GIS Applications in Renewable Energy Project

describes the process of measuring the potential renewable energy production by solar, wind, and biomass using GIS Application by design of a proposed GIS model for Facilities and supporting renewable energy projects Studies. depends on data collecting from the relevant resources

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This study aims to evaluating and or designing a proposed GIS model in order to find the best sites for establishing renewable energy projects. By defining the main site selection criteria:

1. technically
2. Economy
3. Environmentally
4. Socially

using the (AHP) method in the process of assessing the appropriate spatial in the creation of the proposed model for the construction of sustainable renewable energy projects.

The **analytic hierarchy process** (**AHP**) is a structured technique for organizing and analyzing complex decisions, based on mathematics and psychology. It was developed by Thomas L. Saaty in the 1970s and has been extensively studied and refined since then.

- GIS for Renewable Energy.
- The GIS Application Process.

Objectives of Study

- To build the Renewable energy map (solar, wind, water…)
- To determine the main factors that affect the project site selection, through AHP using GIS analysis.
- To build geospatial data linking to the parcel that will serve the full supporting for project studding before, during, and after planning.
- to assess the parcel using GIS analytical tools, with AHP based multi-criteria decision making.
- To develop a comprehensive GIS-based decision making model for select the most suitable parcel.

GIS Application

1st Select the suitable source of renewable energy

2nd Compare between the suitable parcel to select the best site

2nd Compare between the suitable parcel to select the best site

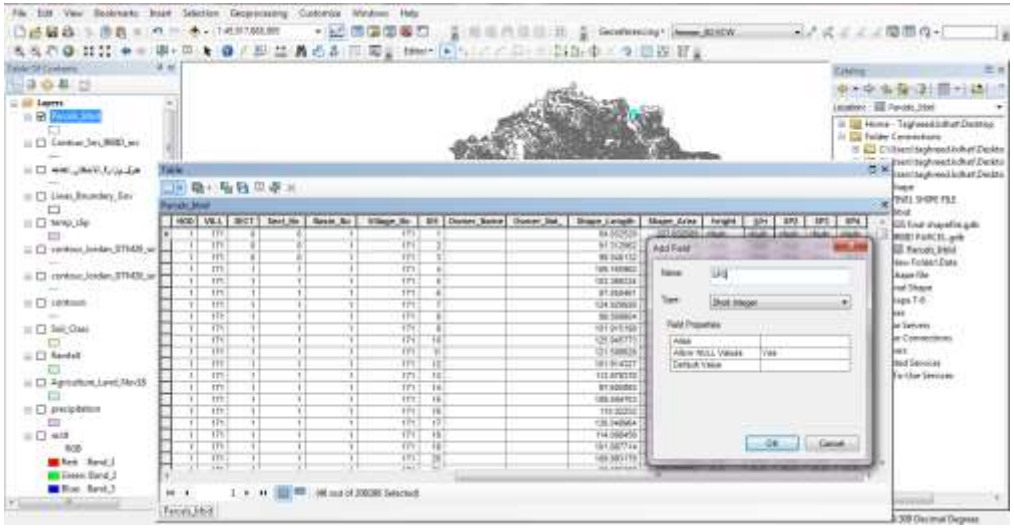
This method will be valid for the parcel that achieve appropriate technical conditions (either solar, wind a map of solar radiation and wind speed map…..

1. Pre-Field Work

The pre-field study was carried out based on per parcel, Procedure that gives better accuracy, efforts and consuming.

1. Image Rectification: to fit all the referenced drawing, image, and layers.
2. Spatial Data (adding, removing or modifying)
3. Descriptive data (Selection Parameters)
4. Correction (for Drawing, and entity data)

2. Field Surveying



- Building Selection Parameters
- Spatial Data Updating
- Descriptive Data Updating

3. Criteria Scores

1. Ranking of criteria : In order to rank each sub-criteria (the value of criteria that achieved by each parcel)

2. Standardizing Criterion Scores: the evaluation criteria for selection attributes are represented by different measurement scales. Therefore, standardization to a common scale is required.

4. Criterion Weighting in Analytic Hierarchy Process (AHP)

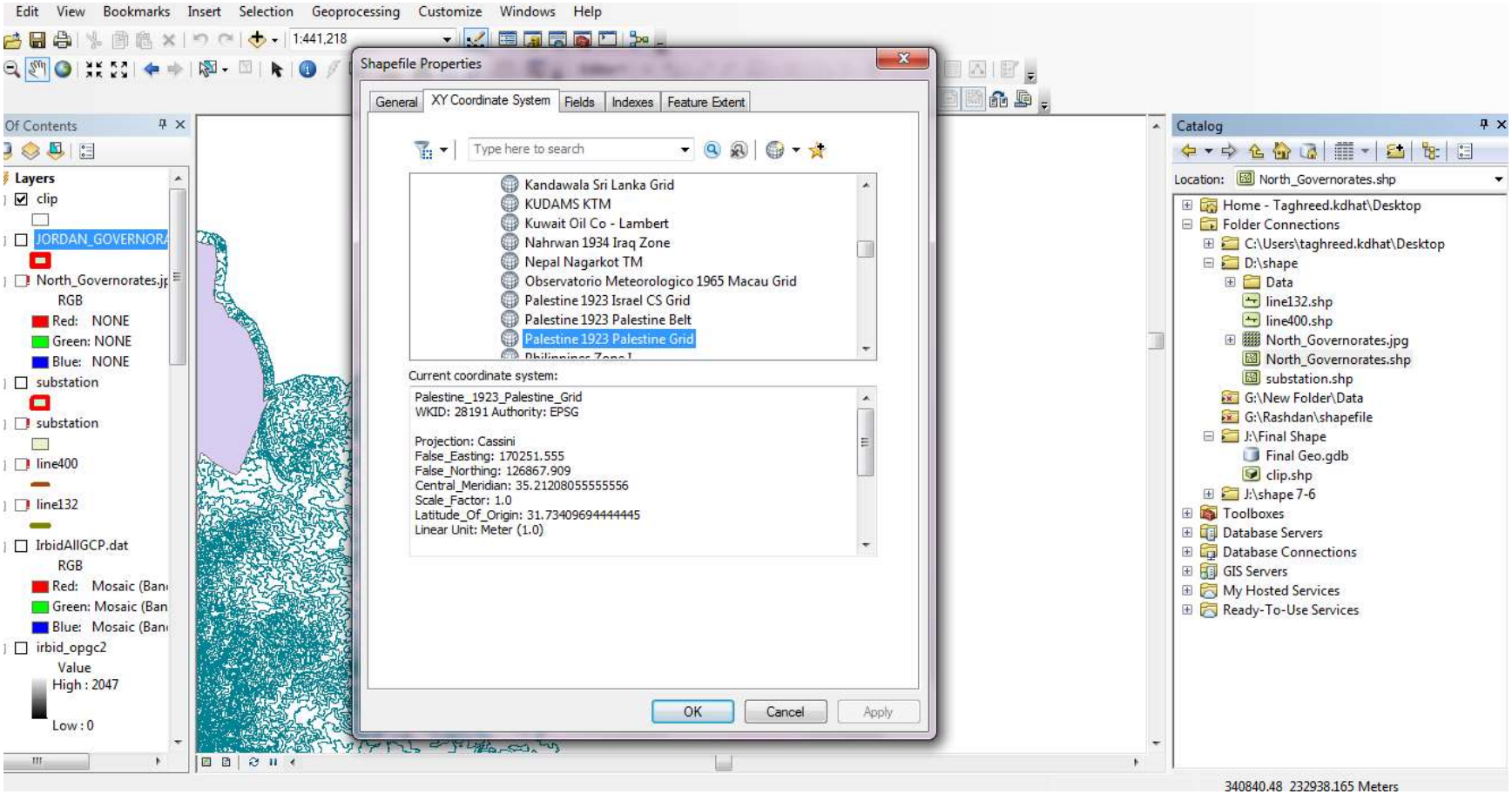
- It is a mathematical decision technique that allows consideration of both qualitative and quantitative aspect of decisions (Saaty, 1986).
- The AHP approach lets one to assess the relative weight of multiple criteria in an intuitive manner. The fundamental input to the AHP is the decision maker's answers to a series of questions of the general form: for ex: How important is criterion A relative to criterion B? Pair wise comparison

Preference level	Numeric value
equal preference	1
moderately preference	3
strong preference	5
very strong preference	7
absolute preference	9
inter mediate values between them	2 , 4 , 6 , 8

5. Weighted Linear Combination (WLC) Model

- Create a thematic map depending on the value of parcel weight which equal the summation for multiple Score by weight for each Parameter

Economy Parameters	Nearest Electricity Network
	Nearest communication and transportation network
	The nearest tourist areas
	Soil Type
	Land Use
	Nearest water Source
Environmentally Parameters	Plant Cover type
	The nearest natural reserves
Socially Parameters	Nearest population centers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Kuwait Oil Co - Lambert
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Nepal Nagarkot TM
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Palestine 1923 Palestine Belt
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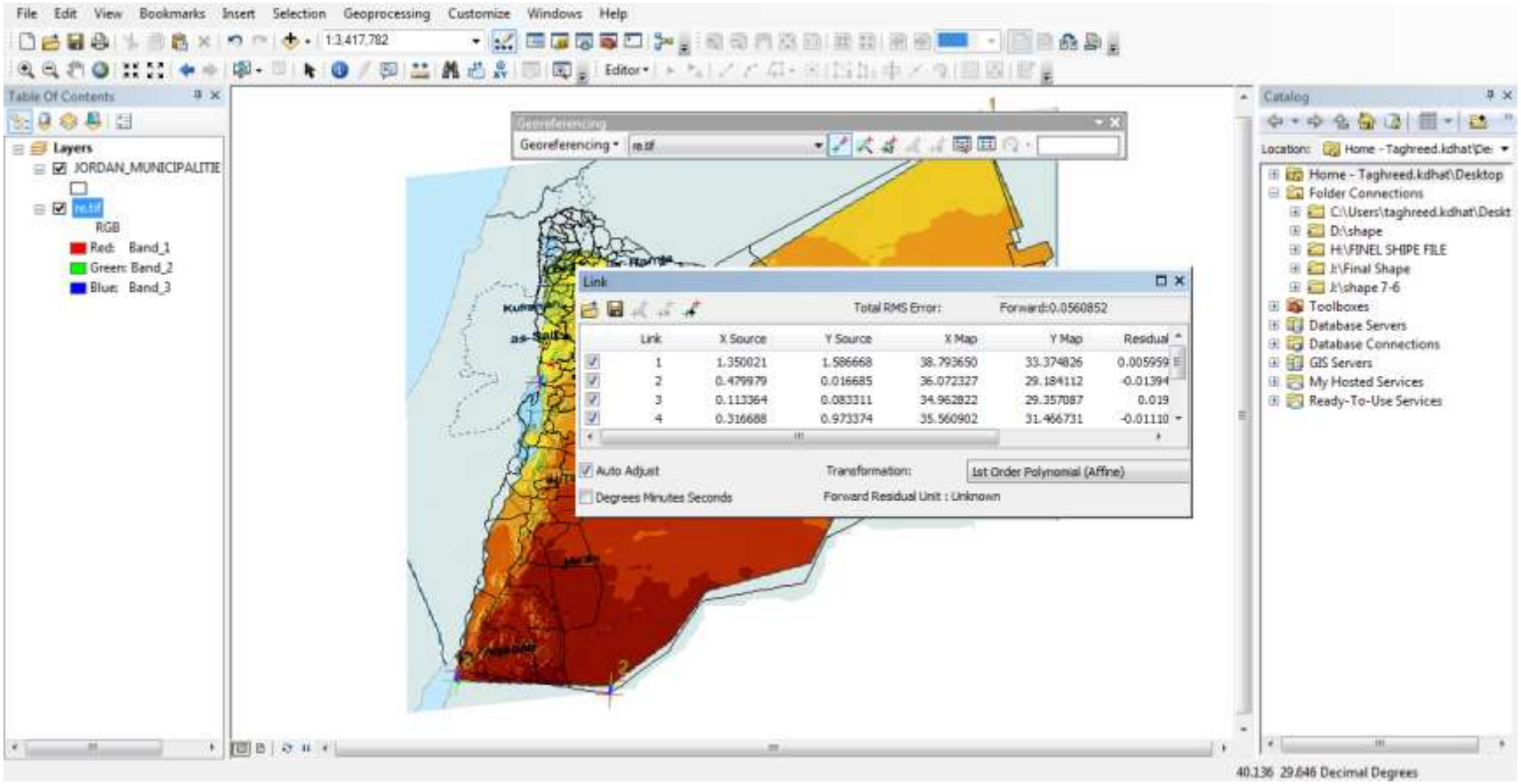
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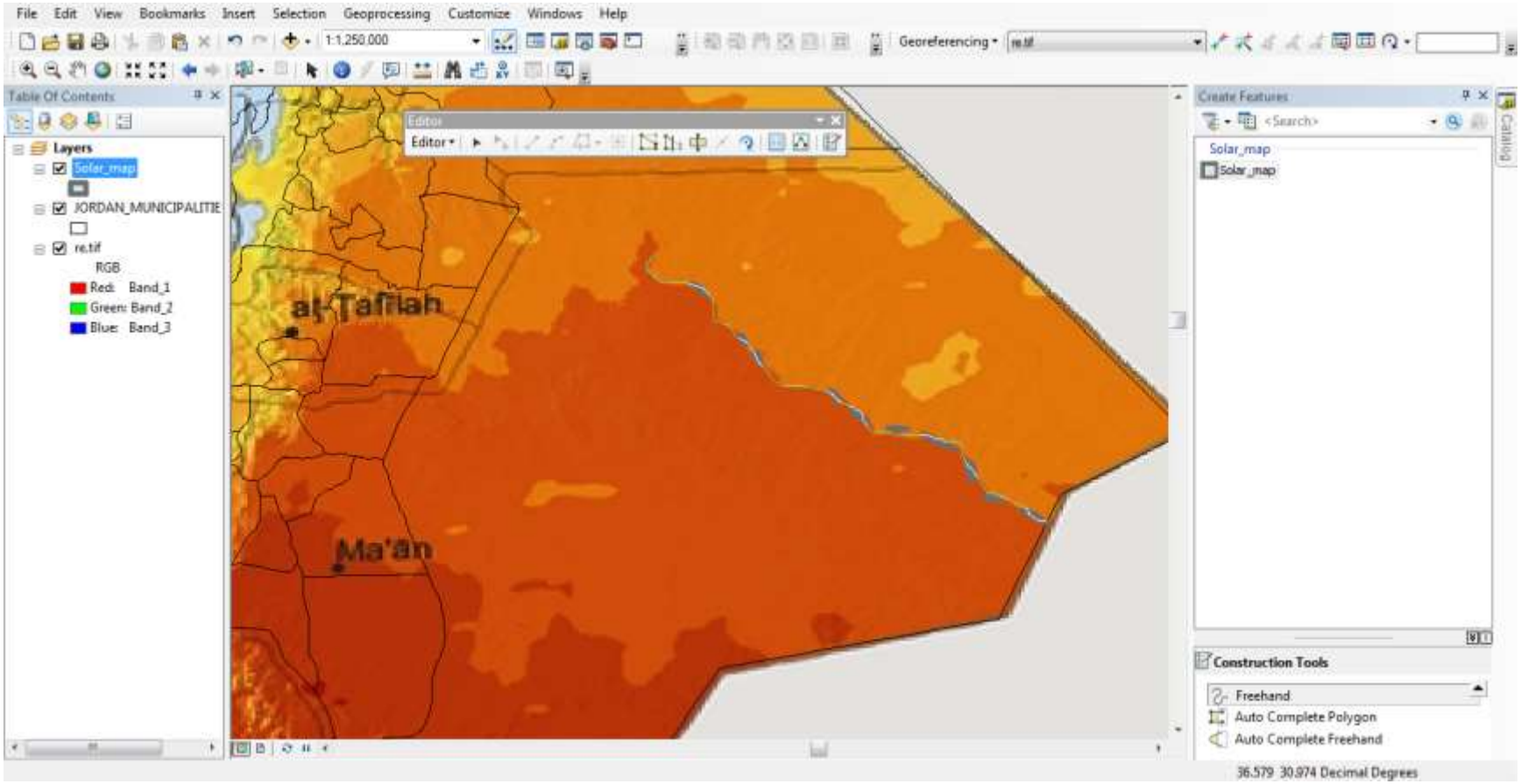
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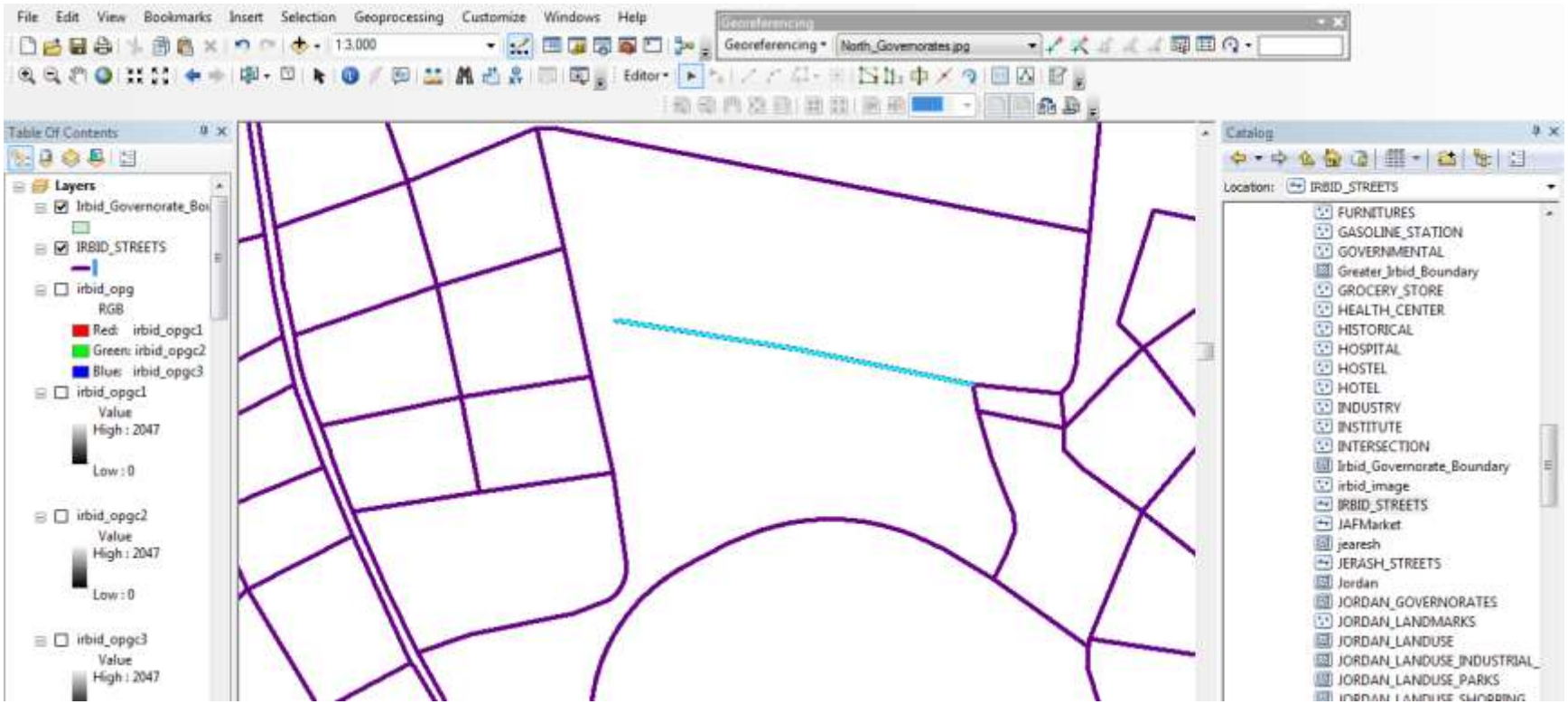
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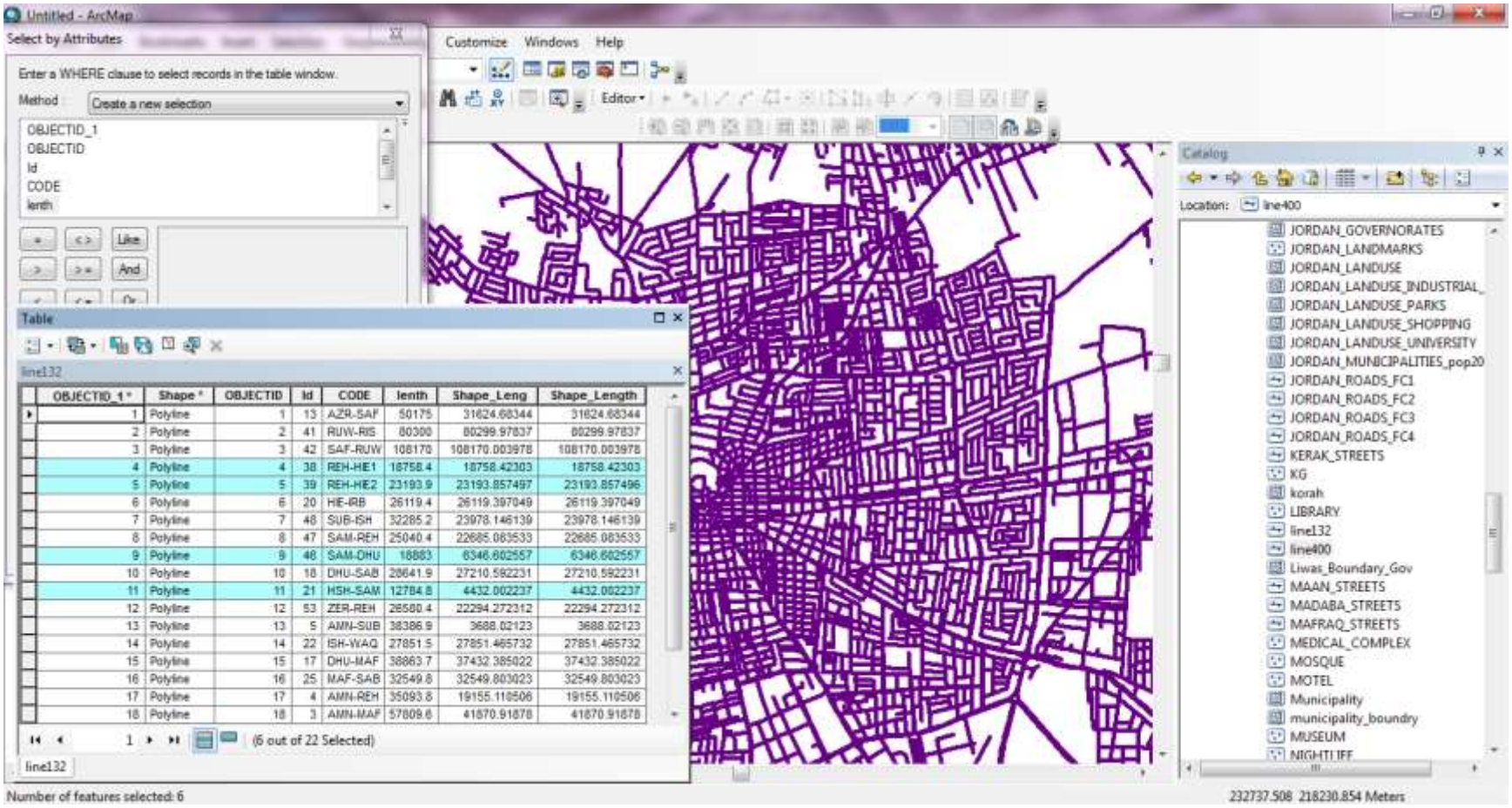
JORDAN_LANDUSE_PARKS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9 | Polyline | 9 | 48 | SAM-DHU | 16883 | 6346.602557 | 6346.602557
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MEDICAL_COMPLEX
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NIGHTLIFE
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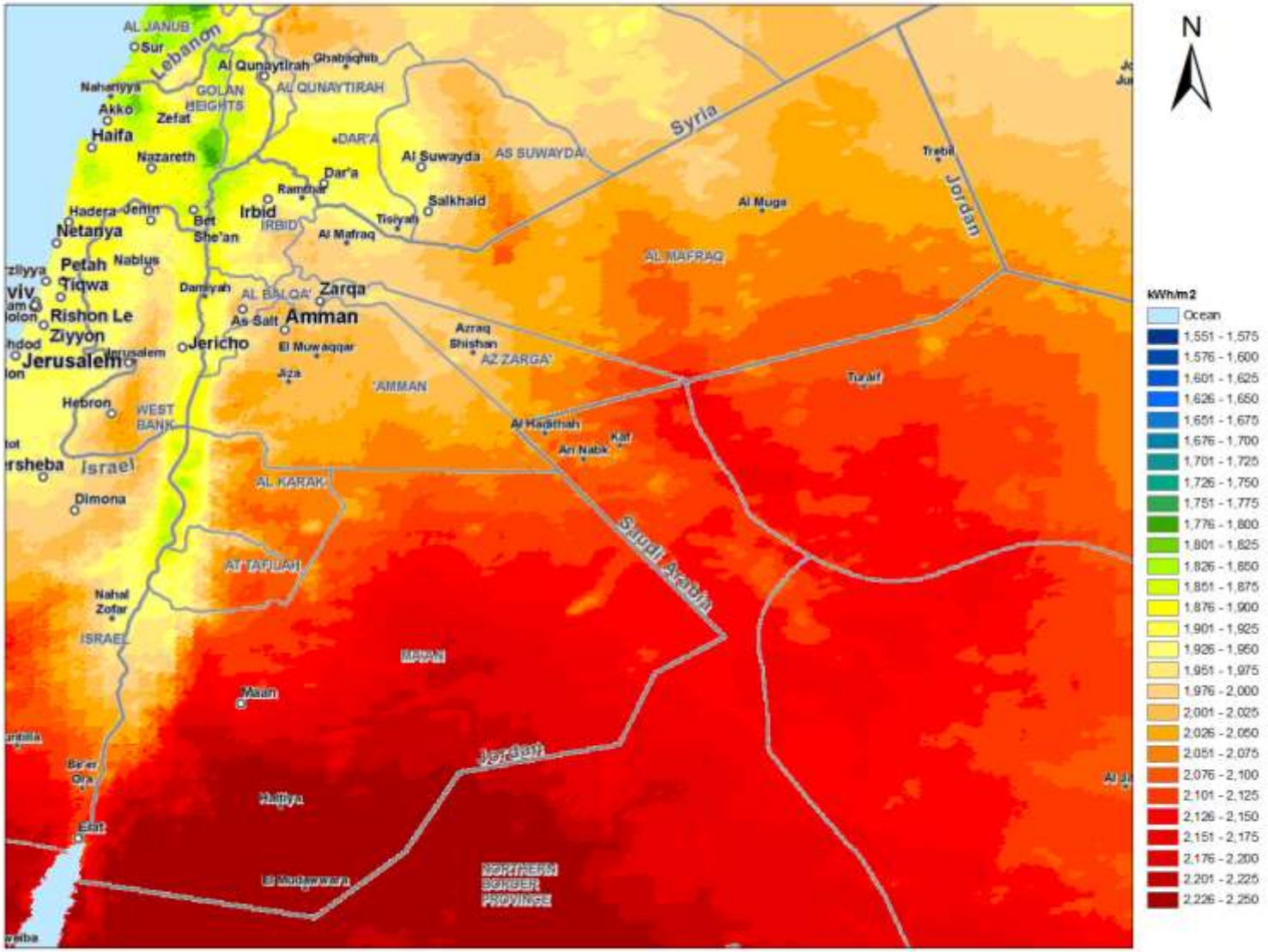
Solar Radiation Jordan



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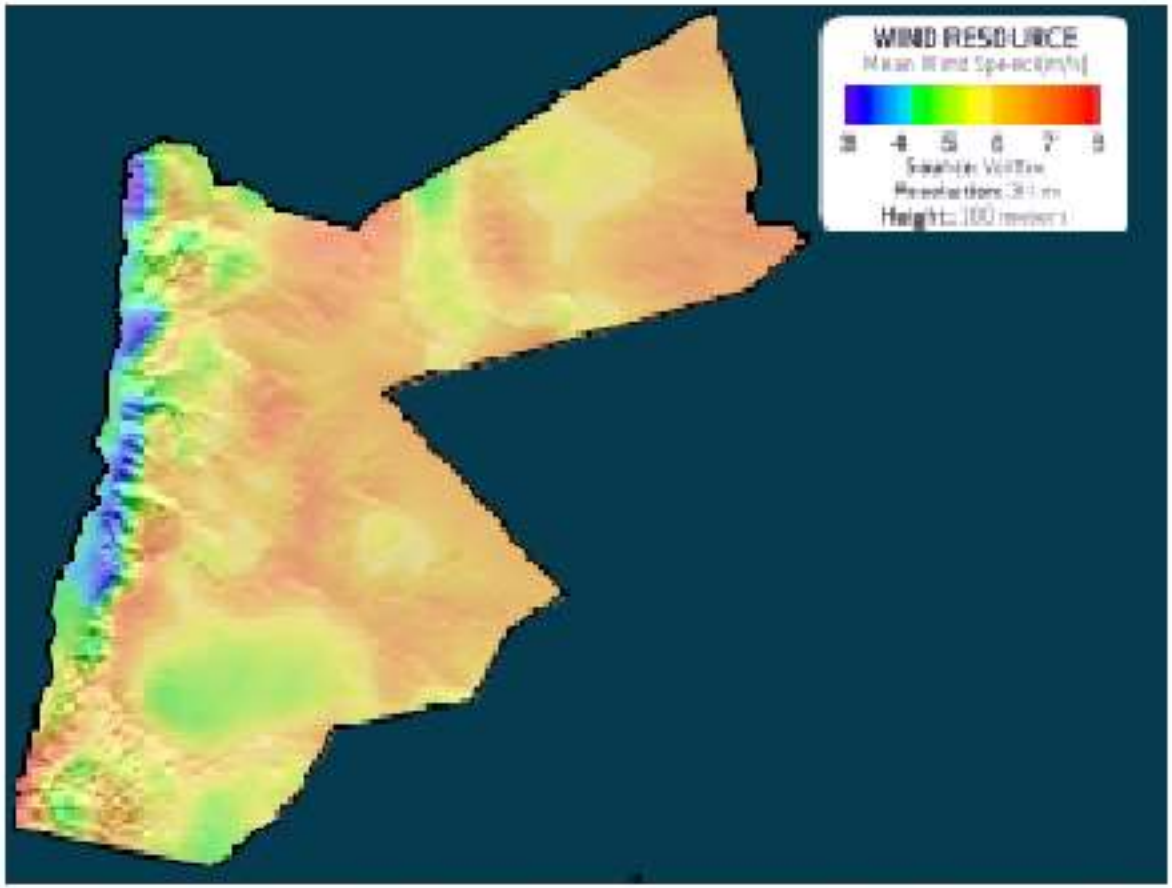
Jordan Wind Map



N

0 10 20 40 60 80 Miles

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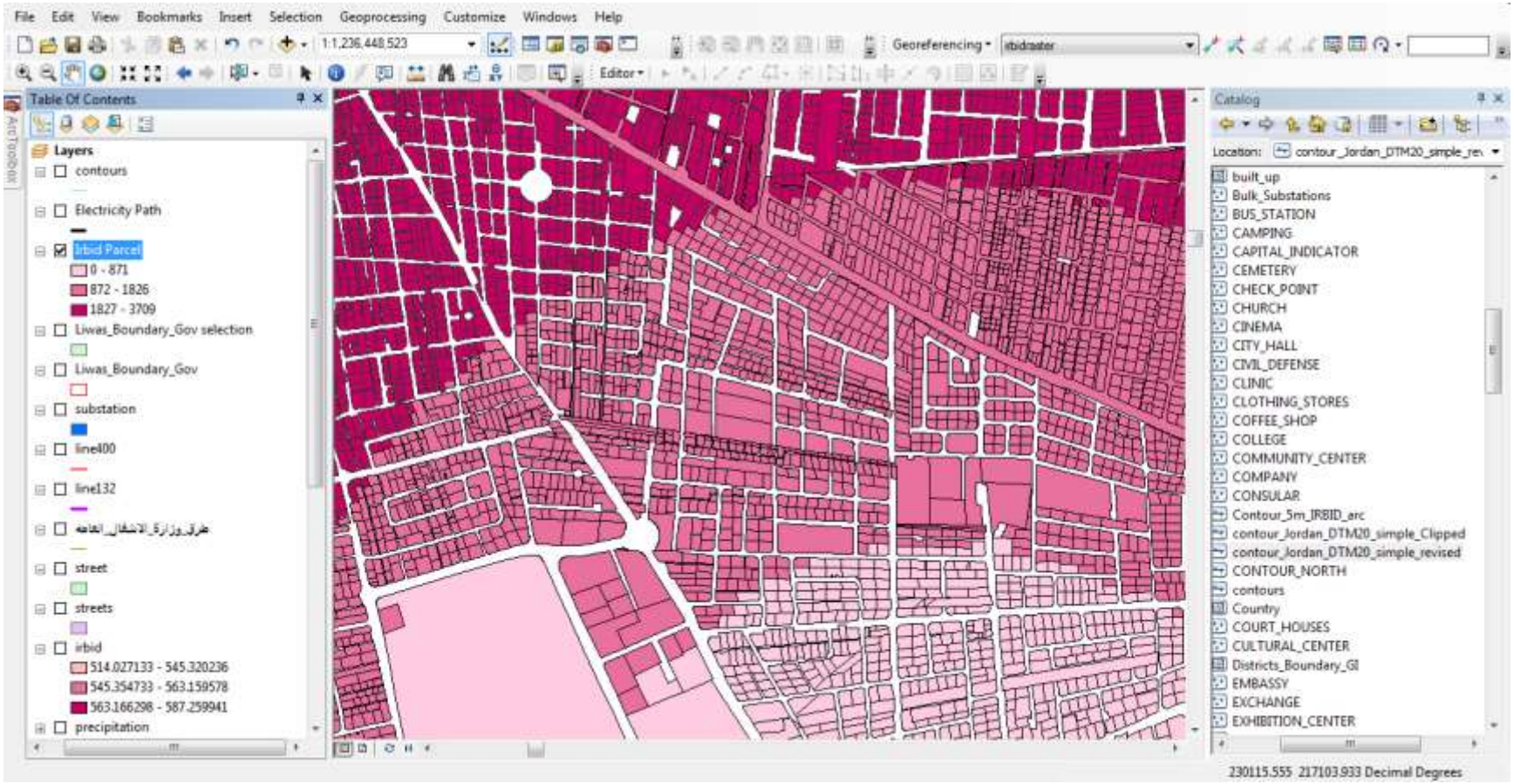
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Liwas_Boundary_Gov
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street
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CAPITAL_INDICATOR
CEMETERY
CHECK_POINT
CHURCH
CINEMA
CITY_HALL
CIVIL_DEFENSE
CLINIC
CLOTHING_STORES
COFFEE_SHOP
COLLEGE
COMMUNITY_CENTER
COMPANY
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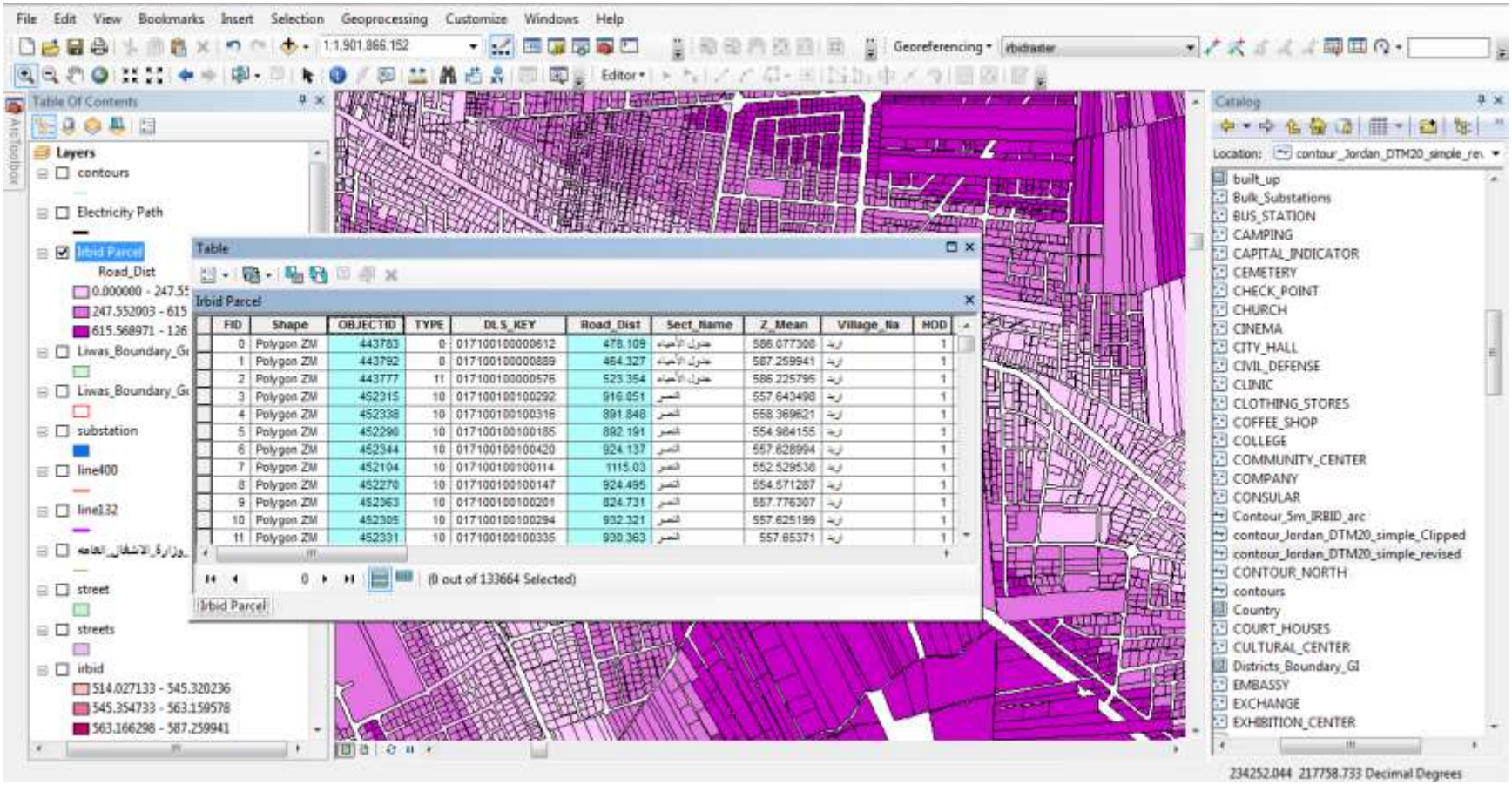
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CLINIC
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COMMUNITY_CENTER
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CONTOUR_NORTH
contours
Country
COURT_HOUSES
CULTURAL_CENTER
Districts_Boundary_GI
EMBASSY
EXCHANGE
EXHIBITION_CENTER
234252.044 217758.733 Decimal Degrees

DM5	DM4	DM3	DM2	DM1		
9	8	9	10	10	Very suitable	Technical Specification
7	7	6	7	8	Suitable	
5	6	3	5	6	Acceptable	
9	8	8	10	10	0m-871	Nearest Electricity Network
8	6	5	9	8	872m-1826m	
7	3	3	8	6	More than 1827	
2	4	6	5	6	0m-200m	Nearest population centers
5	6	8	6	8	200m-400m	
9	8	9	8	9	More than 400m	
8	7	9	9	10	0m-247m	Nearest communication and transportation network
7	5	7	7	8	248m-615m	
6	4	5	4	6	More than 616m	
6	4	3	5	5	0m-900m	The nearest tourist areas
7	7	8	6	8	901m-1801m	
10	9	9	8	9	More than 1801	
10	6	7	8	7	0m-5000m	Nearest water Source
8	5	6	7	5	5001m-10000m	
6	4	5	6	4	More than 10000m	
2	2	6	4	4	0m-1000m	The nearest natural reserves
5	7	8	8	6	1001m-2001m	
8	9	9	9	8	More than 2001	
9	10	8	9	10	Desert	Plant Cover type
3	8	5	6	5	Forestry	
2	6	3	4	3	Farms	
2	3	7	4	4	Mud	Soil Type
4	5	5	6	5	Sandy	
8	7	8	9	8	Rocky	
9	10	7	8	8	Manufactory	Land Use
7	8	4	5	6	Residential or commercial	
3	6	4	4	4	Agricultural, tourist	

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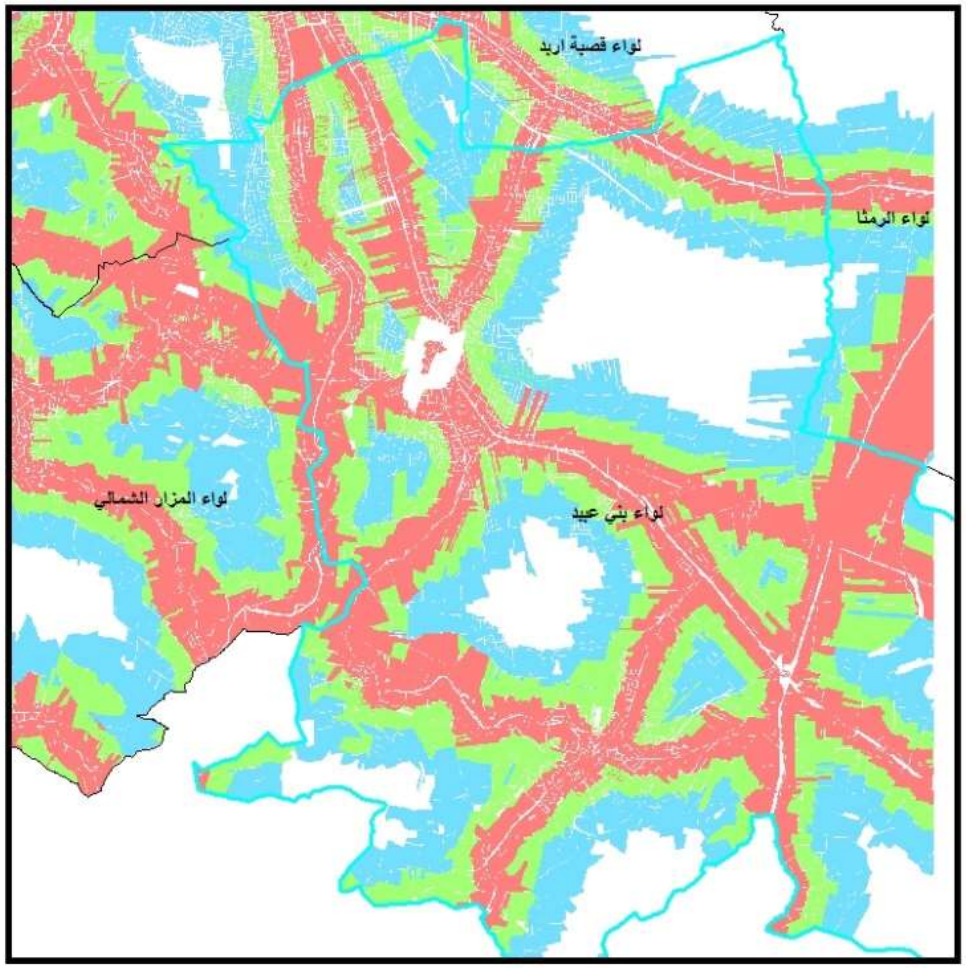
P5	0.1	0.2	0.2	0.3	1	3	4	2	4	3
P6	0.2	0.2	0.3	0.3	0.3	1	6	3	4	3
P7	0.2	0.2	0.2	0.3	0.3	0.2	1	3	4	3
P8	0.1	0.1	0.2	0.2	0.5	0.3	0.3	1	3	3
P9	0.1	0.1	0.1	0.2	0.3	0.3	0.3	0.3	1	3
P10	0.3	0.3	0.5	1.0	0.3	0.3	0.3	0.3	0.3	1

خارطة الملائمة الجغرافية لإنشاء مشاريع الطاقة المتجددة
في لواء بني عبيد لعام ٢٠١٥



1st Select the suitable parcel for renewable energy

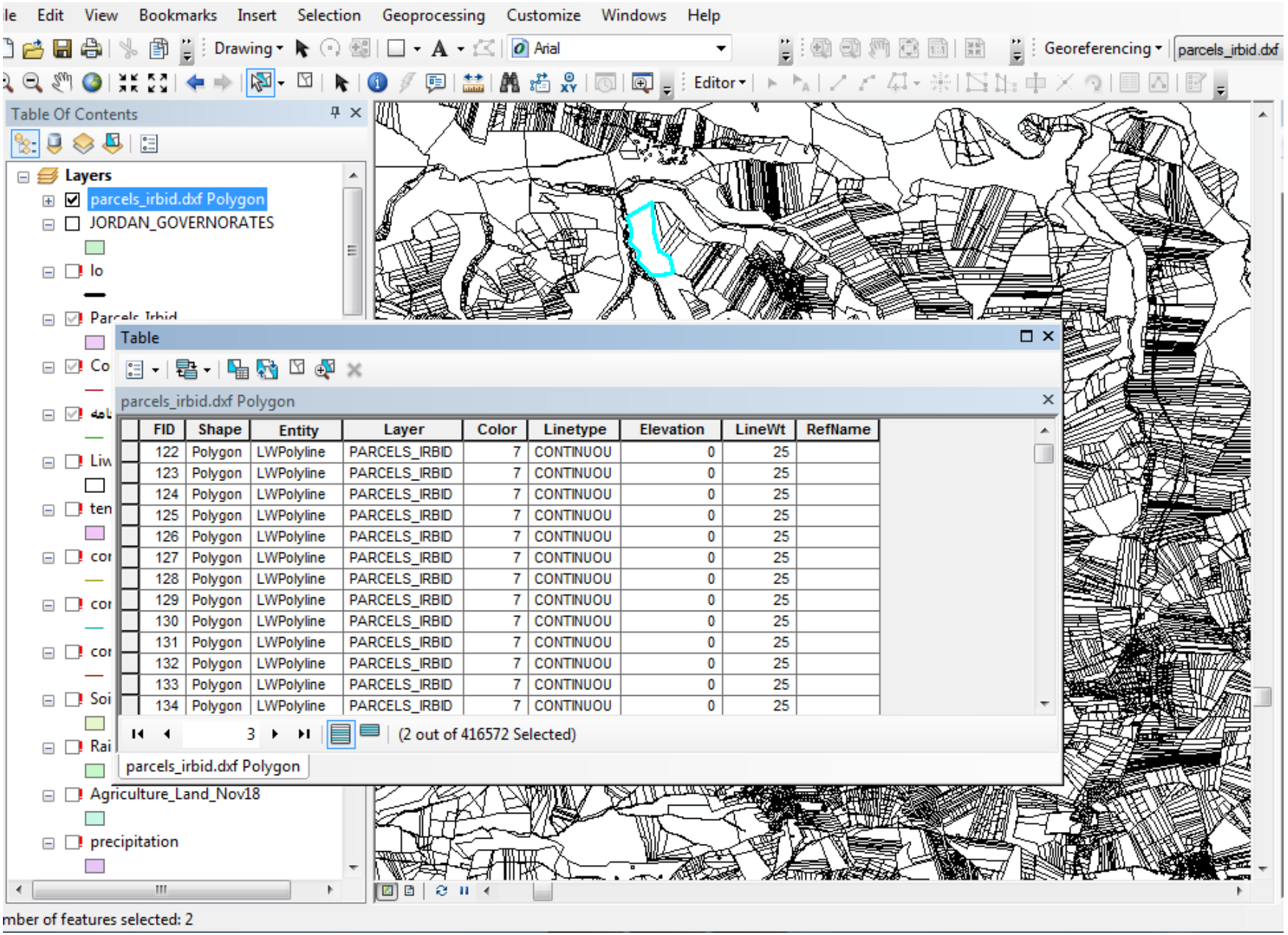
1. Capture the technical descriptive data:

Such as

- Latitude, longitude, and time zone data to calculate sun angles and collector surface angles, assuming that the solar position at the midpoint of the hour applies to the entire hour.
- Solar resource data (global horizontal, direct normal, and diffuse horizontal irradiance) to calculate incident irradiance.
- Ambient weather data (wind speed, temperature, humidity, etc.) to model thermal effects of photovoltaic module performance, thermal losses in CSP and solar water heating systems, and power cycle cooling loads in CSP systems.

- Entire the previous collected value for each parcel.

- Create a thematic map.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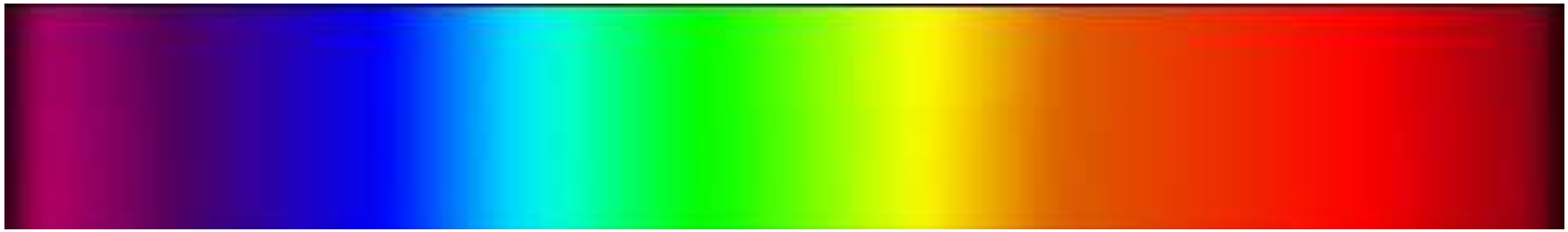

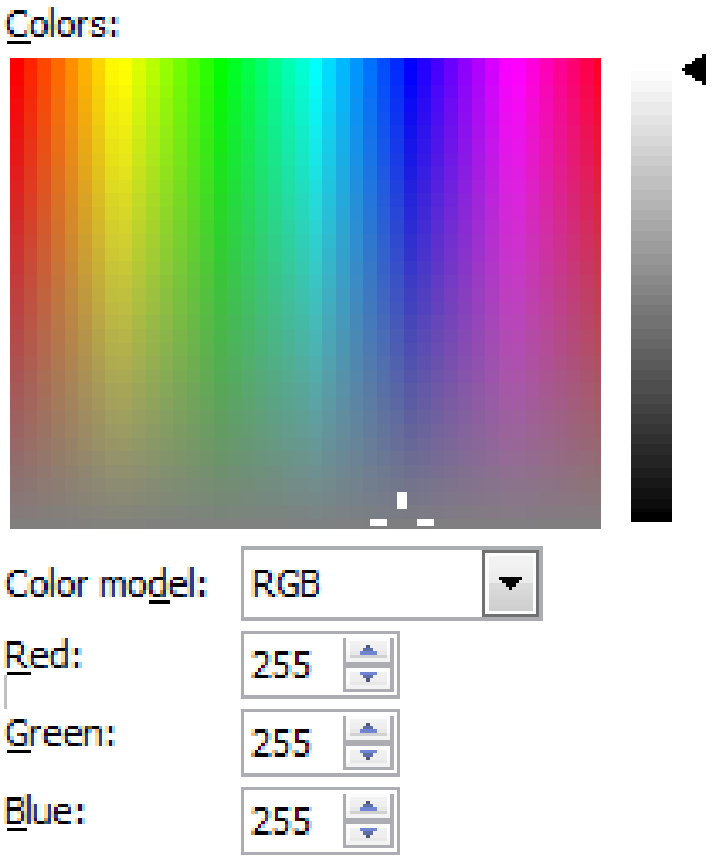
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Blue:
255

- The paper endorse the need to establish spatial and descriptive data bank for Jordan, in order to encourage renewable energy investments, with employment of geographical information system as geographical properties of Jordan is found to be an excellent place for such projects.

The End

Thanks for listening