
Site Suitability of Wind Farms
in Egypt using GIS

Introduction

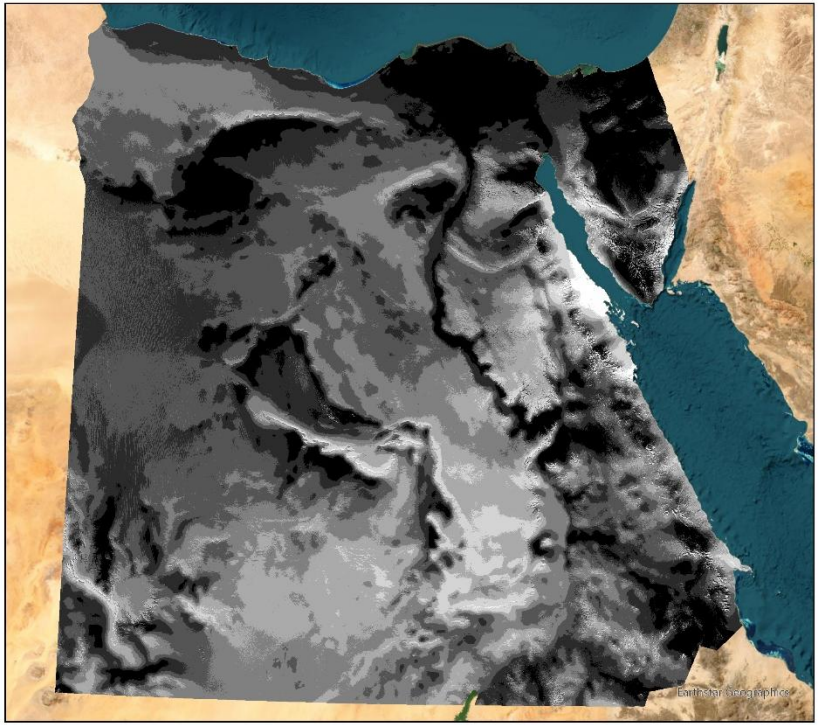
- Through the past two decades, Egypt has aimed to reduce its reliance on fossil fuels and shift toward clean energy sources .
- However, renewable energy still contributes only 12-15% of the country’s electricity, which is low considering Egypt’s strong wind and year-round solar potential .

Project Objectives

- Evaluate the locations of the existing wind farms
- Identify the most suitable location for building new wind farm

Wind Speed at 50m Height

Wind Speed at 50m Height

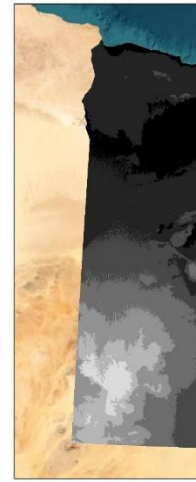


Legend

Wind_Speed

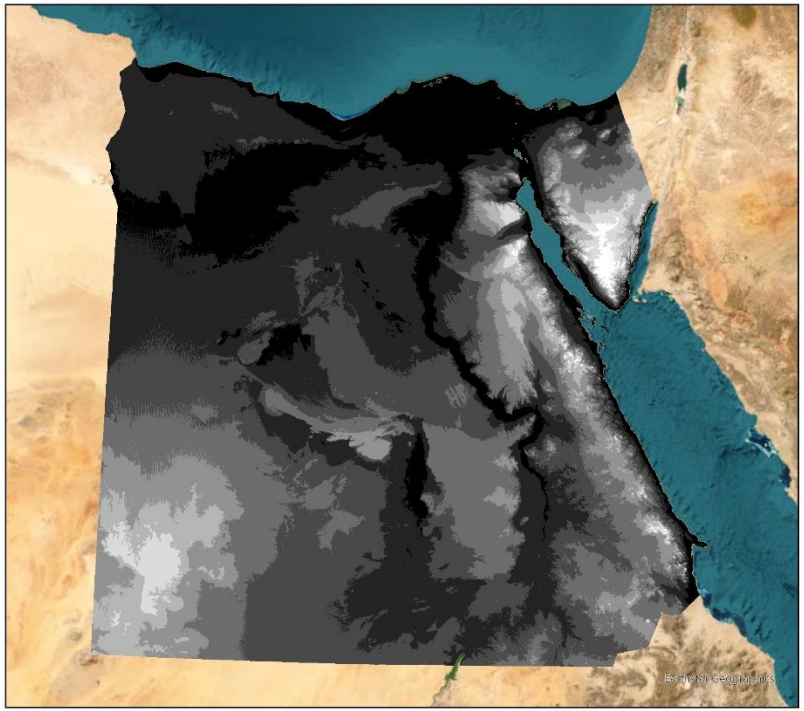
Value

- 0.632 - 4.902
- 4.903 - 5.651
- 5.652 - 6.325
- 6.326 - 6.925
- 6.926 - 7.599
- 7.6 - 8.798
- 8.799 - 19.736



Digital Elevation Model (SRTM)

Digital Elevation Model



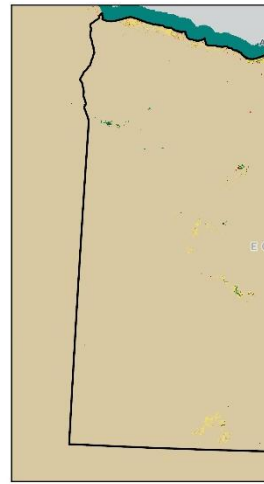
Legend

DEM

Value

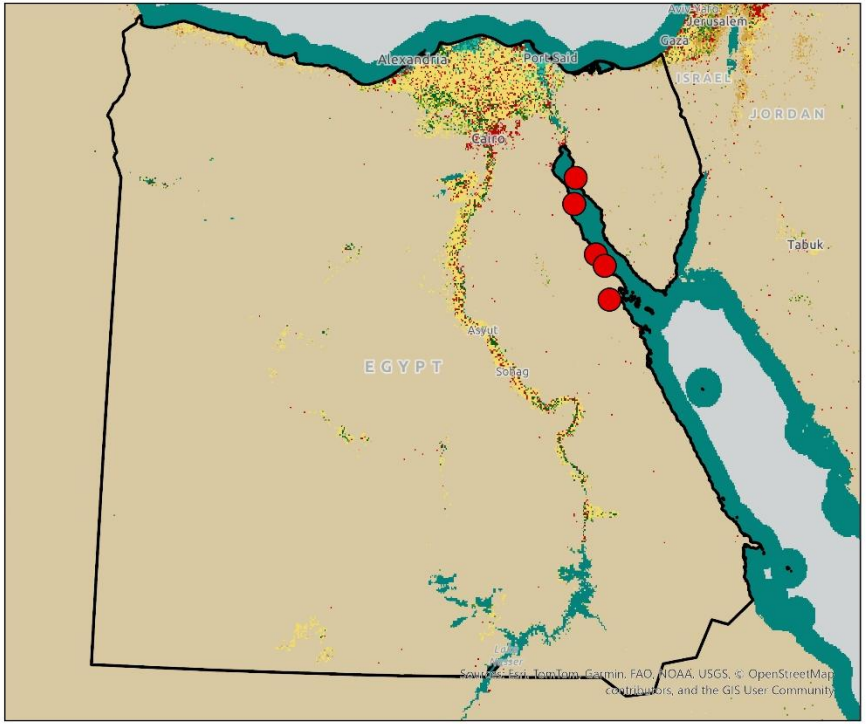
-186.999 - 98.592
98.593 - 230.404
230.405 - 351.231
351.232 - 494.027
494.028 - 658.792
658.793 - 867.494
867.495 - 1,208.008
1,208.009 - 2,614

LandCover



- Land Cover (Esri)

LandCover Classification



Legend

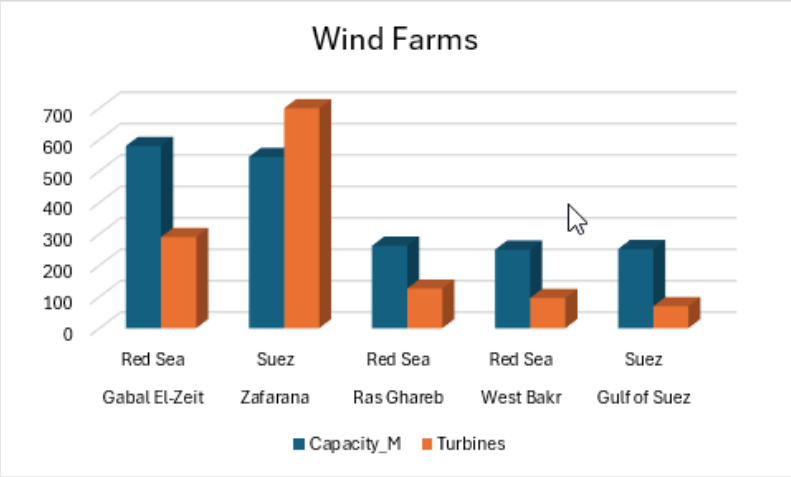
- Current Stations

LandCover

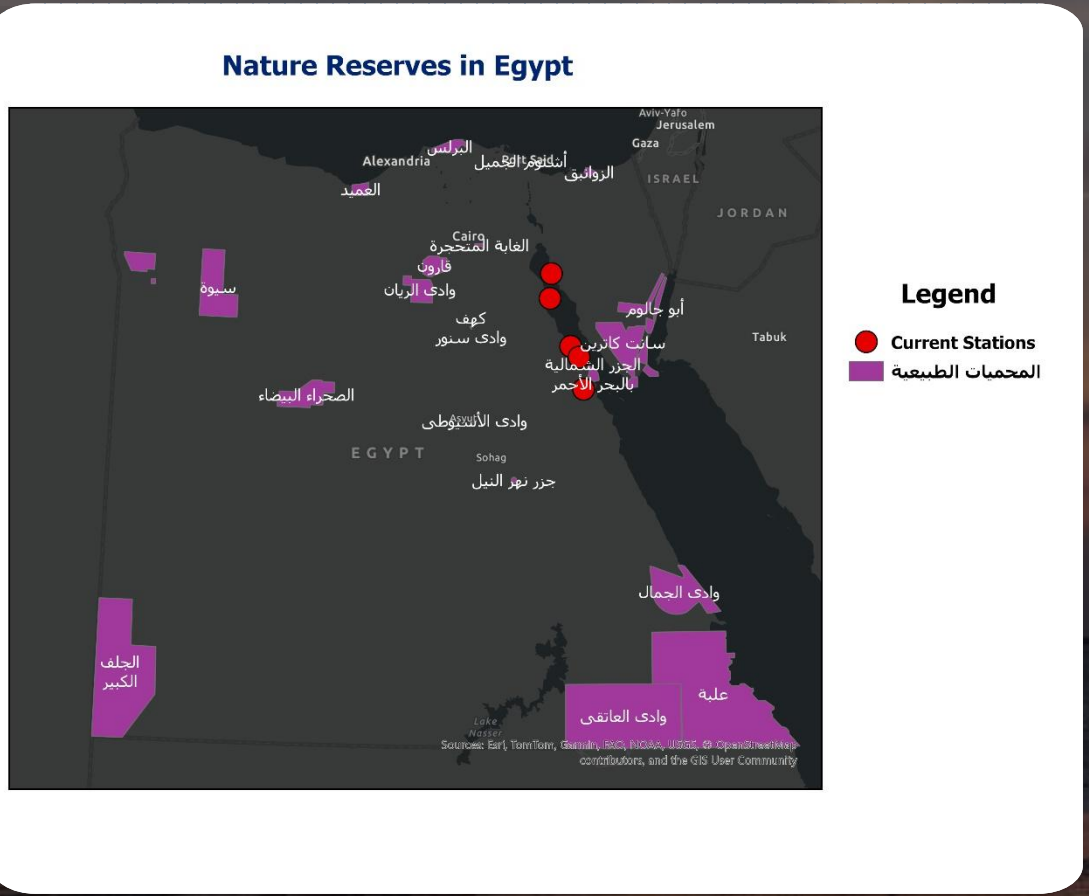
- Tree Cover
- Shrubland
- Grassland
- Cropland
- Built-up
- Bare or sparse vegetation
- Snow and Ice
- Permanent water bodies
- Herbaceous wetland
- Mangroves
- Moss and lichen

Current Stations (Power Technology)

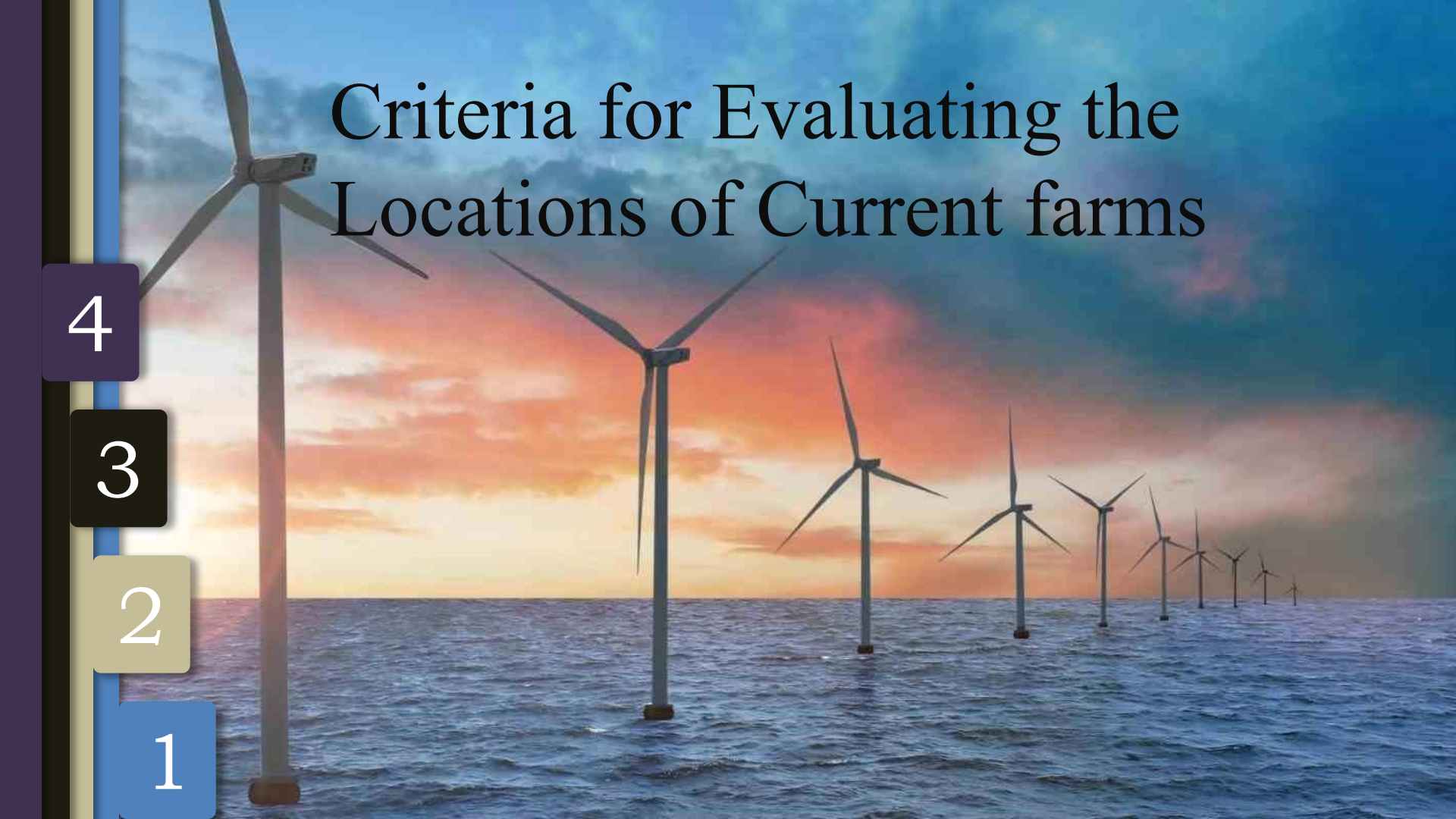
Name	Governorat	Capacity_M	Turbines	Year_Start
Gabal El-Zeit	Red Sea	580	290	2018
Zafarana	Suez	545	700	2001
Ras Ghareb	Red Sea	262.5	126	2019
West Bakr	Red Sea	250	96	2021
Gulf of Suez	Suez	252	70	2015



Nature Reserves (DIVA-GIS)



Criteria for Evaluating the Locations of Current farms



4

3

2

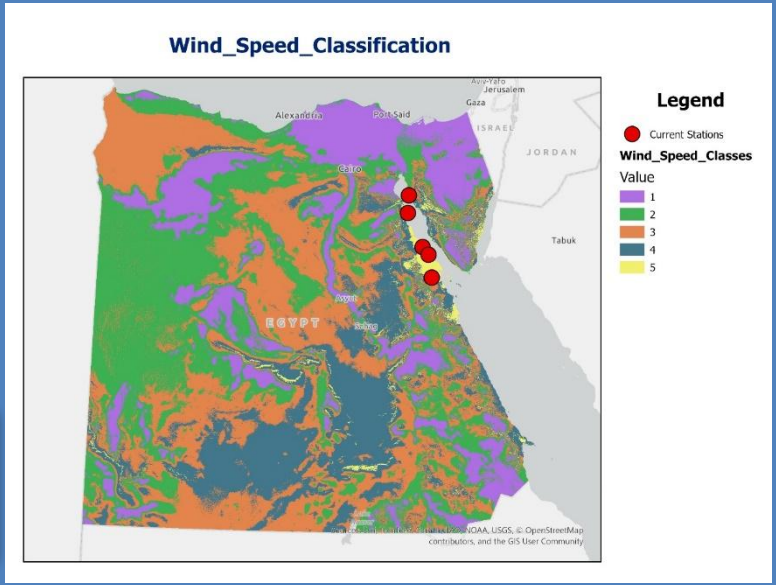
1

4

3

2

1

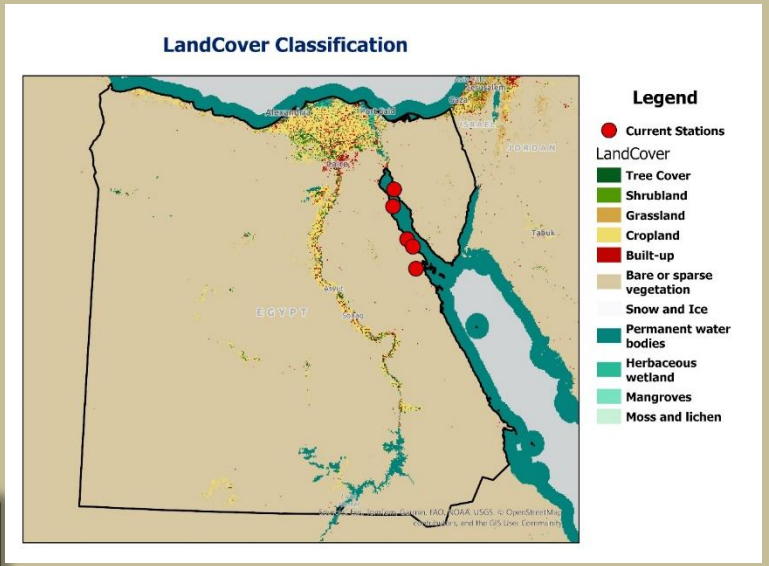


Start	End	New
0.63	5	1
5	6	2
6	6.8	3
6.8	8.2	4
8.2	19.7	5
NODATA	NODATA	NODATA

- Reclassified Wind Speed

4

3



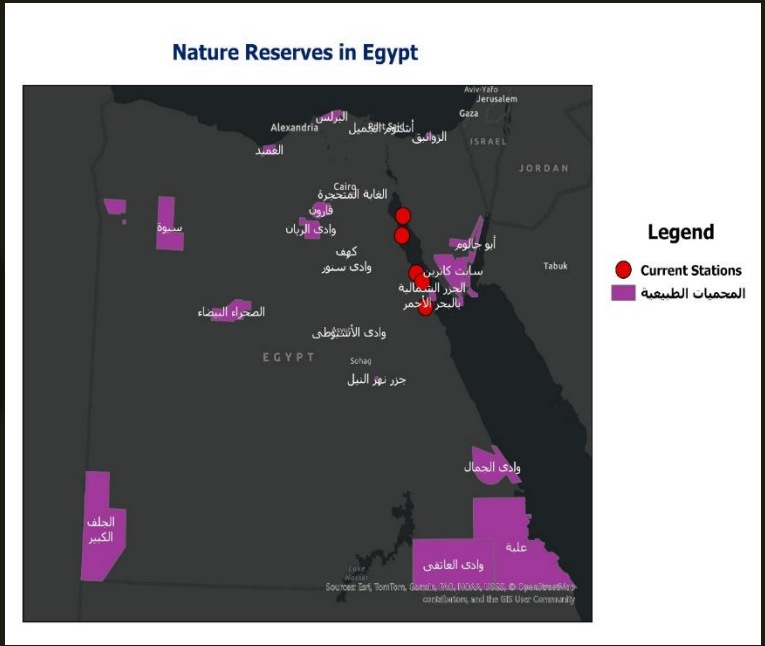
Value	Scale
Tree Cover	2
Shrubland	3
Grassland	4
Cropland	3
Built-up	1
Bare or sparse vegetation	5
Snow and Ice	1
Permanent water bodies	1
Herbaceous wetland	2
Mangroves	1

2

1

- Land Cover

4



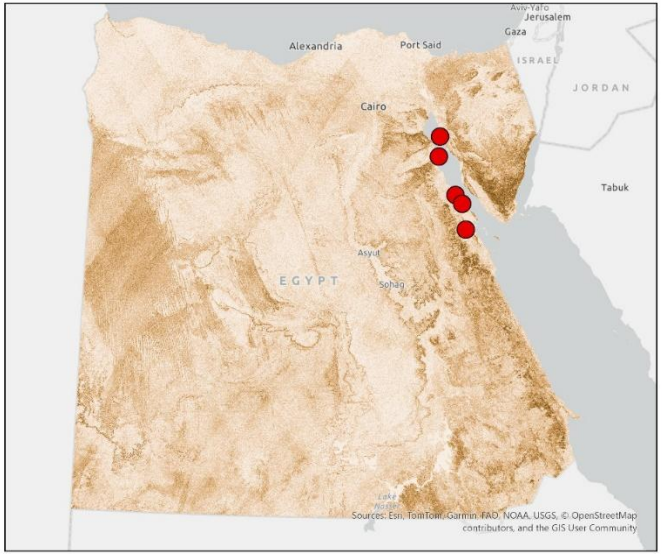
- Distance from Nature Reserves (2 km² Buffer)

3

2

1

Egypt Land Slope



Start	End	New
0	2.95195	5
2.95195	7.379876	4
7.379876	14.169362	3
14.169362	24.501188	2
24.501188	75.274734	1
NODATA	NODATA	NODATA

- Slope

4

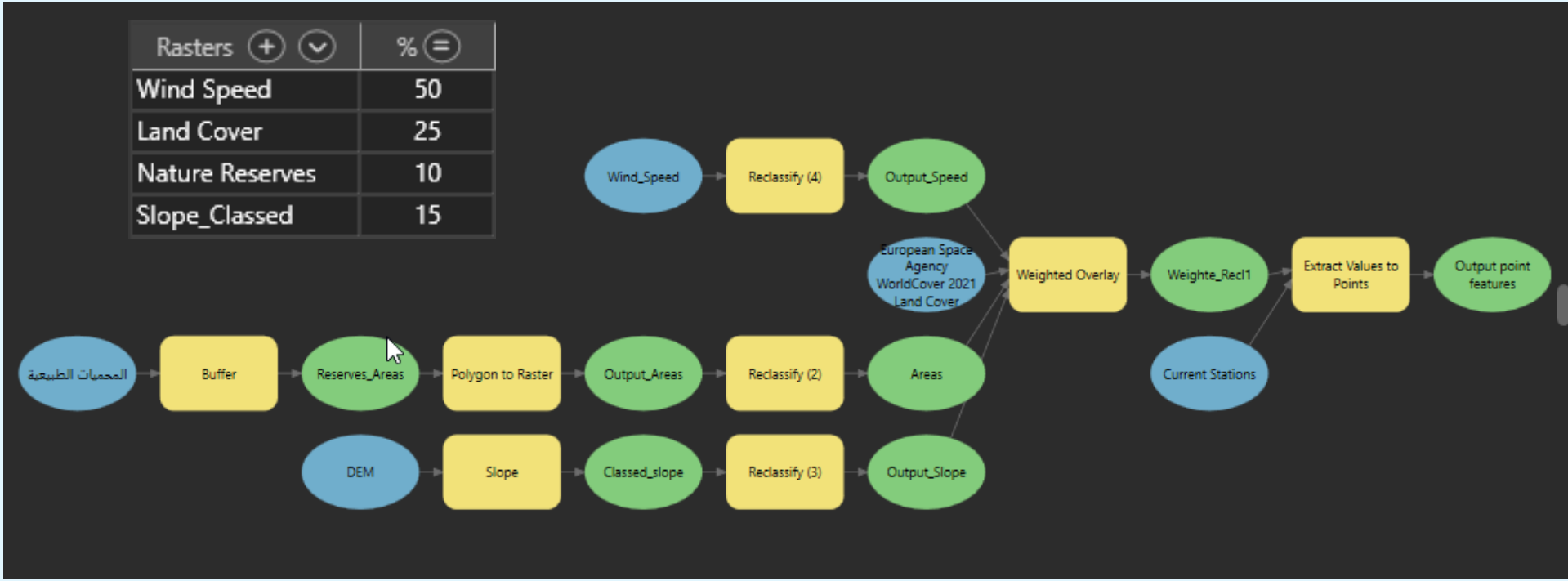
3

2

1

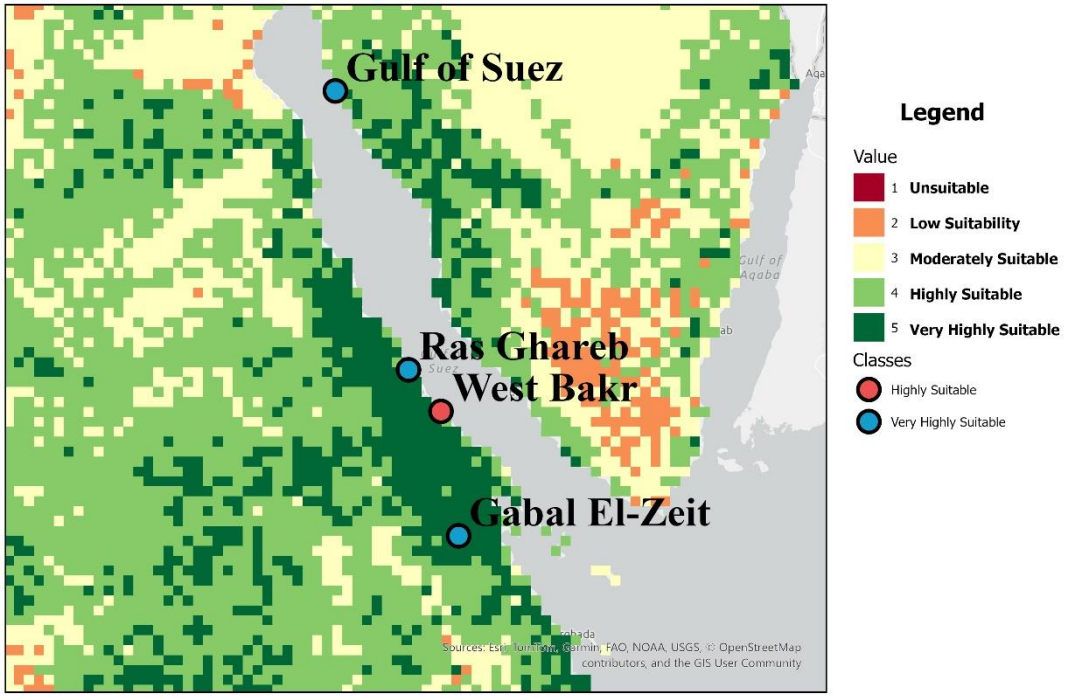
Processing Workflow

Rasters	%
Wind Speed	50
Land Cover	25
Nature Reserves	10
Slope_Classed	15



Results

- **Very Highly Suitable**
  1. Gulf of Suez
  2. Ras Ghareb
  3. Gabal El-Zeit
- **Highly Suitable**
  1. West Bakr

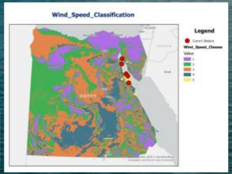


Criteria for identifying the most suitable location for new wind power station

1 — 2 — 3 — 4 — 5

- Wind Speed reclassified

Start	End	New
0.63	5	1
5	6	2
6	6.8	3
6.8	8.2	4
8.2	19.7	5
NODATA	NODATA	NODATA



- Distance from Nature Reserves (2 km² Buffer)

- Land Cover

Value	Scale
Tree Cover	2
Shrubland	3
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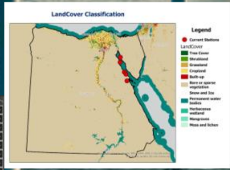
Cropland	3
Built-up	1
Bare or sparse vegetation	5
Snow and Ice	1
Permanent water bodies	1
Herbaceous wetland	2
Mangroves	1



- Slope

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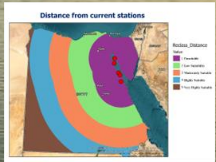
7.379876	14.169362	3
14.169362	24.501188	2
24.501188	75.274734	1
NODATA	NODATA	NODATA

- Distance from current farms



- Wind Speed reclassified

Start	End	New
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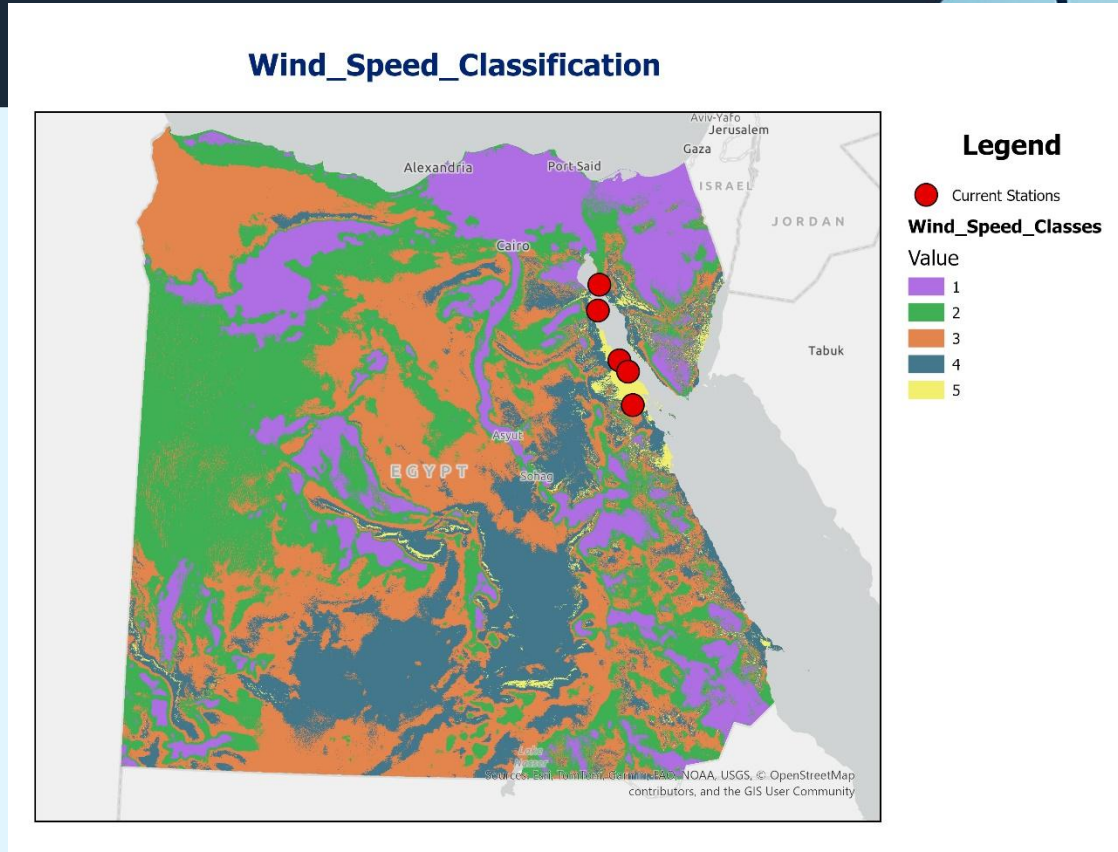
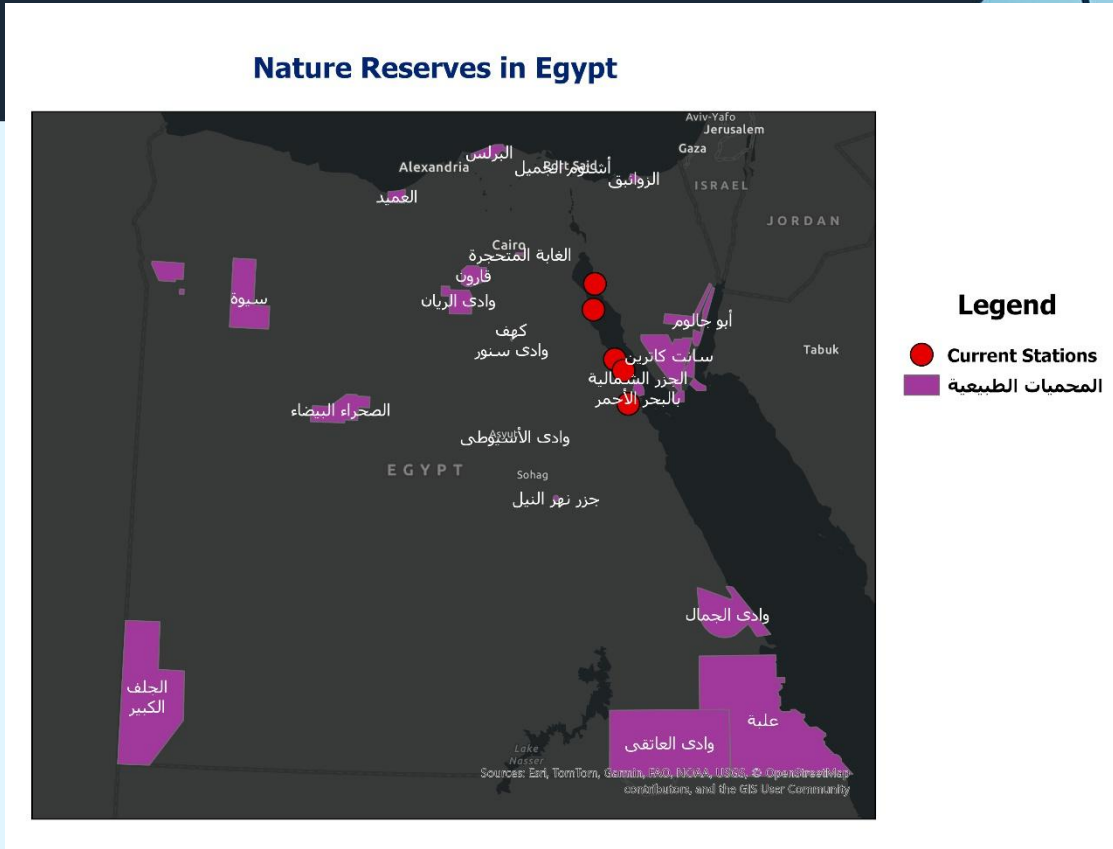


- Distance from Nature Reserves (2 km² Buffer)



- Land Cover

Value	Scale
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Permanent water bodies	1
Herbaceous wetland	2
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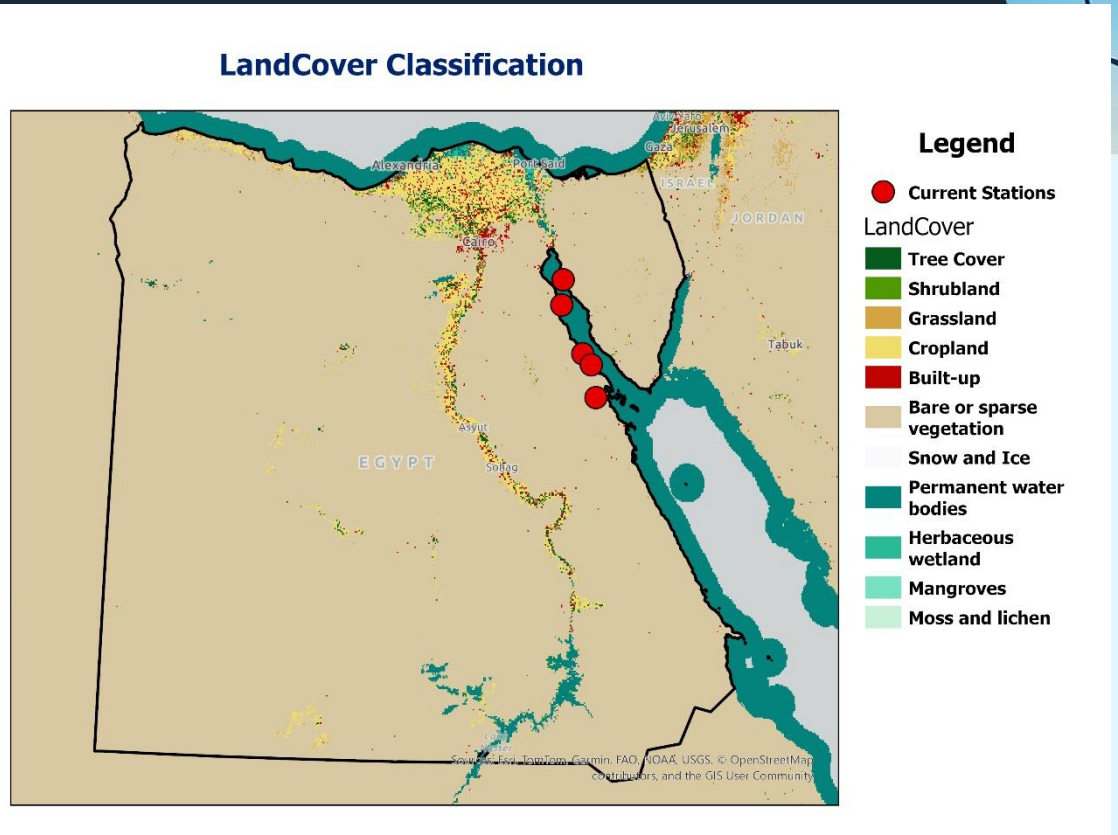

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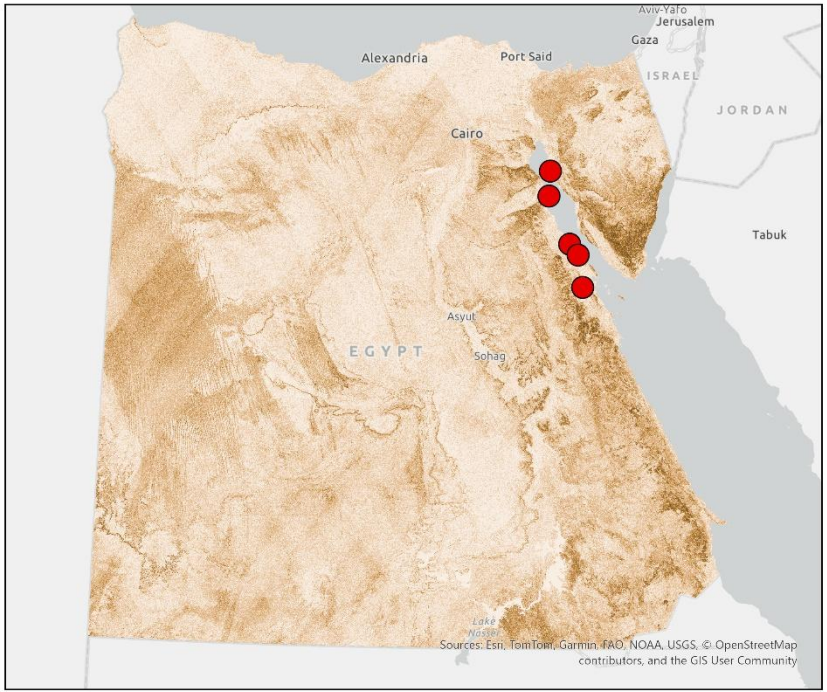
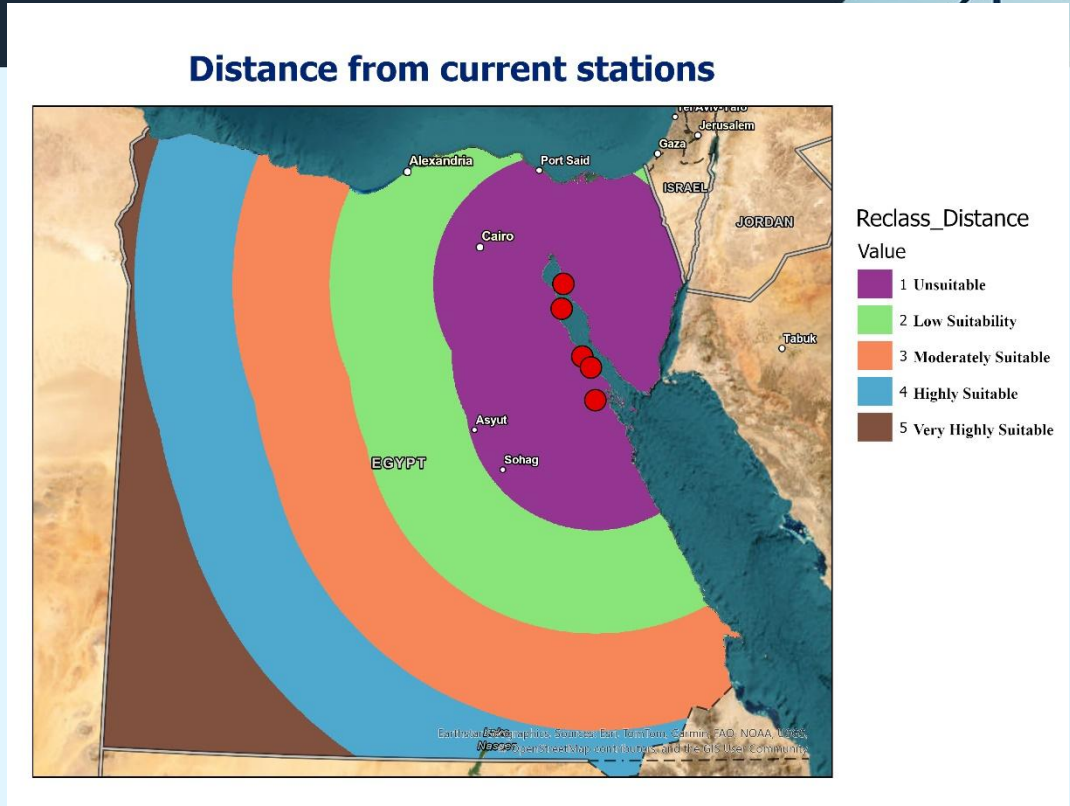
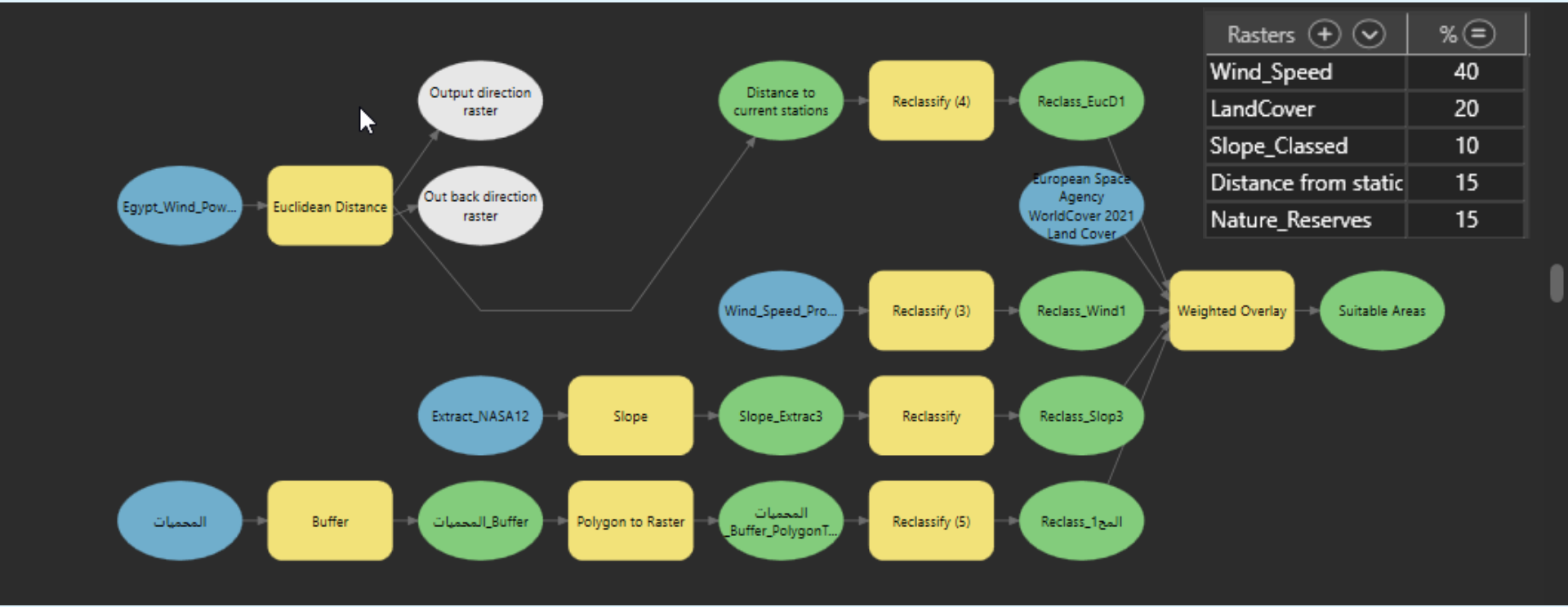


- Distance from current farms



Processing Workflow

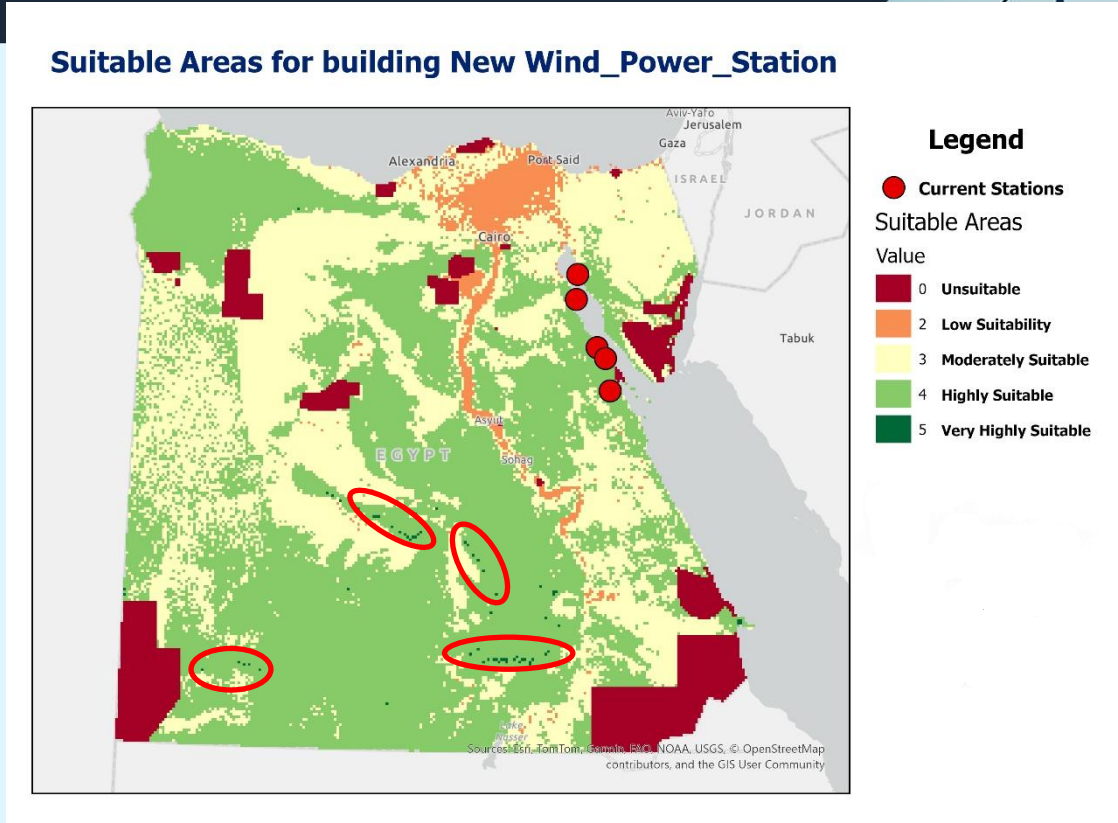


Rasters	%
Wind_Speed	40
LandCover	20
Slope_Classed	10
Distance from static	15
Nature_Reserves	15

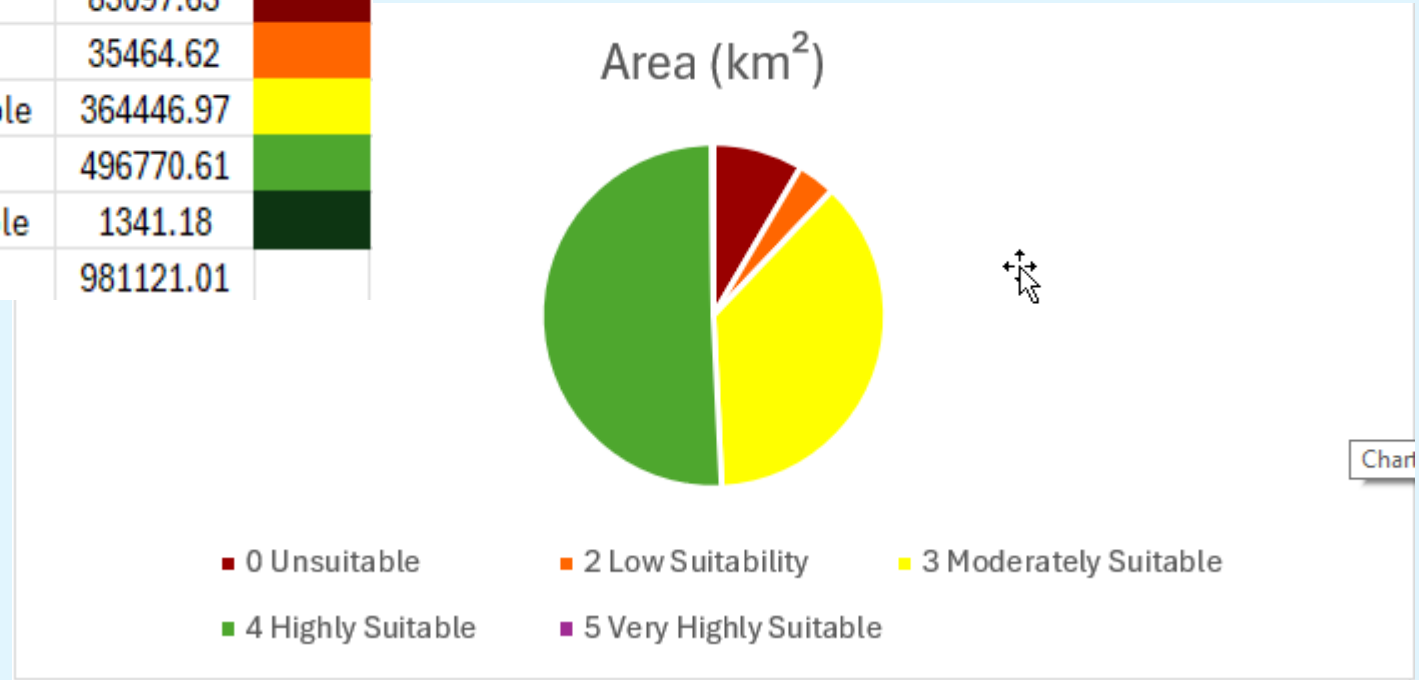
Results

So , the most suitable locations for establishing new wind farms are identified in El Wadi Al Gadid Governorate :

- Western Aswan
- El Kharga , El Dakhla Oases
- The eastern of the Gilf Kebir Plateau .

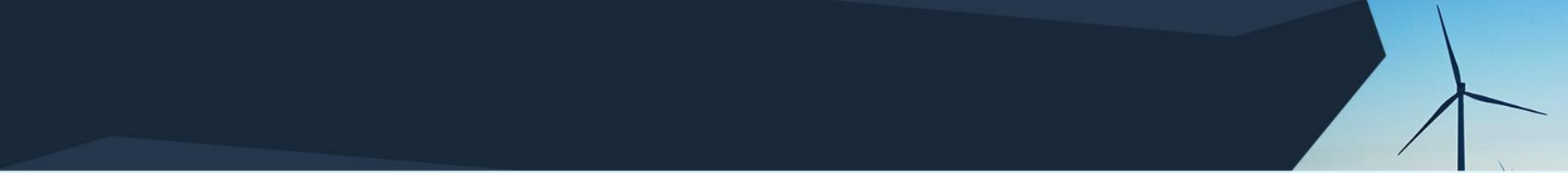


Class	Suitability Degree	Area (km^2)	Color
0	Unsuitable	83097.63	
2	Low Suitability	35464.62	
3	Moderately Suitable	364446.97	
4	Highly Suitable	496770.61	
5	Very Highly Suitable	1341.18	
		981121.01	



References

- **https://www.power-technology.com/**
- **https://globalwindatlas.info/en/**
- **https://livingatlas.arcgis.com/en**
- **https://en.tutiempo.net/climate**
- **https://blog.arabnubia.com/**



Thank you