Mapping Land Collapse Geohazard in the Egyptian Territories using Remotely Sensed Data and Geographic Information System

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Problem Definition

Land Collapse is a serious hazard that reflects a threat to the human environment . Specific zones are more vulnerable to this phenomenon than others according to their physical environment parameters. Land slides or rock falls are components of the land collapse hazard. Impacts are the damage of infra-structure, roads and buildings. Human activities changing the environment activate and accelerate the risk.

Land Collapse Examples (East Cairo, Egypt)

Building Collapse

Objectives

- To define some of the main parameters that contribute to the land collapse hazard.
- To develop a comprehensive methodology (model) using remotely sensed data and geographic information system for identifying zones vulnerable (hotspots) to the land collapse hazard.
- To map the relative risk index for land collapse areas in Egypt.

Materials and Method

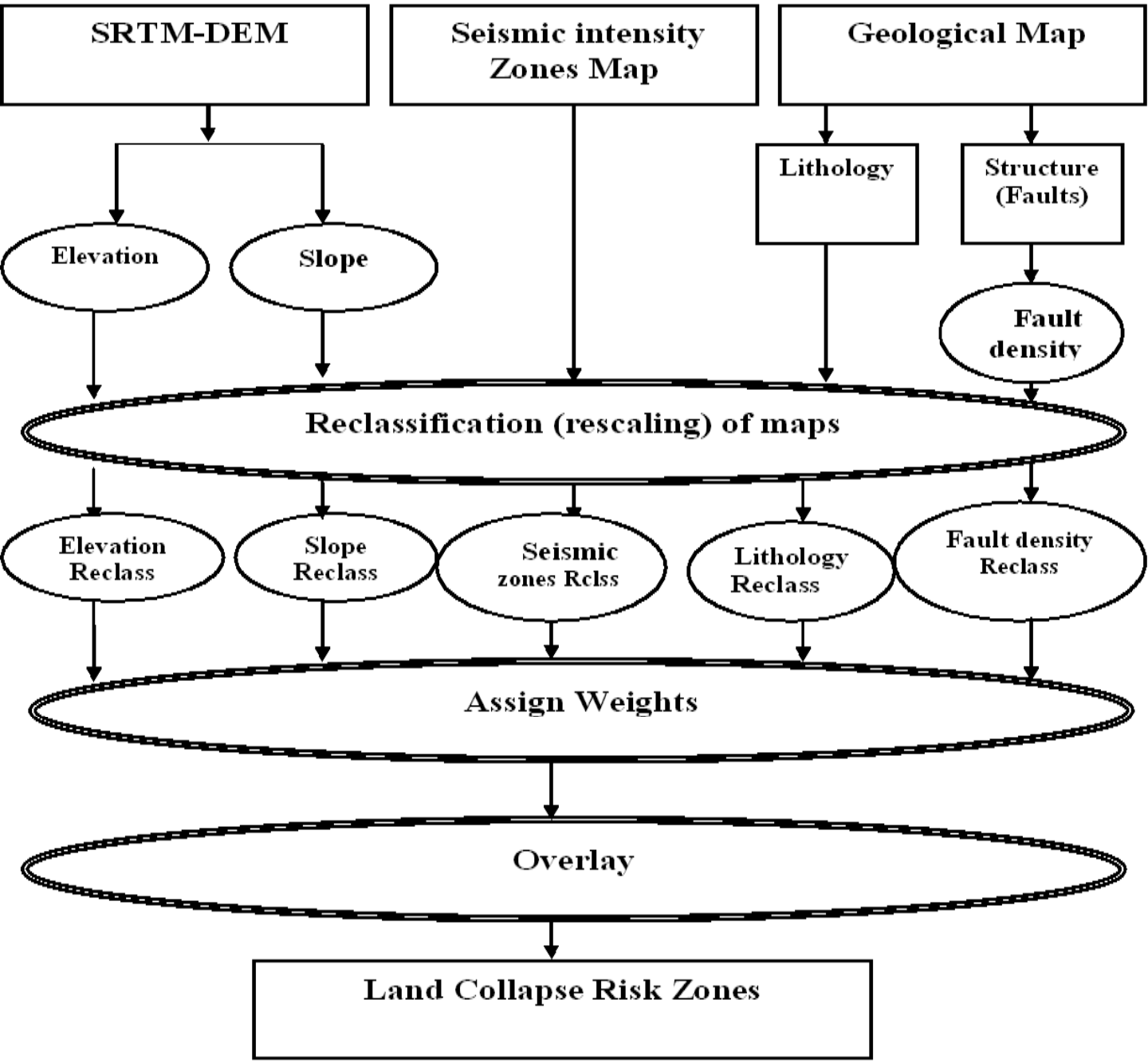
1. Shuttle Radar Topography Mission (SRTM) data was used to create terrain characteristics layers including elevation zones grid , slope angle grid .

2. The geological map of Egypt was used to delineate the lithology map (rock type) and fault distribution map.

3. Seismic maximum intensity zones map of Egypt was converted to a grid .

4. ArcGIS9.2 software was used to reclassify the grids to a standard scale reflecting the risk intensity of each attribute according to the pre-set conditions. An overlay function was used using two scenarios (unity weight and rank-sum weights).

Flow Chart for Land Collapse Risk Procedures



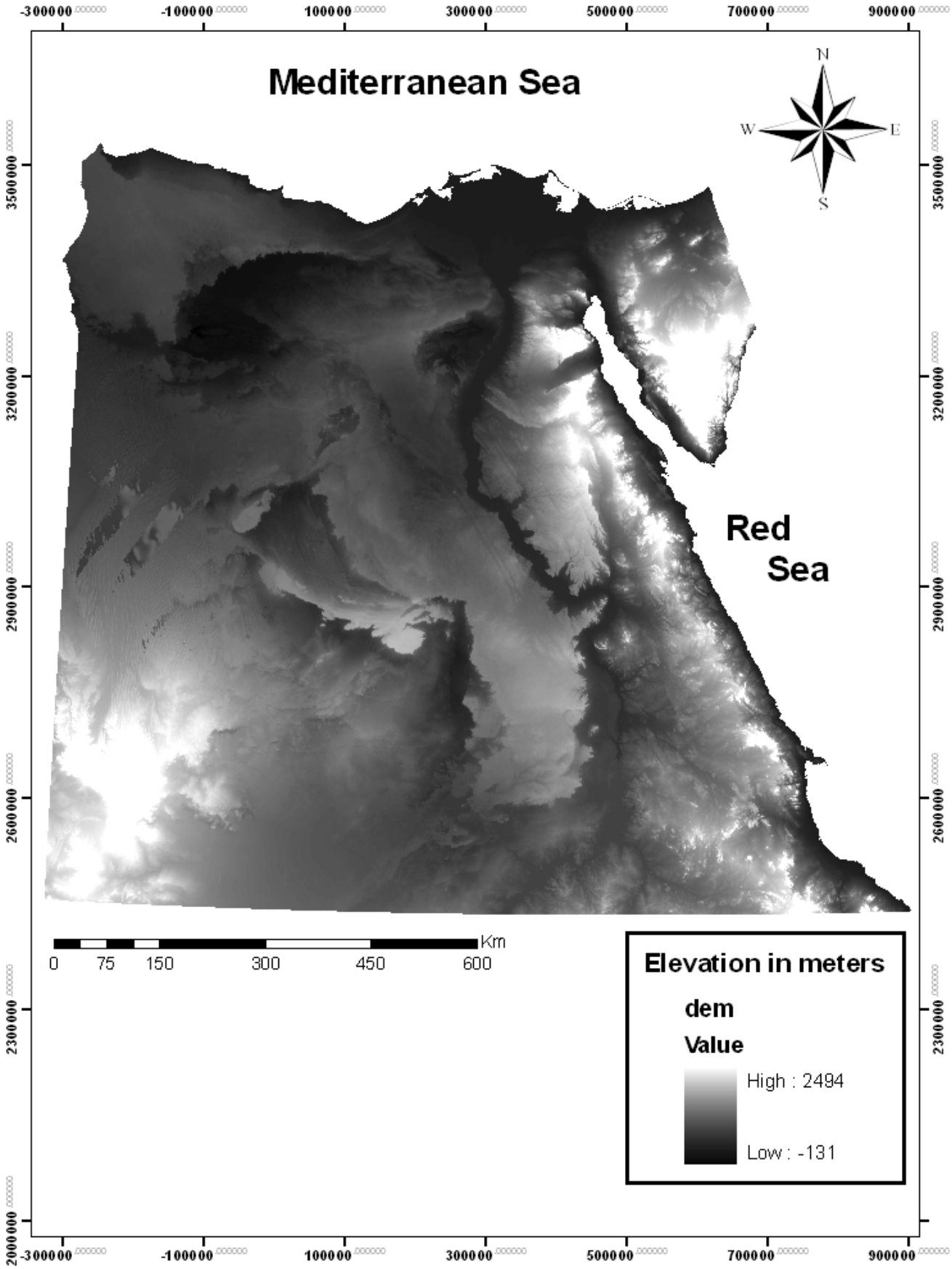
Rescaling the Factor Map Grids to a Standard Scale

Each of the five derived parameters grids were reclassified to a standard scale. The standard scale reflects the relative risk intensity derived from its true values according to the pre-set conditions.

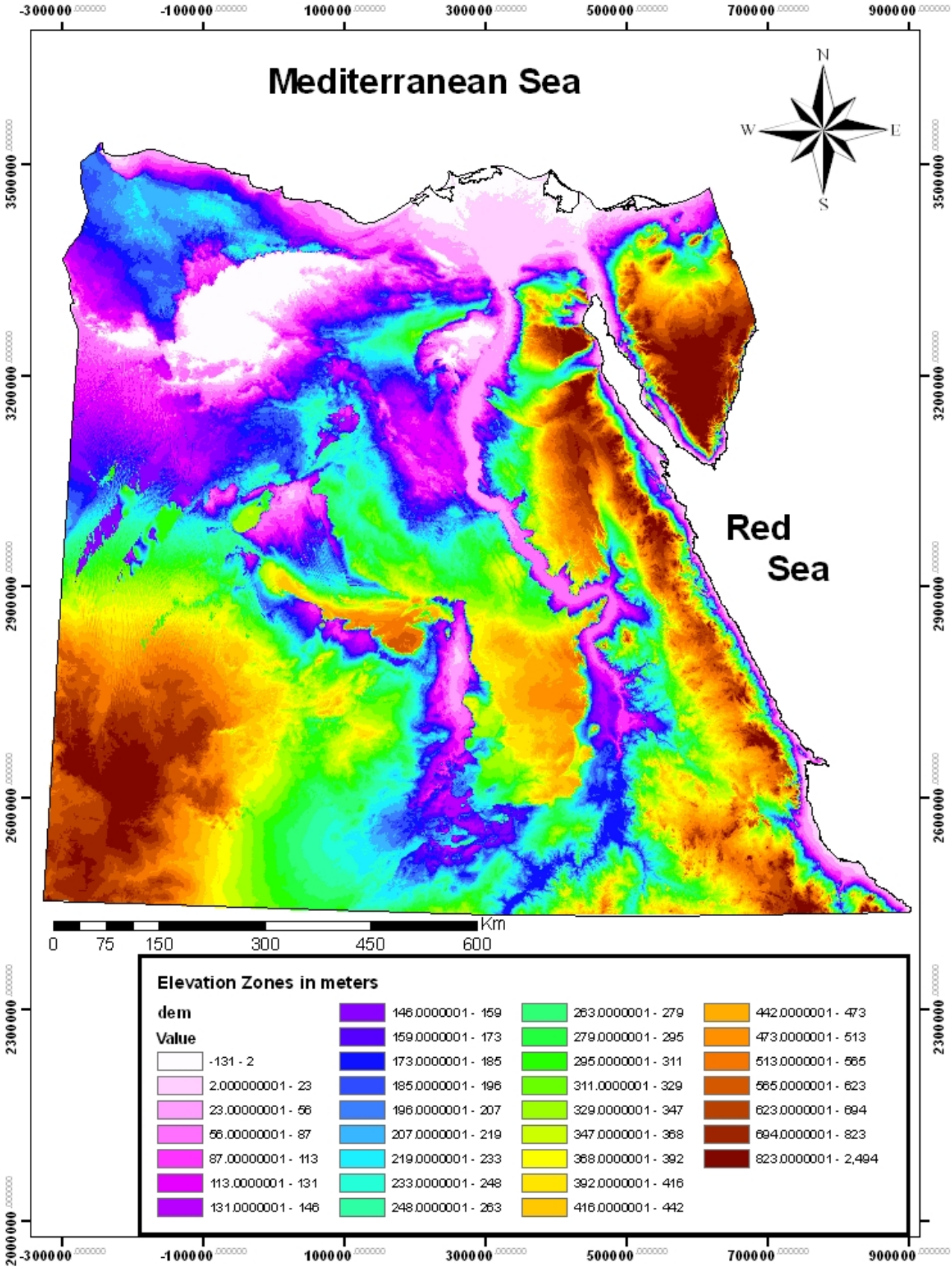
Therefore…

For each factor map, a risk index map was derived.

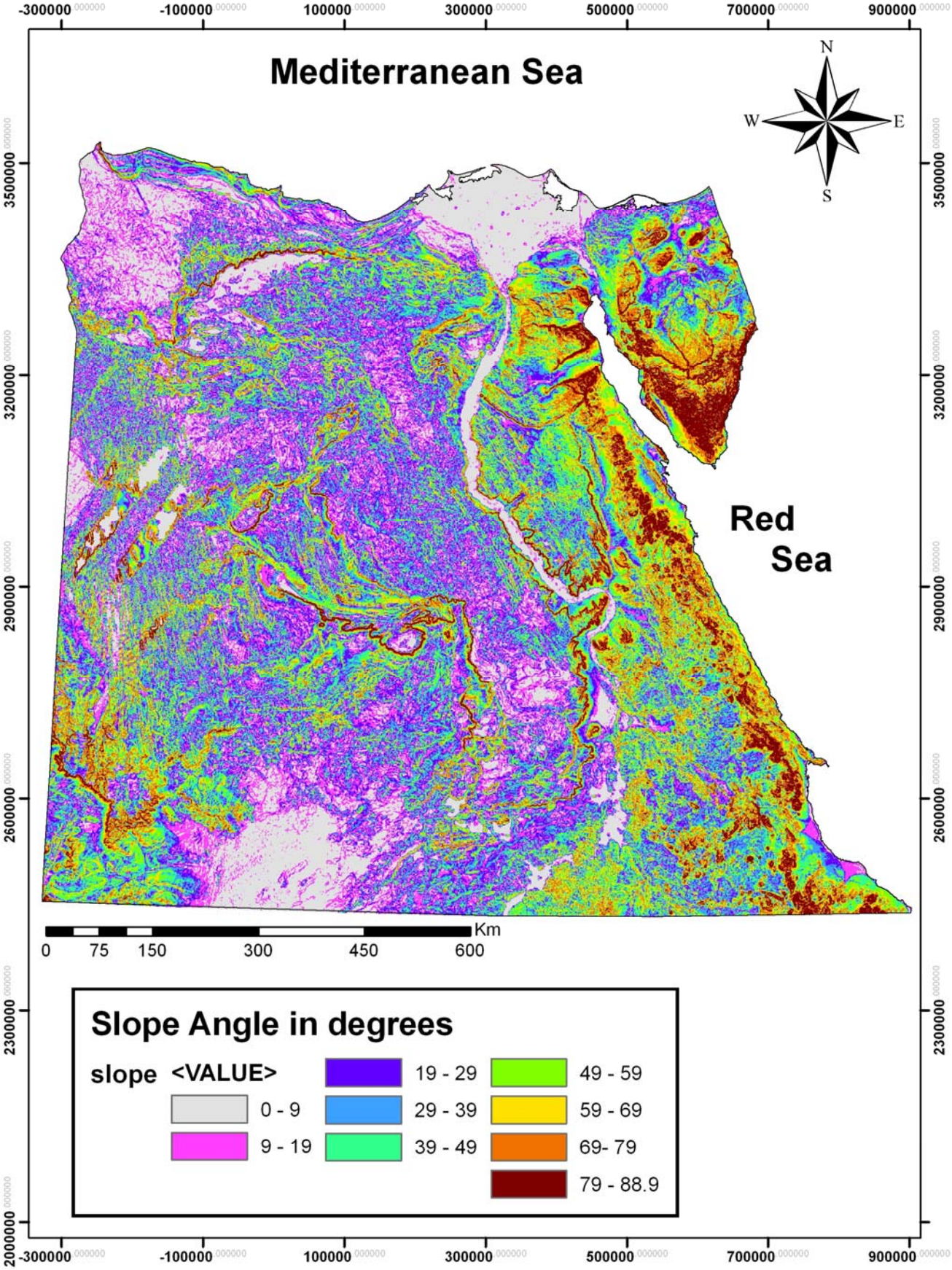
SRTM 30 Arc.Sec.(DEM) for the Egyptian terrain



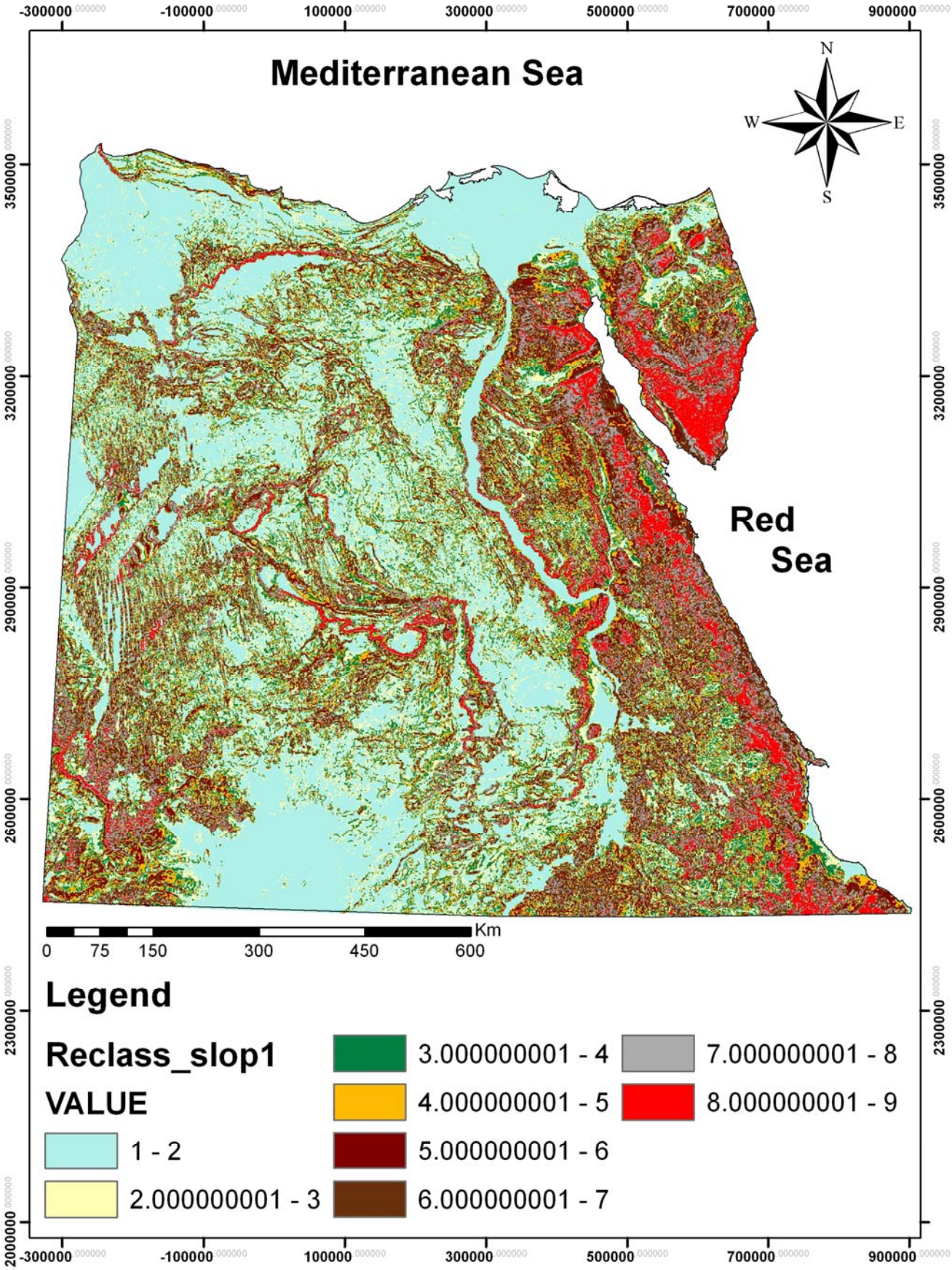
Elevation Zones Map of the Egyptian Terrain



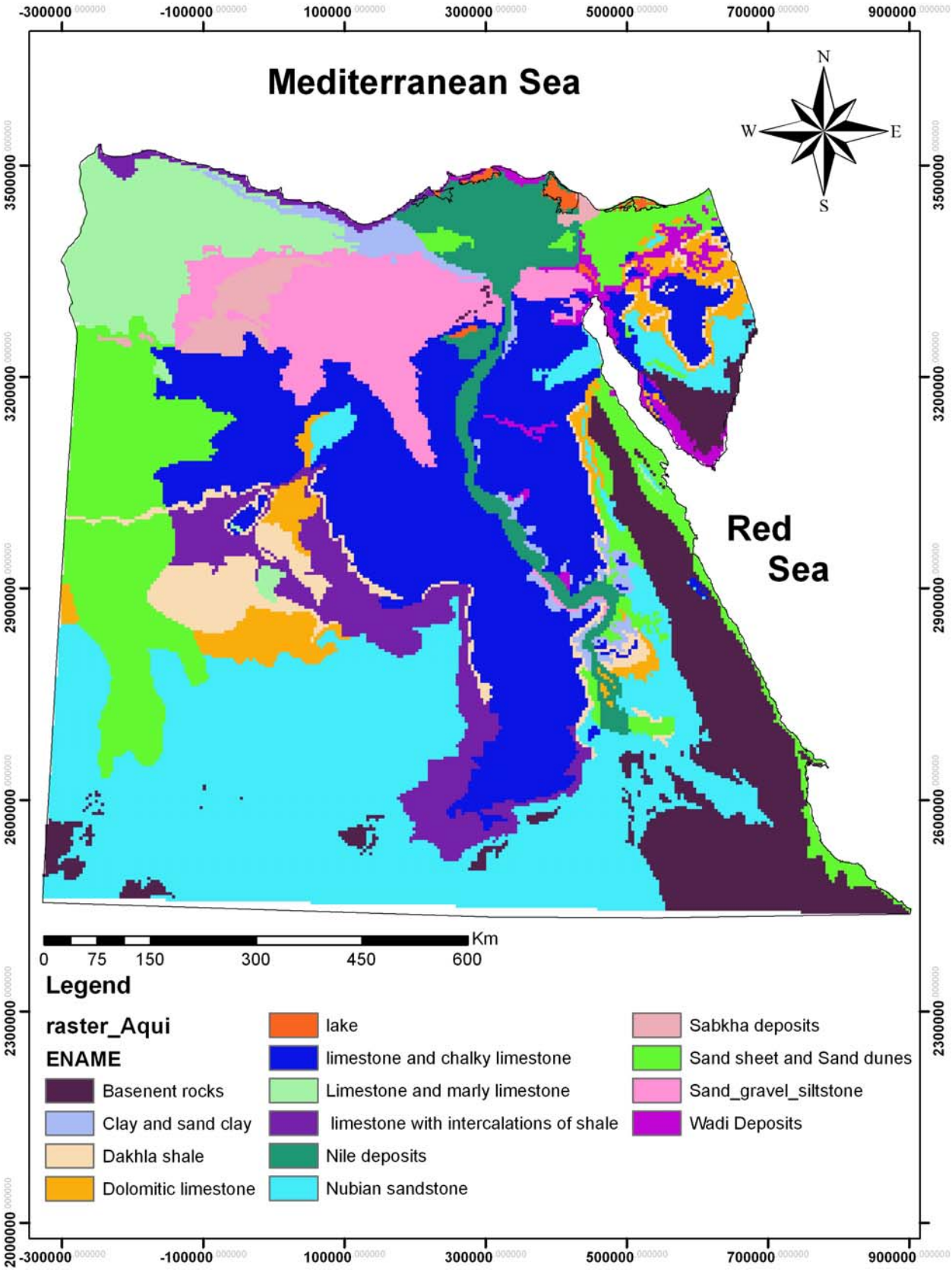
Slope Angle Map of the Egyptian Terrain



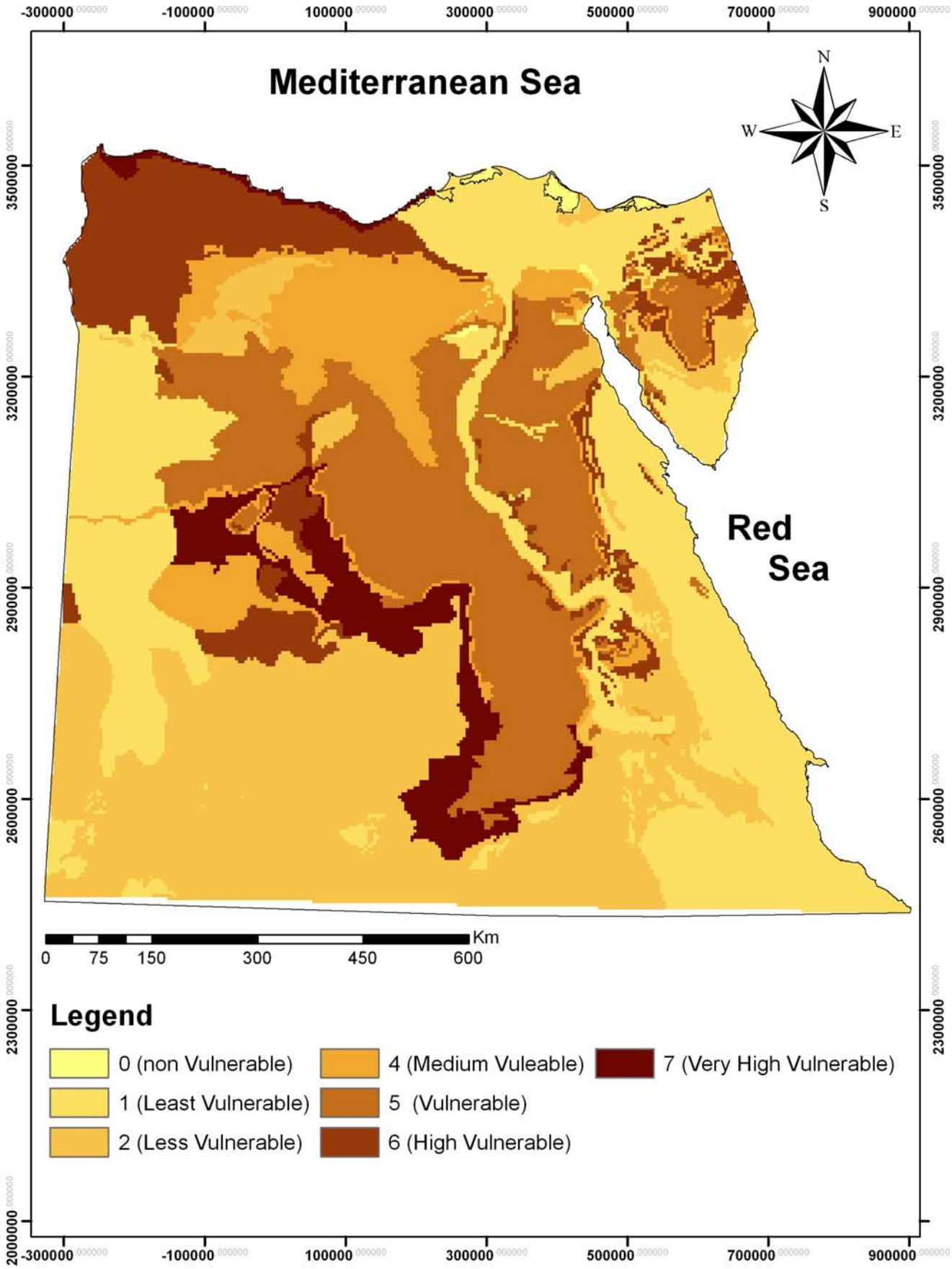
Slope Angle Reclass Map of the Egyptian Terrain



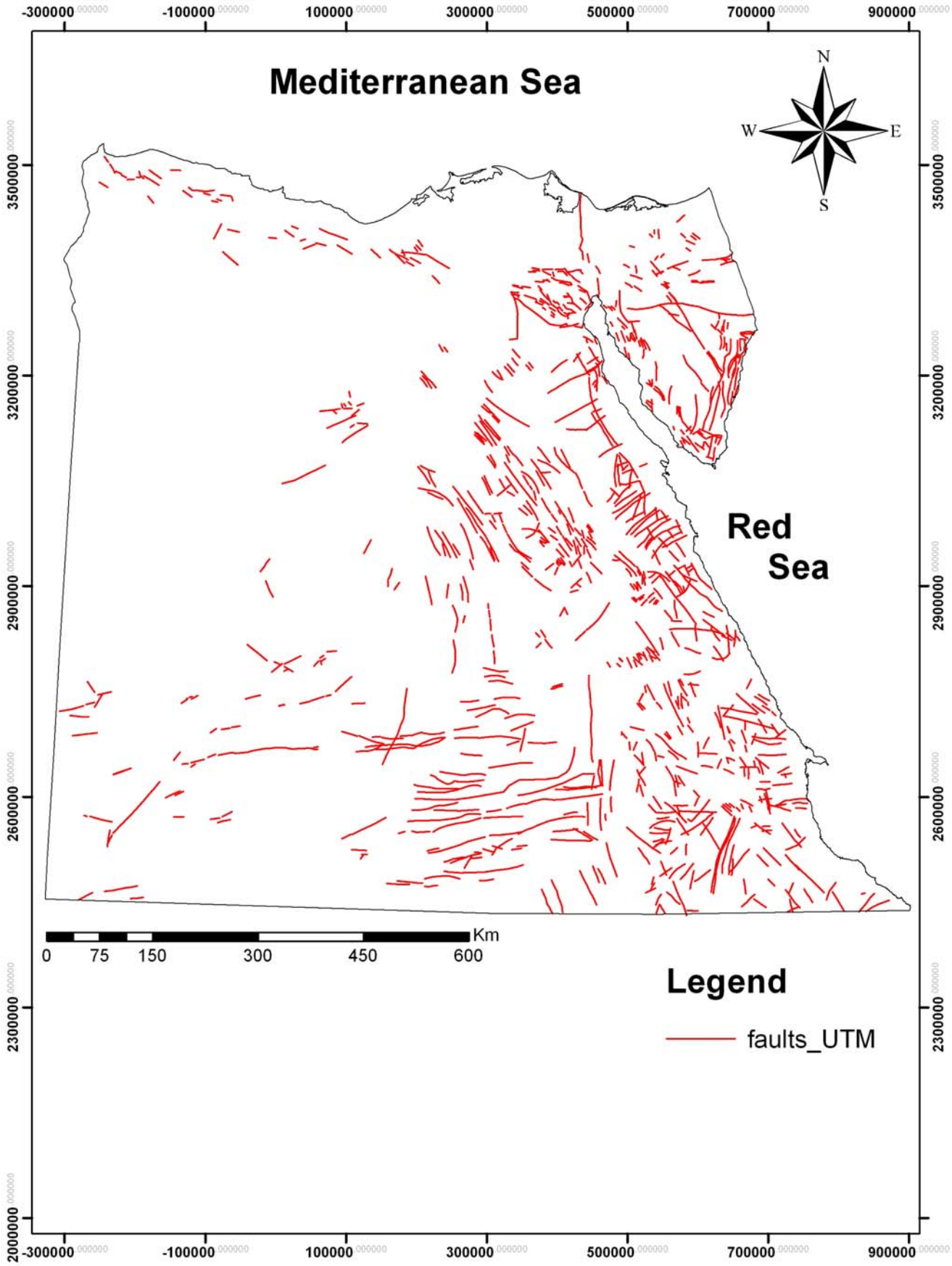
Lithology Map of the Egyptian Terrain



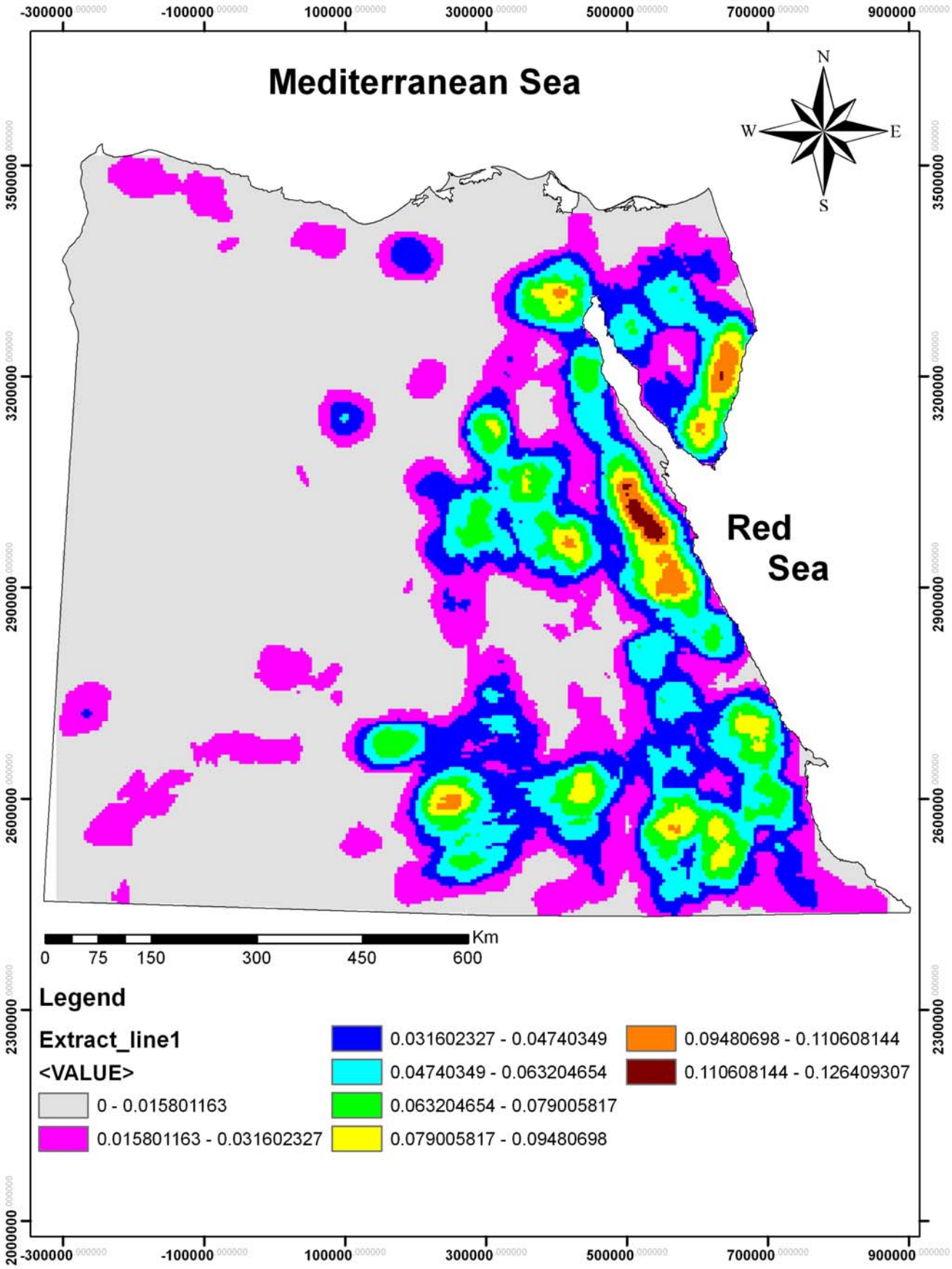
Lithology Reclass Map of the Egyptian Terrain



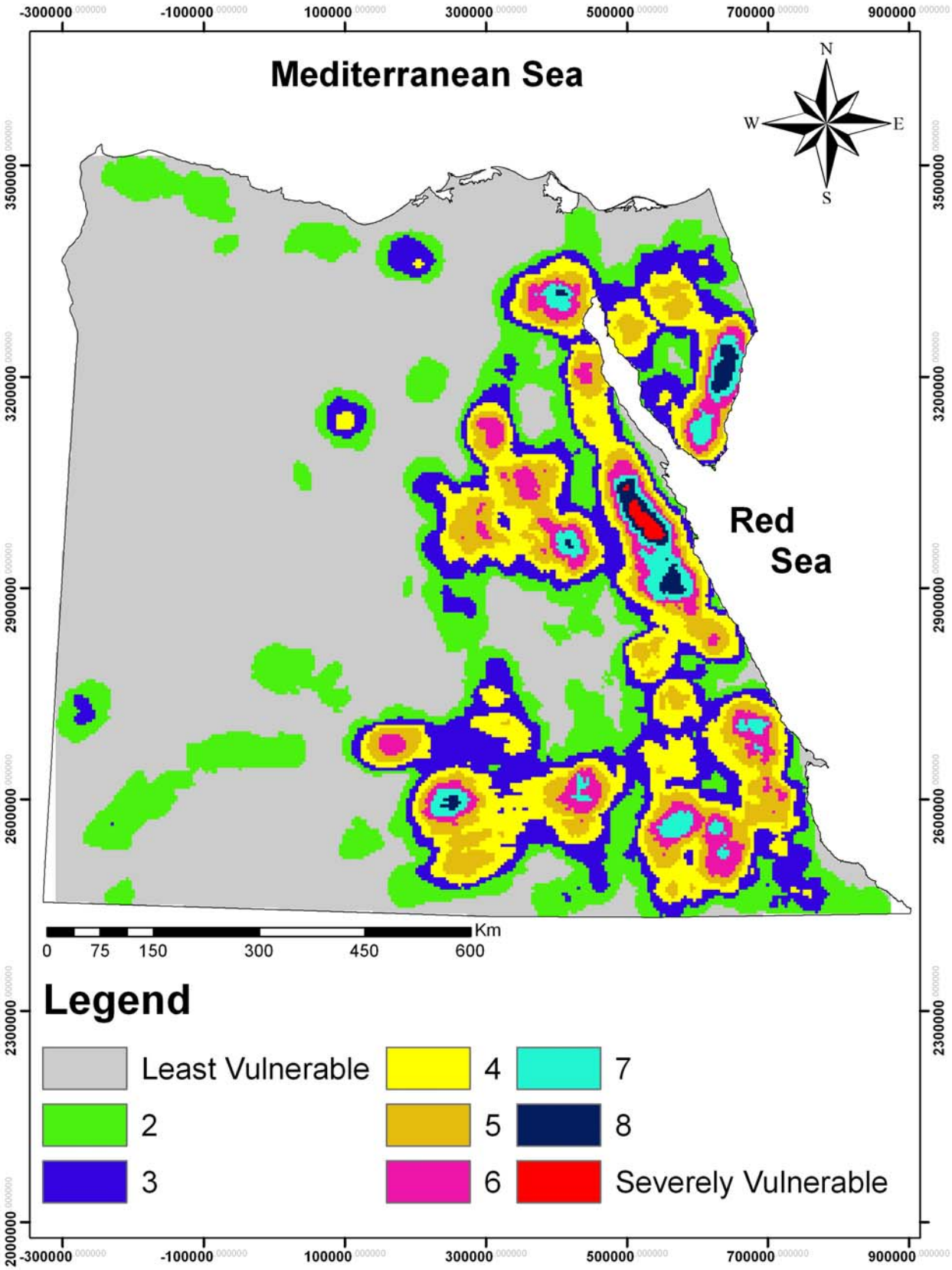
Faults Map of the Egyptian Terrain



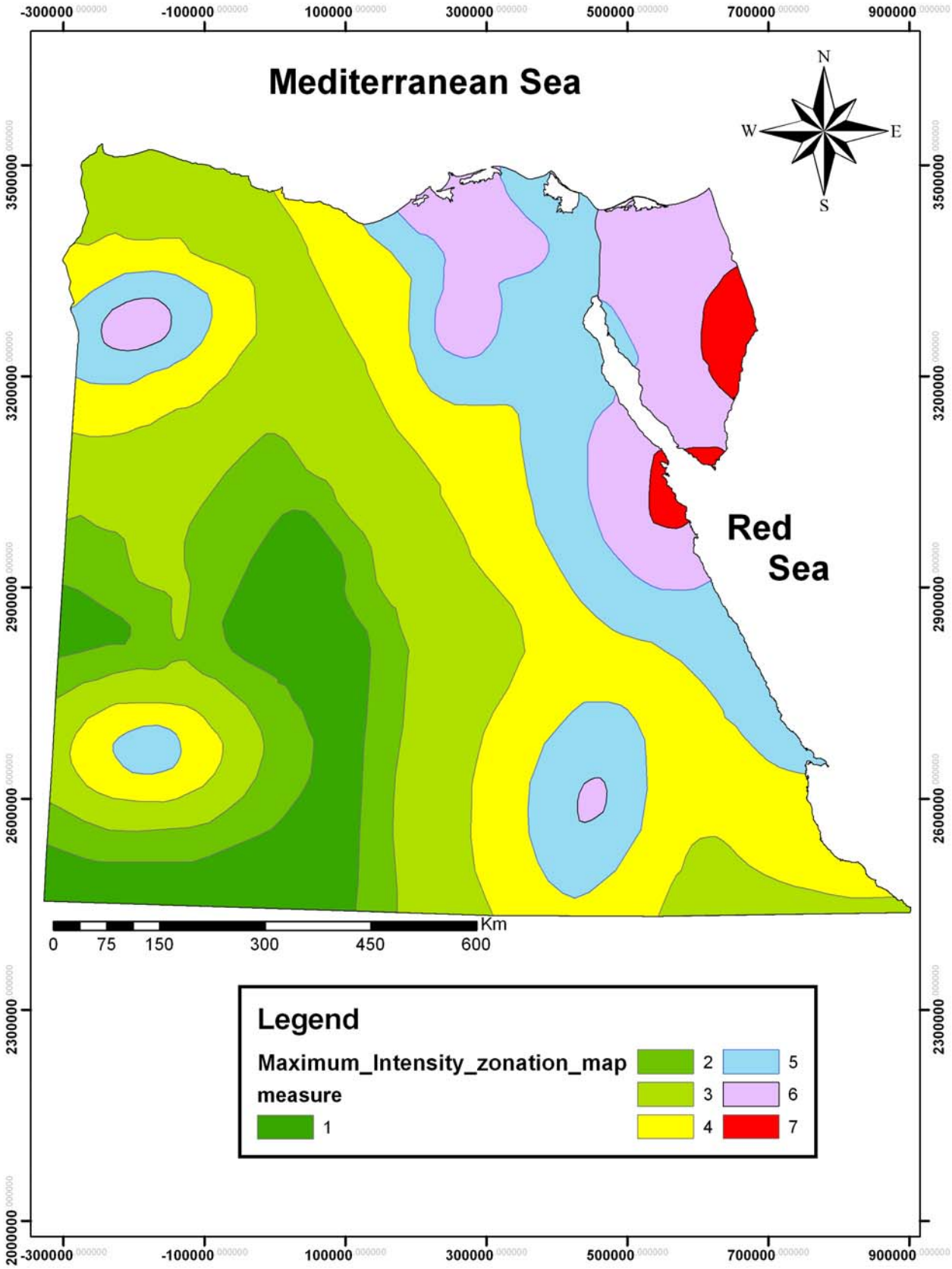
Fault Density Map of the Egyptian Terrain



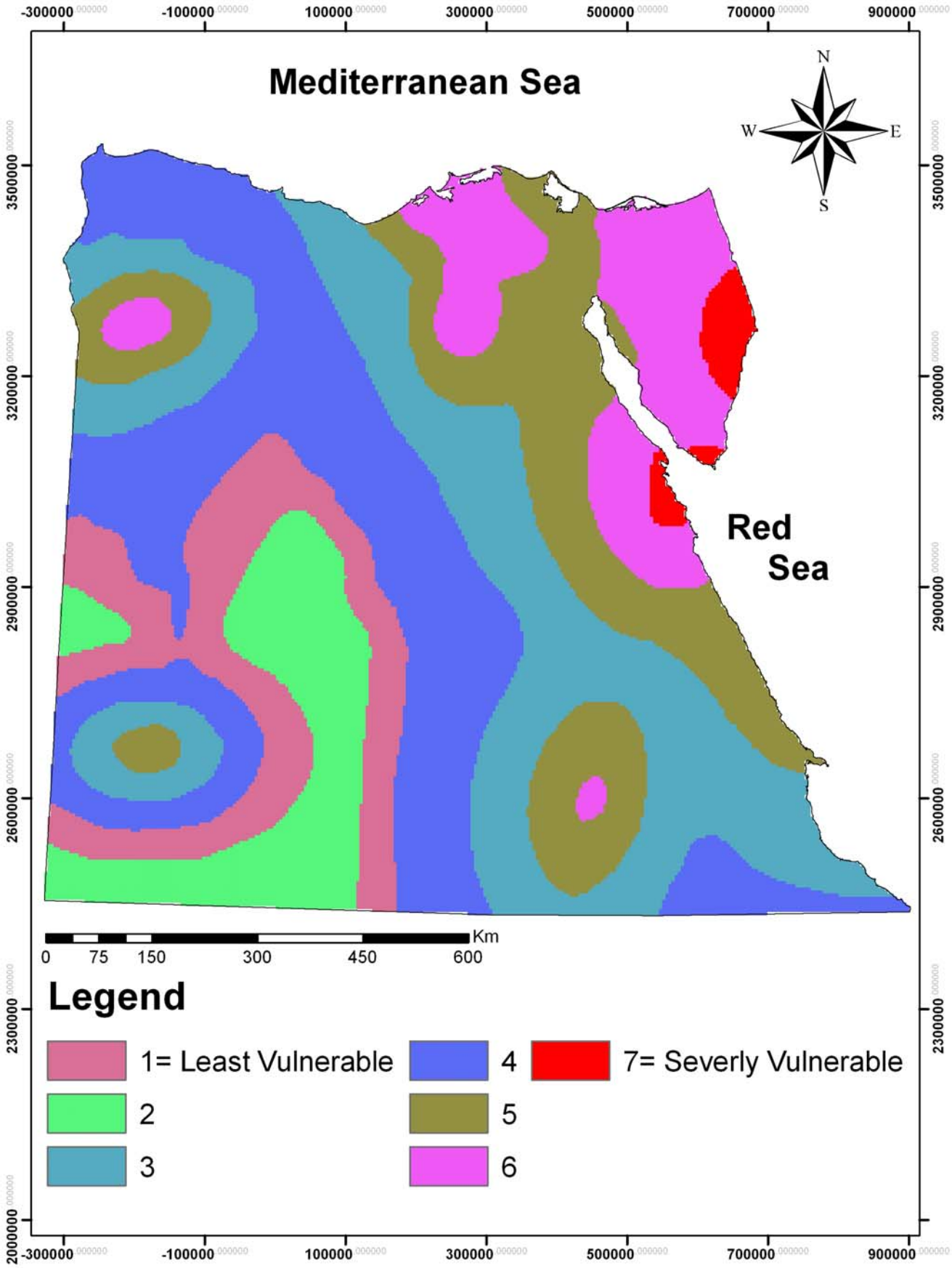
Fault Density Reclass Map of the Egyptian Terrain



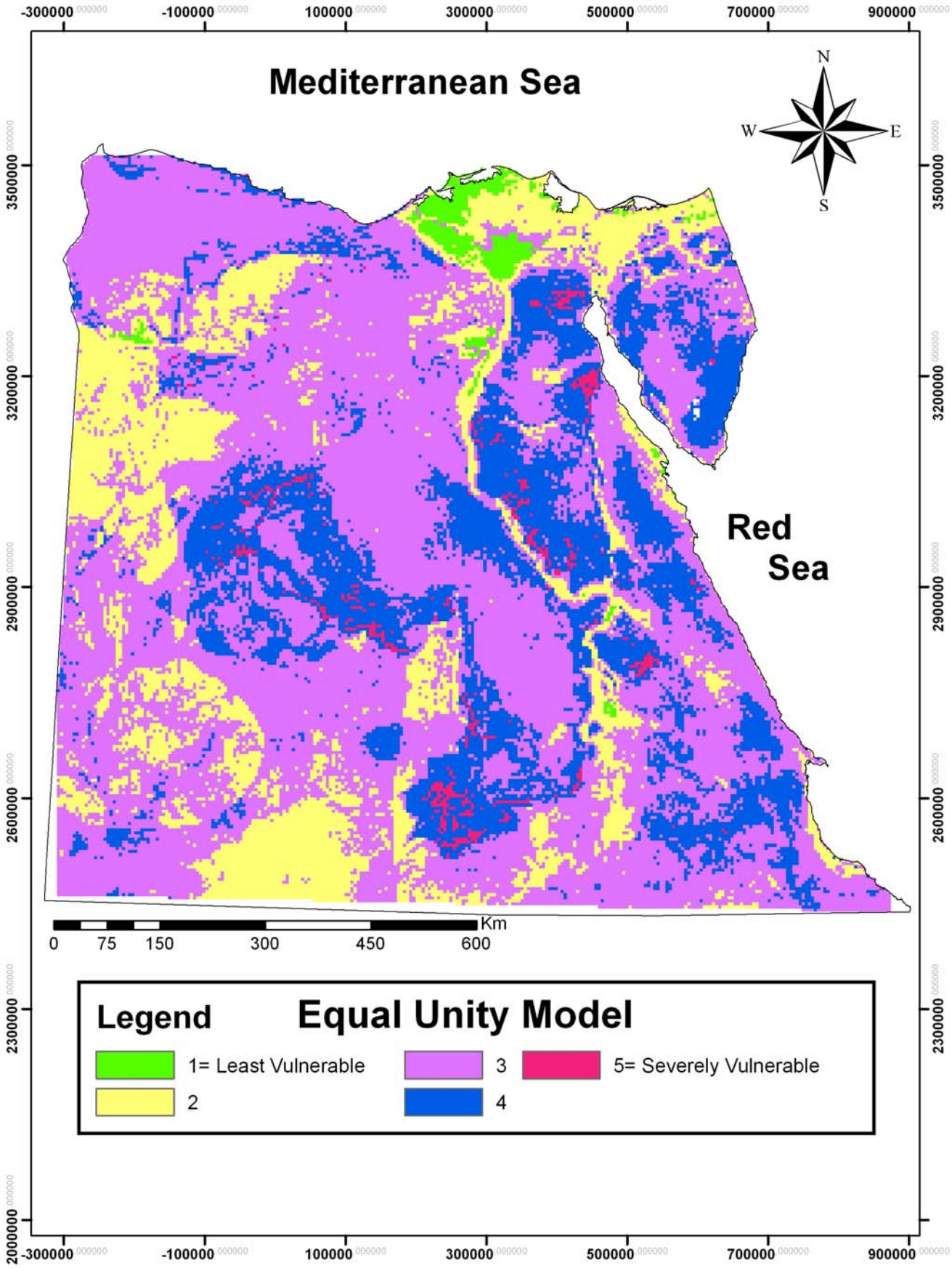
Seismic maximum Intensity zonation Map of the Egyptian Terrain



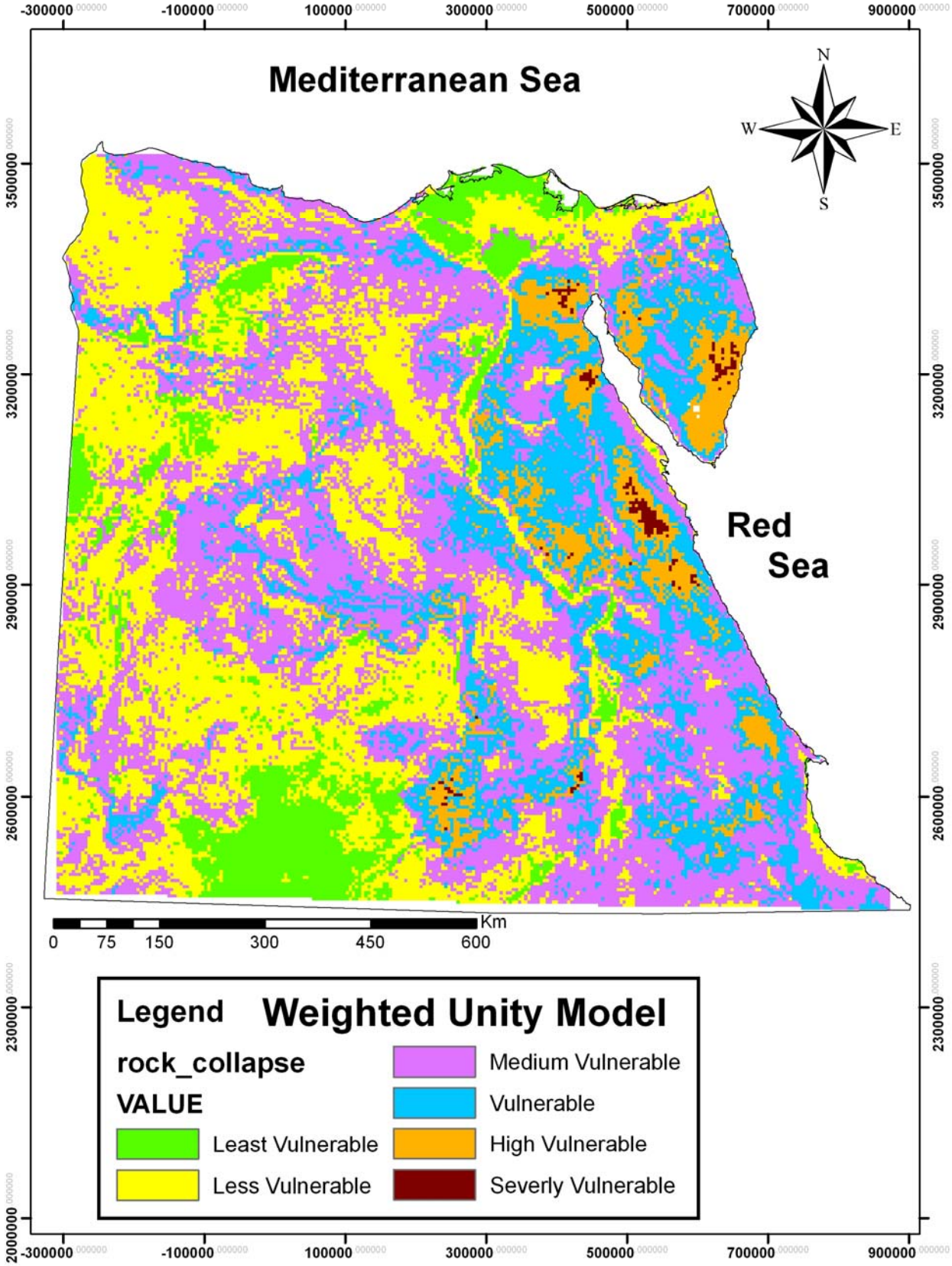
Seismic Intensity Reclass Map of the Egyptian Terrain



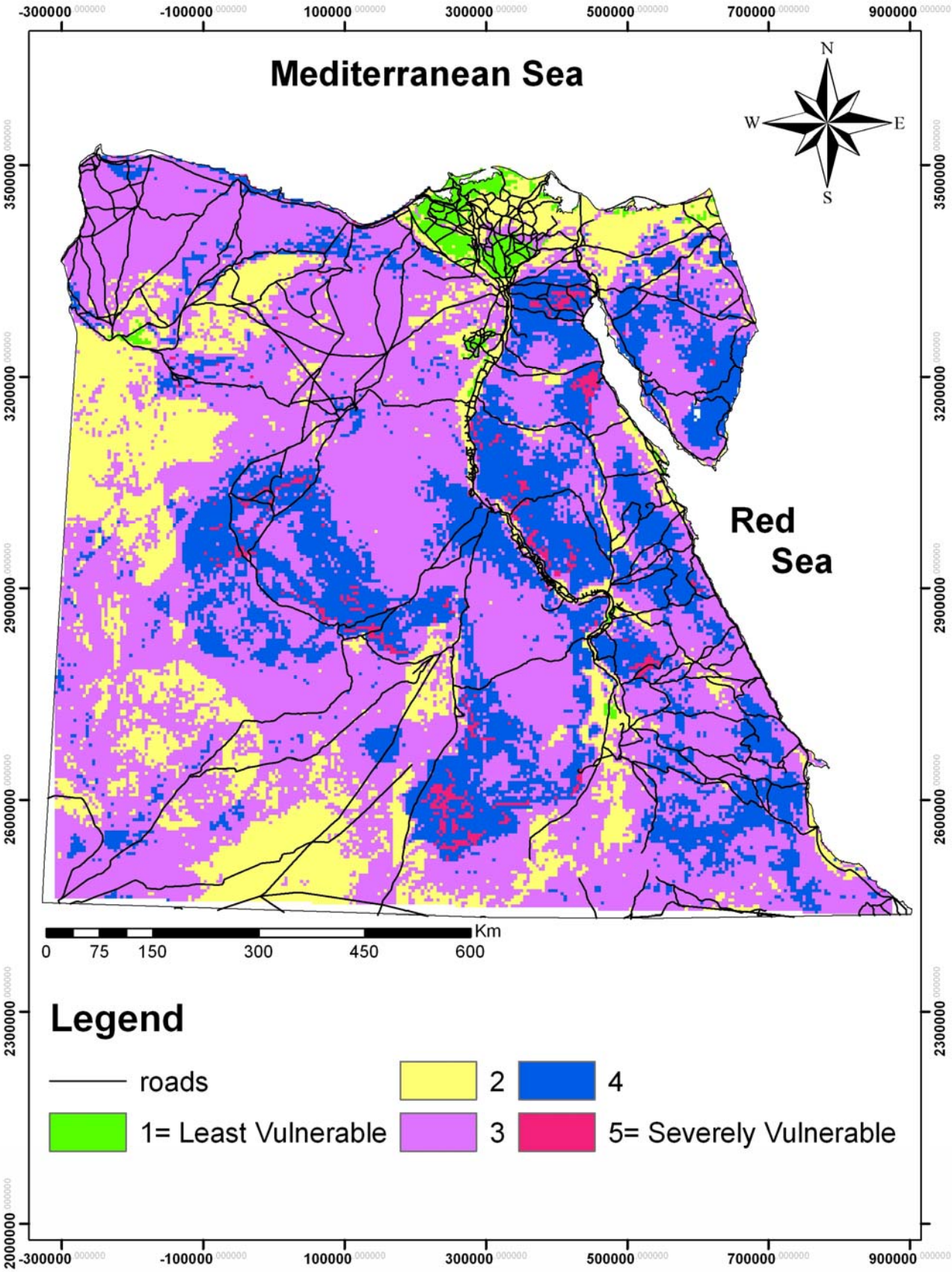
Land Collapse Vulnerability Map of the Egyptian Terrain



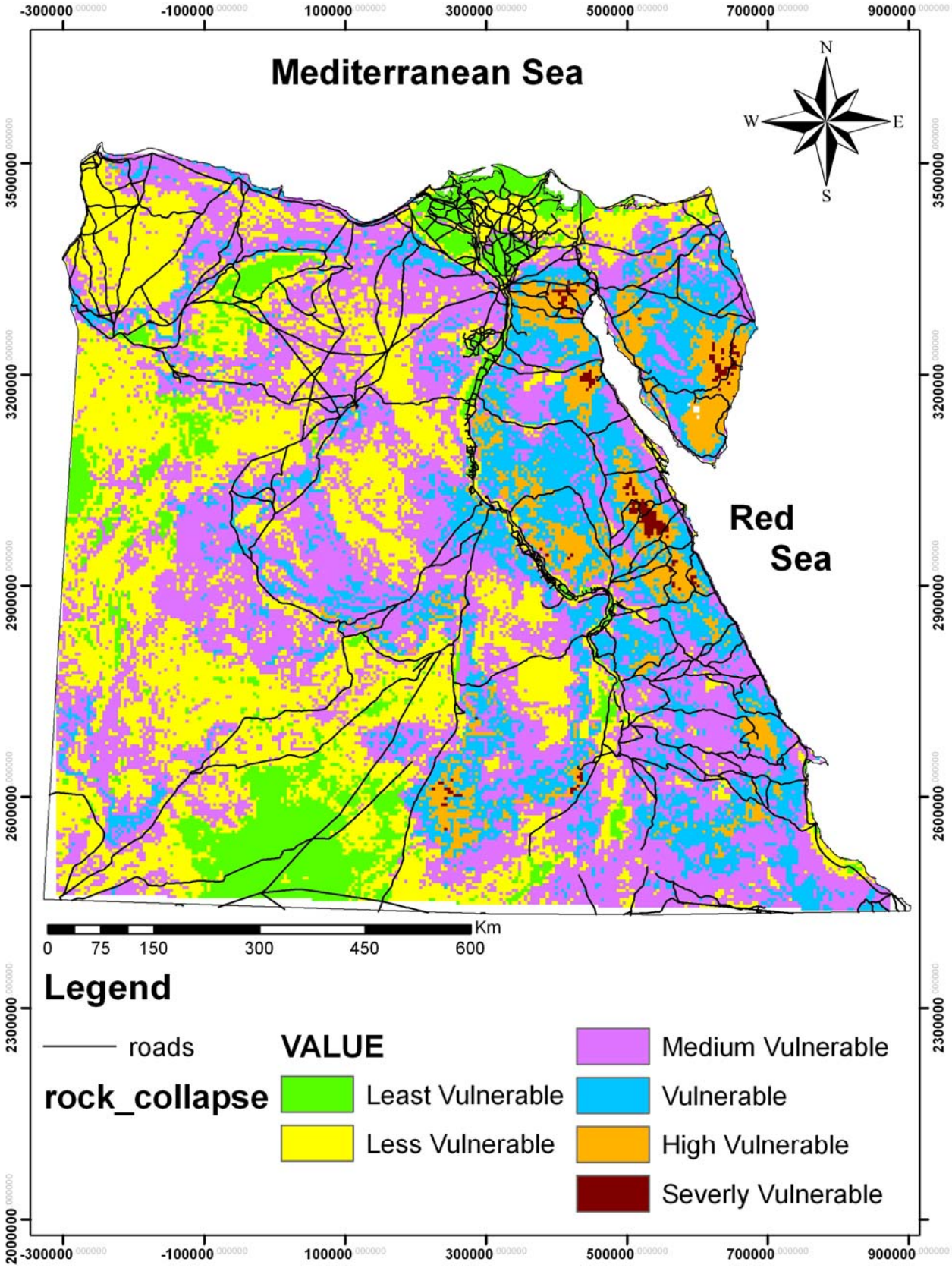
Land Collapse Vulnerability Map of the Egyptian Terrain



Road Network Vulnerability to Land Collapse in Egypt



Road Network Vulnerability to Land Collapse in Egypt



Result and Conclusion

The output of the Model pointed out areas of high vulnerability to land collapse geohazard. These include landslides and rock falls.

The resultant map is essential prior to locating development corridors, roads, highways and new settlements.

The resultant map also provides indicators for the vulnerability of the existing infra structures in need for environmental management

Recommendations

- It is recommended to conduct hazard assessment at national scale in order to point out hot spots (zones most vulnerable to land collapse risk).

- These studies have to be followed by regional and local quantitative studies using high resolution satellite data and field verifications. The results of such studies can provide guidelines for needed mitigation measures and costs.

- Technology transfer and trans-boundaries collaboration are needed to minimize the impacts of land collapse hazard in less developed countries facing lack of data and experience.

Thank you

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