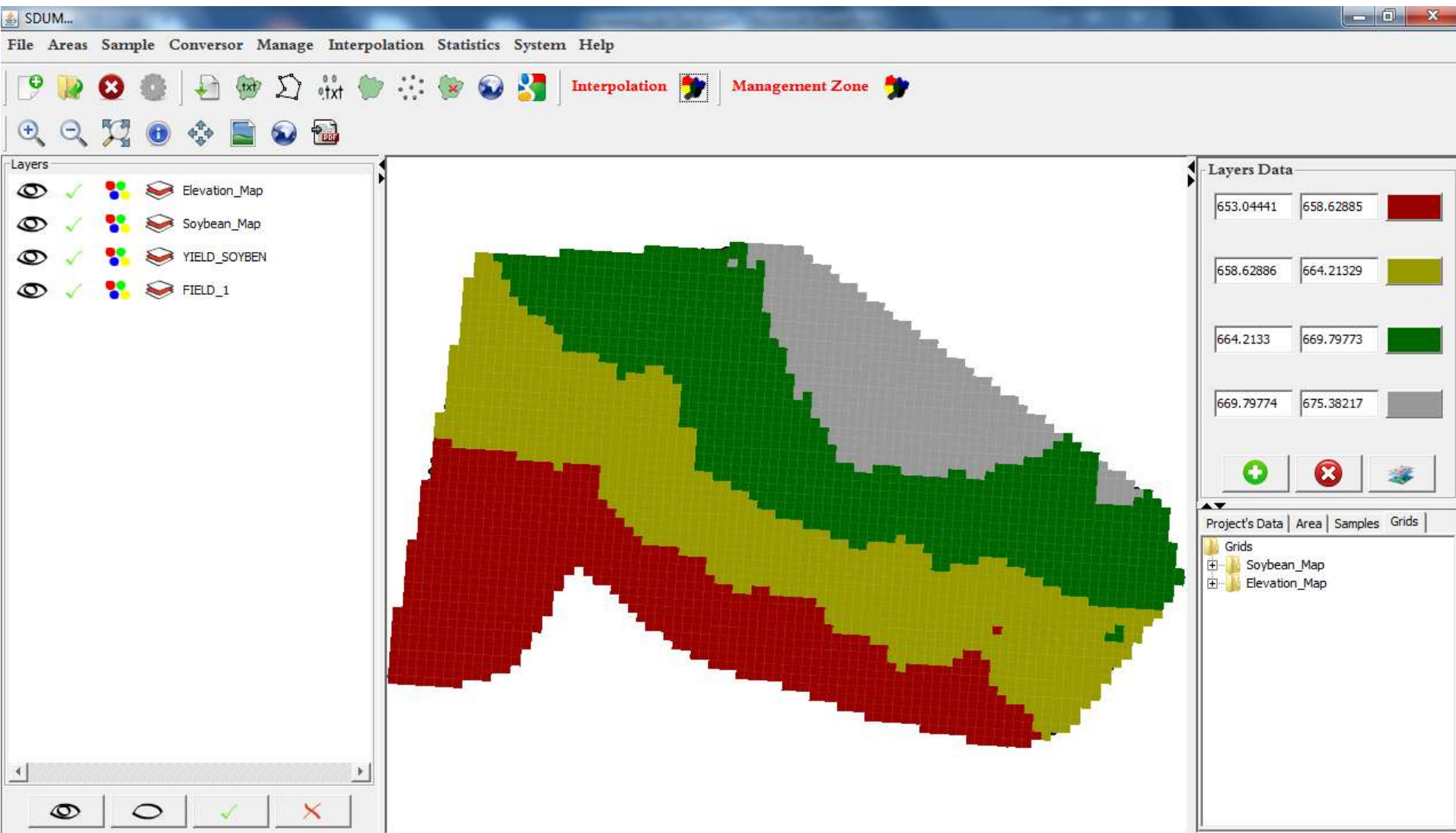
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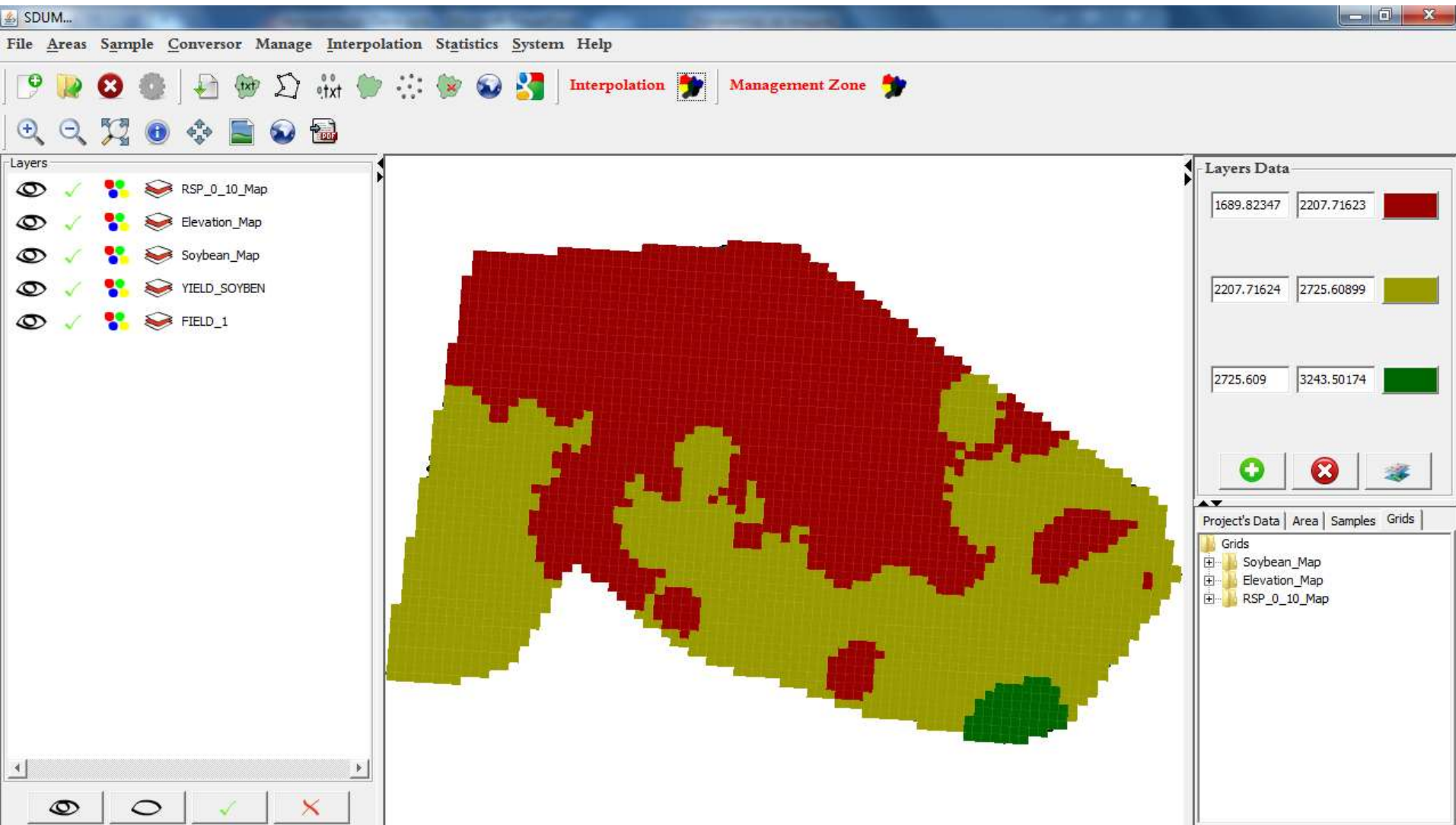
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The screenshot displays the SDUM software interface with the Interpolation dialog box open. The main map shows a field with green and black patterns. The Interpolation dialog box is configured as follows:

- Use Patterns:**
- Define Data:**
- Name:** RSP_0_10_Map
- Geometry:** POLYGON
- Interpolator:** IDP
- Pixel X:** 7
- Expoent:** 1
- Pixel Y:** 7
- Radius:** 0
- N° Points:** 8
- Load grid:**
- Save data as standards:**

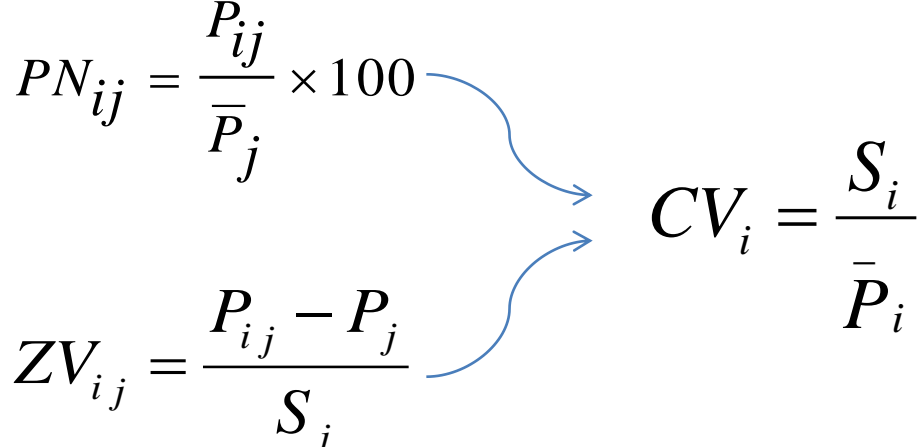
The Interpolation dialog box also shows a tree view with "Samples" and "RSP_0_10". The Layers panel on the left shows "YIELD_SOYBEN" and "FIELD_1". The Layers Data panel on the right shows "Sample" and "YIELD_SOYBEN". The Project's Data panel at the bottom shows "Area" and "Samples".



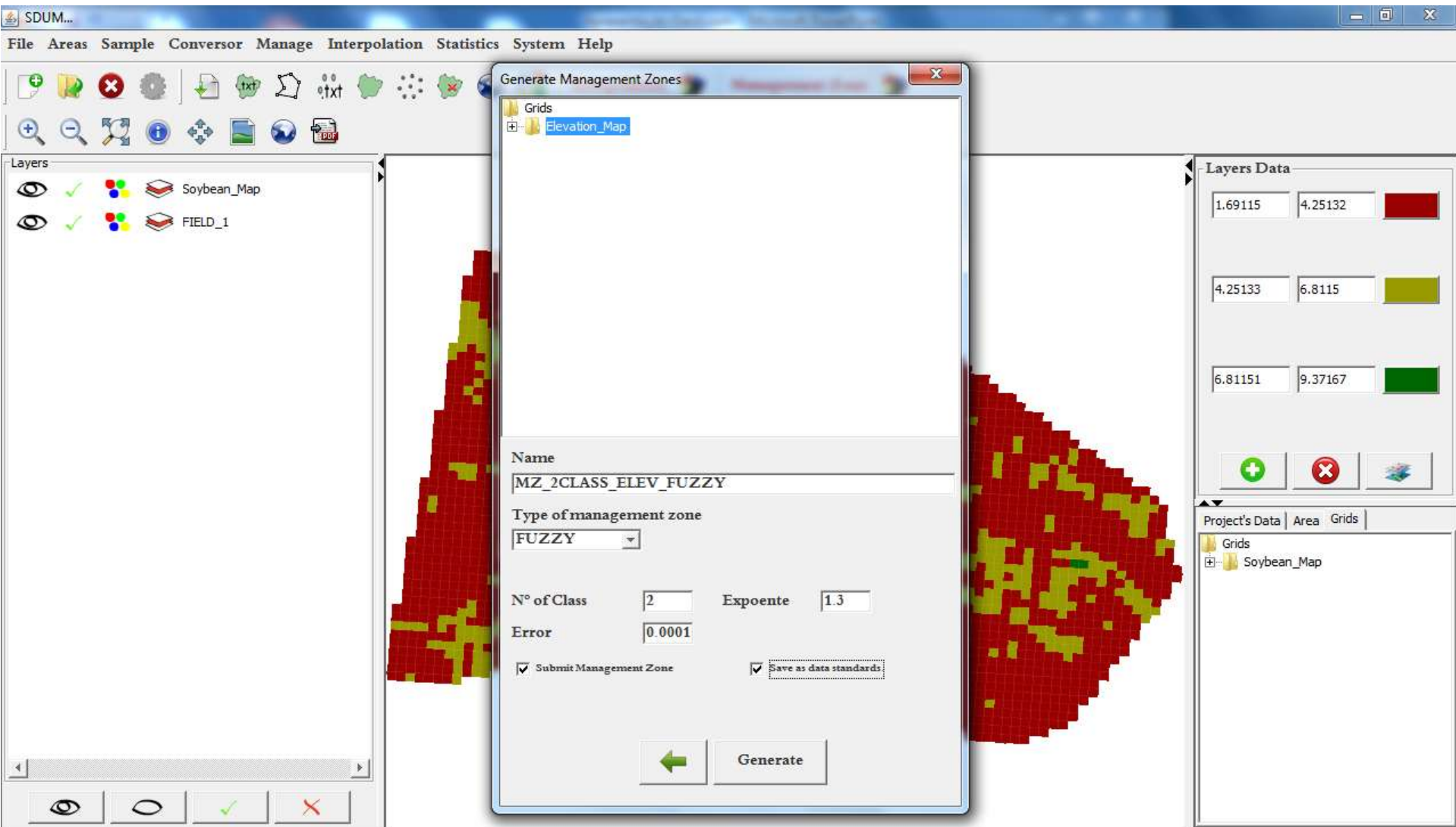


Generate Management Zones

- Empirical Methods:
 - Normalized data
 - Padronized data

$$PN_{ij} = \frac{P_{ij}}{\bar{P}_j} \times 100$$
$$ZV_{ij} = \frac{P_{ij} - P_j}{S_j}$$

$$CV_i = \frac{S_i}{\bar{P}_i}$$

- Clustering Methods:
 - K-Means:
 - Fuzzy C-Means:



The screenshot shows the SDUM software interface with a map of soybean fields. A dialog box titled "Generate Management Zones" is open, displaying the following configuration:

- Name:** MZ_2CLASS_ELEV_FUZZY
- Type of management zone:** FUZZY
- N° of Class:** 2
- Expoente:** 1.3
- Error:** 0.0001
- Submit Management Zone
- Save as data standards

The background map shows two layers: "Soybean_Map" and "FIELD_1". The "Layers Data" panel on the right shows a legend with three color-coded ranges:

Value Range	Color
1.69115 - 4.25132	Red
4.25133 - 6.8115	Yellow-Green
6.81151 - 9.37167	Green

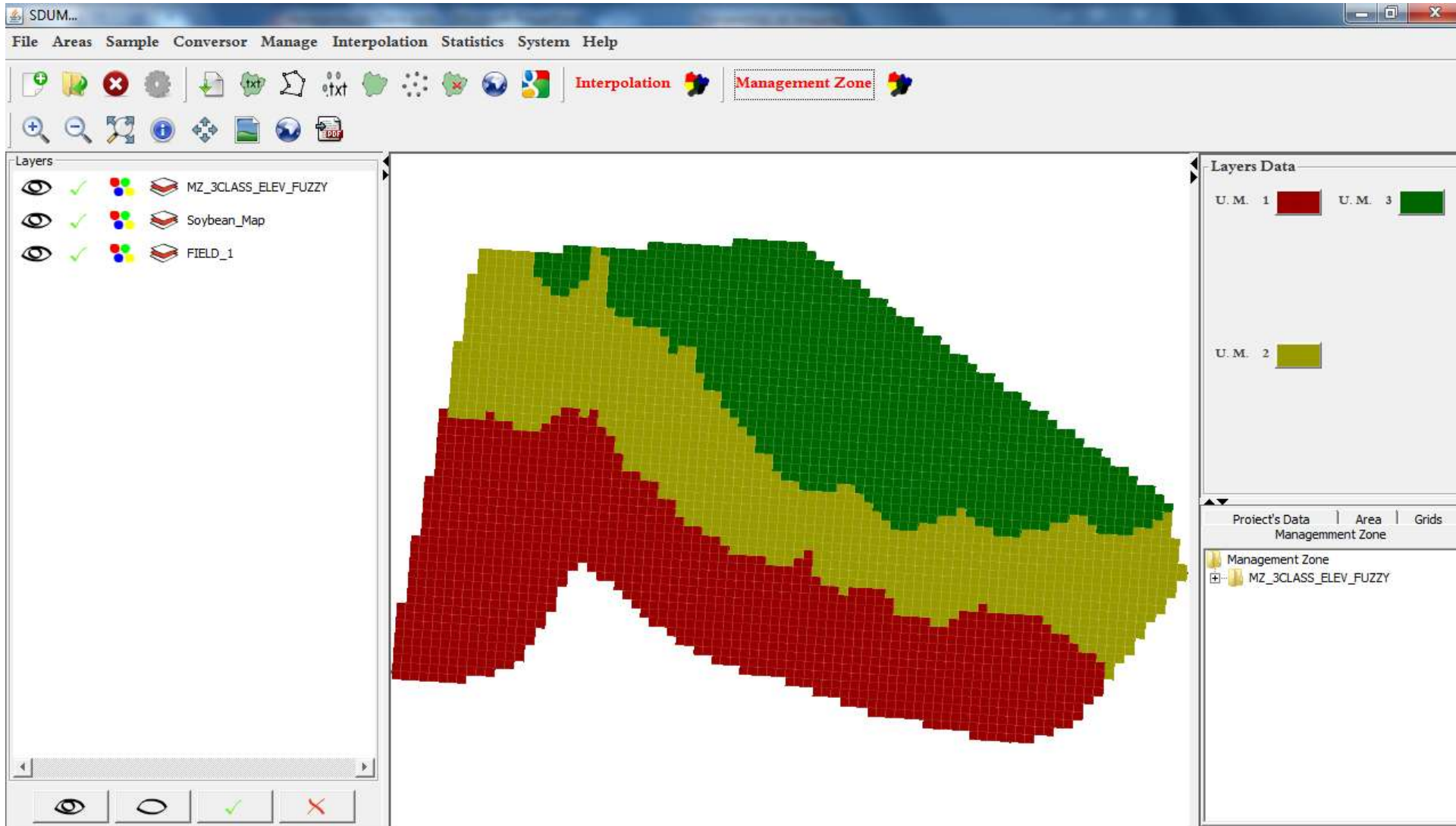
The "Project's Data" panel at the bottom right shows the loaded layers: "Grids" and "Soybean_Map".



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SDUM... File Areas Sample Conversor Manage Interpolation Statistics System Help

Interpolation Management Zone

Layers Layers Data

Assessment Unit Manenjo

MZ_3CLASS_ELEV_FUZZY: YIELD_SOYBEN x

Nº	% Areas	Nº Sam...	Minimum	Average	Maximum	DP	Variance	Variation coeffici...	Proportional vari...	Proportional cha...	Relative Efficiency
1	0,37297	2223	1,3423	3,77401	11,6785	0,6902	0,47637	0,18288	1.058,97493	0,63487	1,02081
2	0,3175	1620	1,3624	4,13021	11,7302	0,8824	0,77862	0,21364	1.261,37208	0,63487	1,02081
3	0,30953	1718	1,3015	3,94532	11,3275	0,82364	0,67839	0,20876	1.165,47286	0,63487	1,02081

Anova

Significância: 0.05

Valores

1 <> 2 1 <> 3 2 <> 3

← TXT + ?



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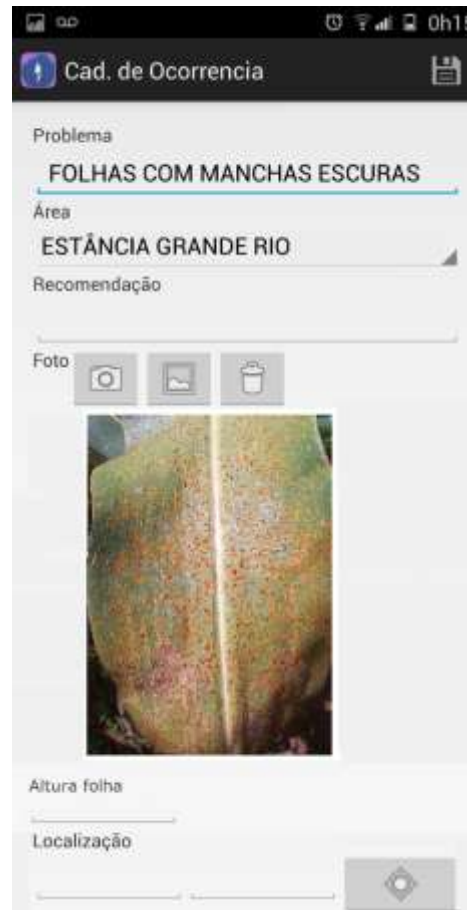


Conclusion

- The software is a important geospatial tool to generate and evaluate management zones;
- The management data on Precision Agriculture is easy, using the software.

The next steps

- Create geostatistic module;
- Create mobile module (collect data by farmers);




Cad. de Ocorrência

Problema
FOLHAS COM MANCHAS ESCURAS

Área
ESTÂNCIA GRANDE RIO

Recomendação

Foto



Altura folha

Localização



Gestão de Ocorrência

Nome Produtor
José Antonio da Silva

Nome Área
ESTÂNCIA GRANDE RIO

Cidade/UF
Cascavel/PR

Problema
FOLHAS COM MANCHAS ESCURAS

Recomendação
✓ APLICAR ROUNDUP 50 LITROS / HA

Foto



Fechar Salvar

The next steps

- Implement new methods to select layers (PCA and MULTISPATI PCA);
- Apply the software in others countries and cultures and implement new aspects of regions and cultures

Thank You!

- Bazzi@utfpr.edu.br / clbazzi@gmail.com
- E-Book: www.unioste.br/pos/pgeagri/livros