



# Practitioner's Guide:

## Identification of Desertification Prone Areas



### An example from Lebanon



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## Identification of Desertification Prone Areas

### Example:



### Defining Desertification Prone Areas in Lebanon

The Lebanese government has recognized that the overall process of economic development is closely bound up with environmental conditions, and is therefore focussing strongly on activities that will protect the environment and improve the management of natural resources. During and immediately after the war in the Lebanon, planning rules or any form of sustain-able development planning were totally lacking, and this has ultimately led to uncontrolled development as far as land use is concerned, accompanied by the over-exploitation of natural resources.

The central problem is chiefly that land use has been misdirected, and is now inappropriate to the climatic, physical geographic, socio-economic and ecological conditions. The key causes of this central problem are the lack of any planning for appropriate land use and organizing the necessary supervision, and inadequate institutional structures responsible for issuing rules and supervising adherence to them.

The key impacts of the central problem include extensive building in rural areas, accelerating deforestation and inappropriate use of pastures, ultimately leading to an increase in land degradation.

In order to be able to determine the degraded land in the country, the method to define desertification prone areas was applied.

**The indices and their pertinent data layers, which have been selected for Lebanon, are as follows:**

**Table 1: Information layers used in evaluating DPA and related sources**

Index	Layers	Source
Climate	Precipitations, Evapotranspiration	Published data at various scales from different climatic maps and data.
Soil	Soil textural class, Soil structural stability, Soil organic matter, Soil Depth, Slope gradient	Published data at 1/200000 scale for soils and geology and 50m contour lines.
Vegetation	Fire risk, Erosion protection, Drought resistance	Land cover / land use map 1/ 20000 scale 2002
Land use intensity	Land use, grazing intensity	Land use map 1/100000 scale (1997), landcover / land use map 1/ 20000, 2002 and socio economic data
Demographic pressure	Population density, Household satisfaction index	Published socioeconomic data

### Climate:

It is assessed on the basis of how it influences water availability to the plants. Consideration has been given to the amount of rainfall, potential evapotranspiration and thus aridity. In particular the selected information layers are the annual precipitation and potential evapotranspiration.

The climate index is the ratio of the yearly precipitation over yearly potential evapotranspiration calculated using the Penman method (P/ET<sub>o</sub>).

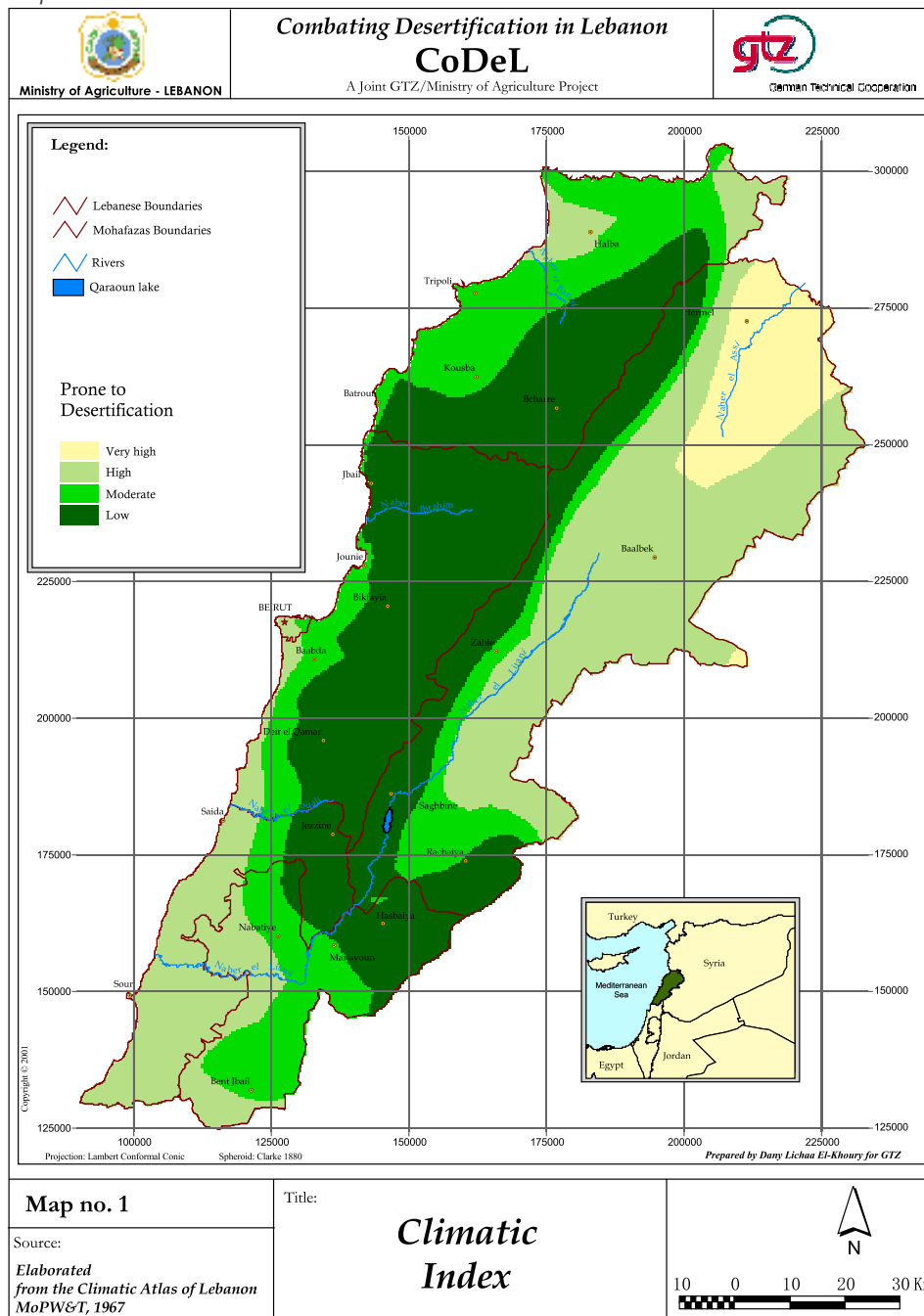


# Identification of Desertification Prone Areas

Table 2: Defining the climatic index

Climate Index (P/ET <sub>o</sub> )	Model classification (qualitative)
$\geq 1$	1 (least prone to desertification)
$\leq 0.1$	2 (most prone to desertification)
$0.1 < x < 1$	$1 < x < 2$

Map 1: Climatic Index





## Identification of Desertification Prone Areas

### Soil:

Soil water retention capacity and erodibility are important properties, which influence soil degradation phenomena. Therefore the model incorporates these properties as part of the soil index, which is based on the following characteristics

- ▶ Slope gradient
- ▶ Soil texture in relation to both erosion and salinization
- ▶ Soil structure in relation to erosion
- ▶ Soil depth in relation to erosion and biomass production
- ▶ Organic matter in relation to erosion and biomass production.

The soil index was calculated using information layers describing the above characteristics. Table 3 shows the different information layers used and their relative scores in the model.

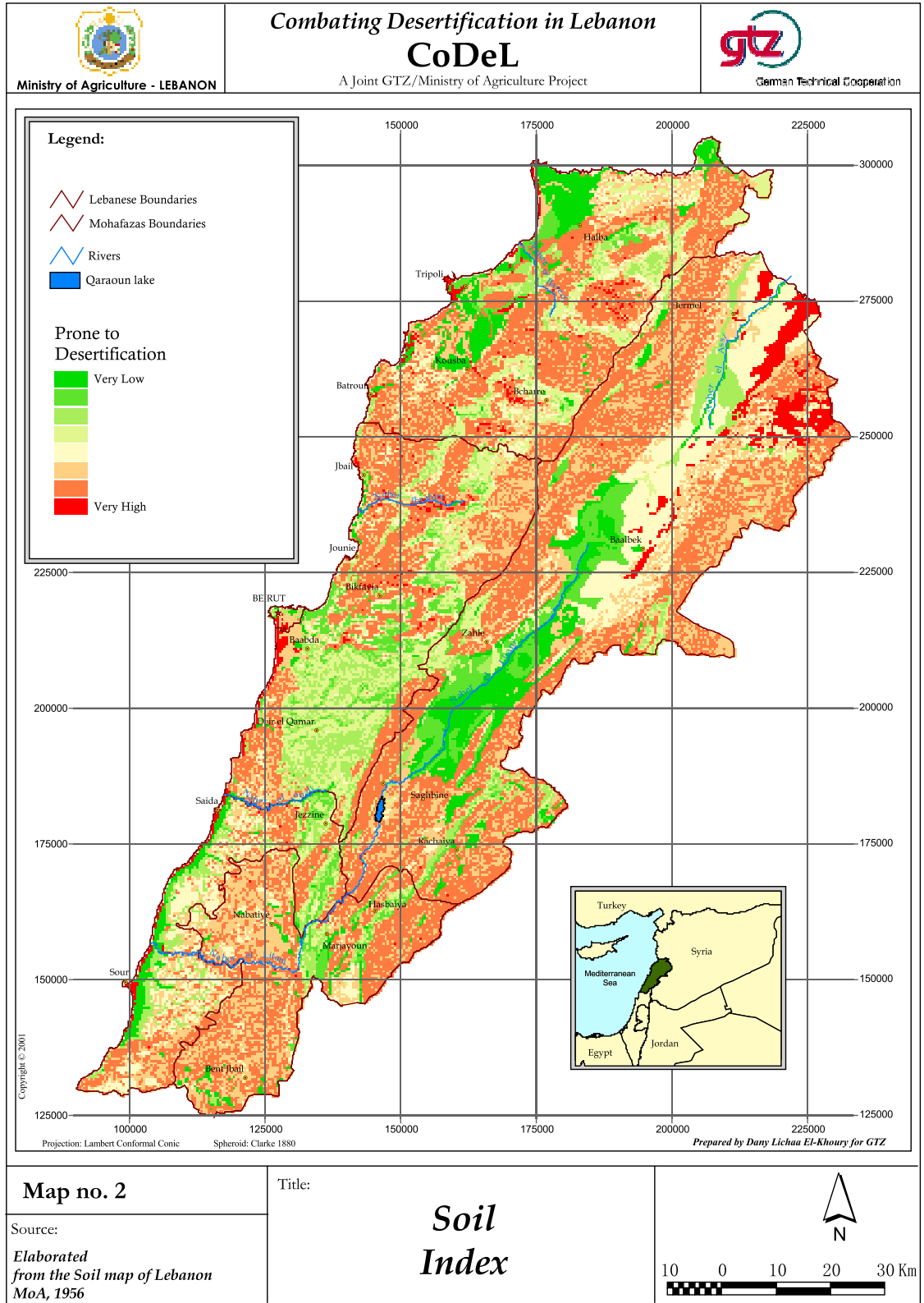
Table 3: Soil layers and relative scores

Layer	Classes	Scores
Soil texture	Coarse	2.00
	Medium	1.25
	Medium-fine	1.5
	Fine	1.00
	Very Fine	1.75
Soil structure	Stable	1.00
	Intermediate stability	1.25
	Low Stability	1.50
	Very low stability	1.75
	Unstable	2.00
Soil depth, cm	>150	1.00
	100 - 150	1.25
	50 - 100	1.50
	10 - 50	1.75
	< 10	2.00
Soil organic matter content, %	> 3.0	1.00
	2.0 - 3.0	1.25
	1.0 - 2.0	1.50
	0.5 - 1.0	1.75
	< 0.5	2.00
Slope gradient, %	< 6	1
	6 - 18	1.33
	18 - 35	1.66
	> 35	2



Identification of Desertification Prone Areas

Map 2: Soil Index





## Identification of Desertification Prone Areas

### Vegetation:

The vegetation index is calculated based on the various functions and roles played by the vegetative cover with regard to the degradation processes:

- ▶ Fire risk and regenerative ability
- ▶ Soil erosion protection
- ▶ Drought resistance

These functions were translated into information layers (based on the Lebanese land cover / land use map, 2002), which were used in the calculation of the vegetation index. Table 4 represents the legend of the Lebanese land cover, and table 5 lists the three information layers and their relative scores.

Table 4: Classes of Lebanese land cover / land use map 2002

Nr.	Classes	Description
1	Urban areas	Built up, industrial, airports, quarries, etc.
2	Horticulture	
3	Field crops & fallow land	Irrigated and non-irrigated
4	Trees and perennial crops	Olive, vineyards, deciduous fruit trees, citrus and bananas
5	Grassland (unimproved land)	Grassland and forbs from open to closed, or abandoned fields or old fallows in agricultural areas, sparse grassland and forbs in mountains or deserts areas
6	Forests and other wooded areas	Deciduous forest, coniferous forest, scrubland and other types of degraded forest
7	Unproductive land	Barren rocks, highly dissected and eroded land, beaches
8	Swamp	
9	Water bodies	

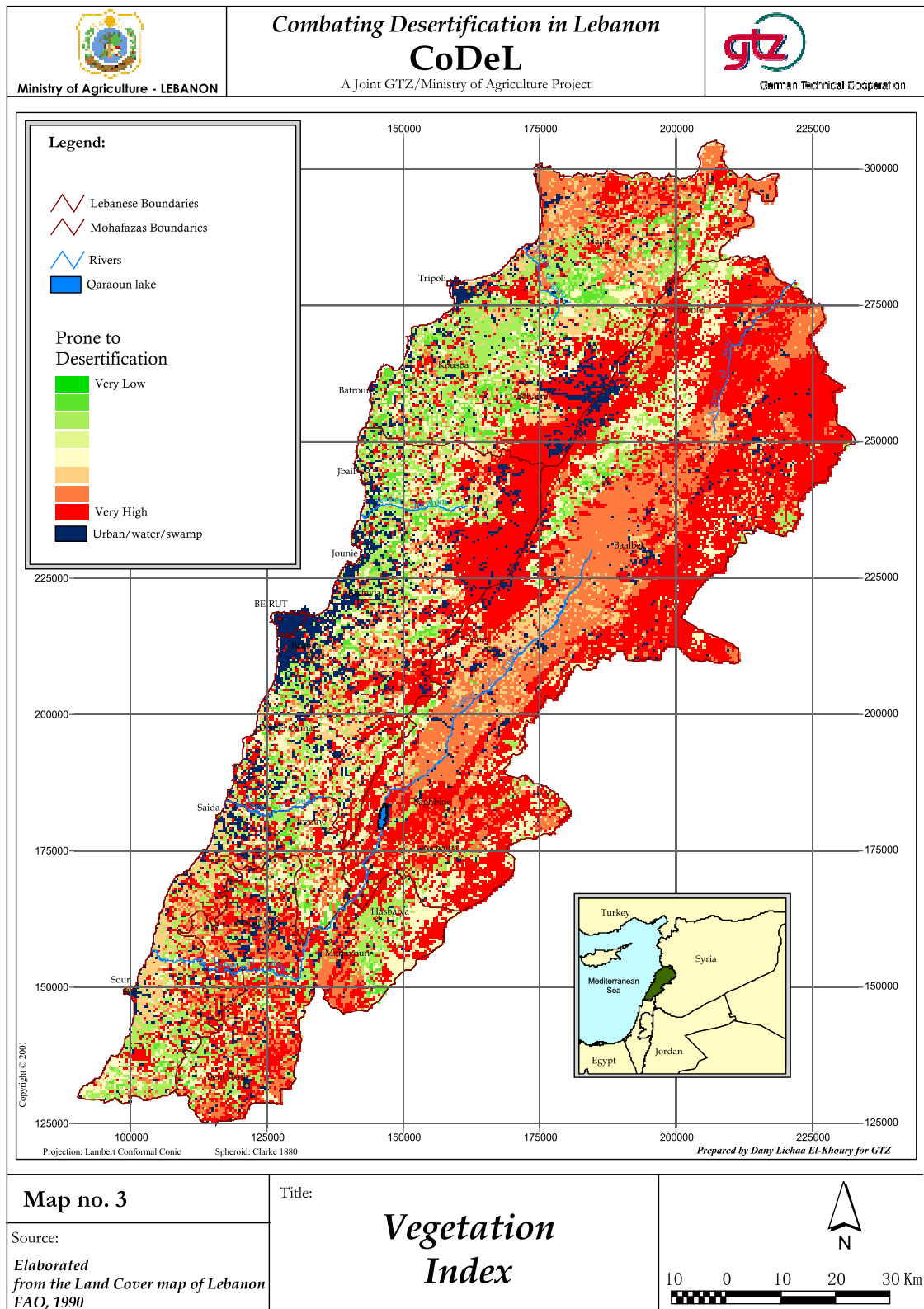
Table 5: Vegetation index layers and relative scores

Layer	Classes	Scores
Erosion protection	Deciduous forest, horticulture	1.00
	Coniferous forest	1.20
	Citrus and banana	1.40
	Scrubland	1.50
	Olives	1.60
	Vineyards, deciduous fruit trees	1.80
	Field crops and fallow land, grassland, unproductive land	2.00
Drought resistance	Deciduous forest, coniferous forest, scrubland, olives	1.25
	Vineyards, deciduous fruit trees	1.50
	Grassland	1.75
	Horticulture, field crops and fallow land, citrus and bananas, unproductive land	2.00
Fire risk	Horticulture, field crops and fallow land, olives, vineyards, deciduous fruit trees, citrus and bananas, unproductive land	1.00
	Deciduous forest, scrubland, grassland	1.33
	Coniferous forest	2.00



# Identification of Desertification Prone Areas

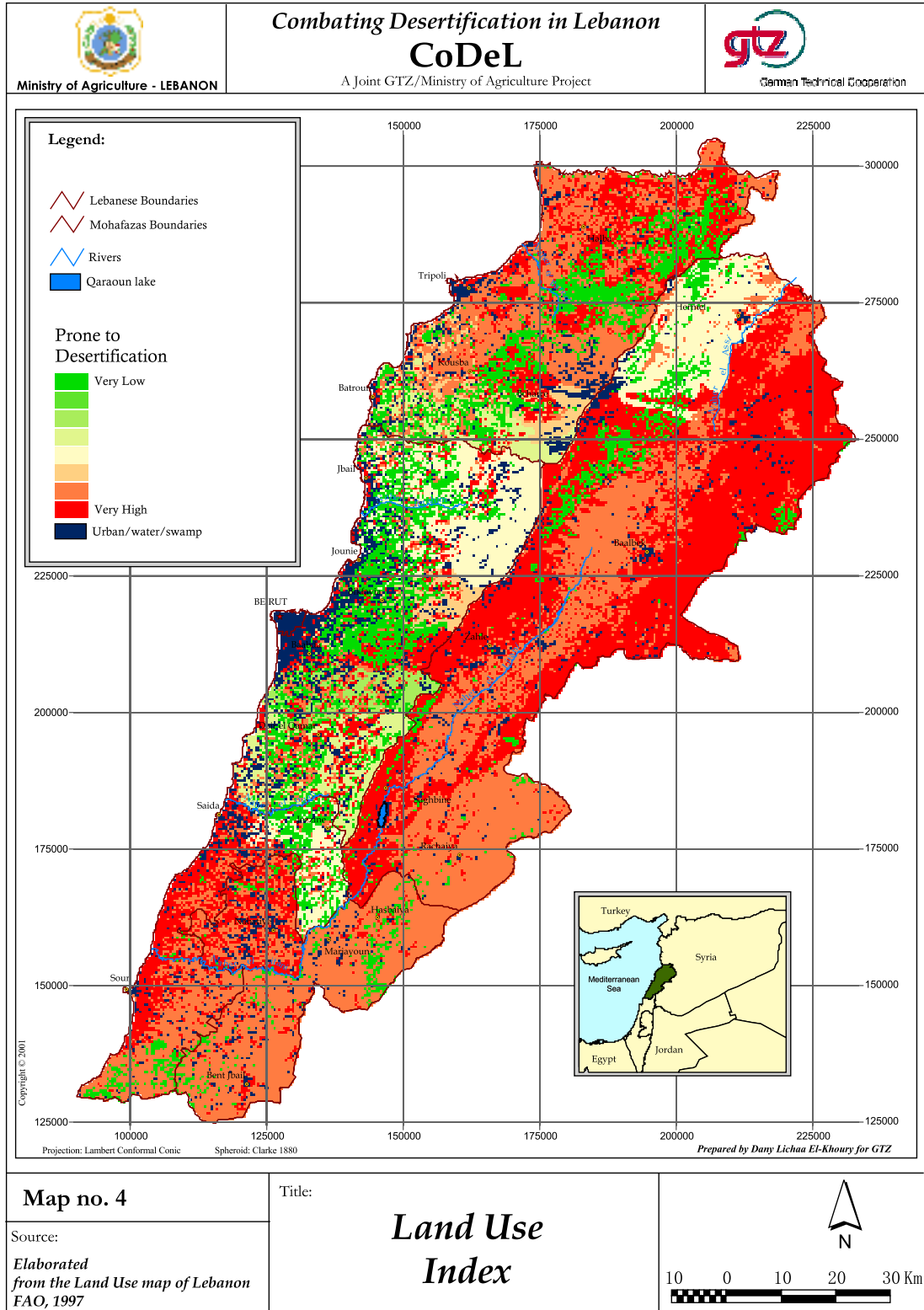
Map 3: Vegetation Index





# Identification of Desertification Prone Areas

Map 4: Land use Index







## Identification of Desertification Prone Areas

### Land use intensity:

The criteria considered to describe land use intensity were chosen based on data availability. The "Derived Land Use Map of Lebanon" (1997) was used. It is based on the following legend:

- (a) Horticulture
- (b) Irrigated temporary cropping,
- (c) Non irrigated temporary cropping
- (d) Permanent cropping, which is subdivided into olive, grape, fruit trees and citrus and banana cultivation
- (e) Pastures
- (f) Forests for re- and afforestation
- (g) Recreational forests
- (h) Forest for pine kernel production
- (i) Non used forests
- (j) Non usage
- (k) Residential, industrial, mining, ...

The grazing intensity on pastures was calculated separately and added to the land use index. Table 6 shows the different land uses and their respective relative scores:

Table 6: Land use and relative scores

Land use classes	Scores
Non used forests	1.00
Forest for pine kernel production, forests for re-afforestation	1.13
Recreational forest	1.25
Non irrigated temporary cropping, olive cultivation	1.50
Grape cultivation	1.63
Fruit trees	1.75
Horticulture, citrus and banana cultivation	1.88
Irrigated temporary cropping	2.00
Pastures (depending on grazing intensity)	1.25 - 2.00

### Demographic pressure:

The demographic index has been calculated on the basis of :

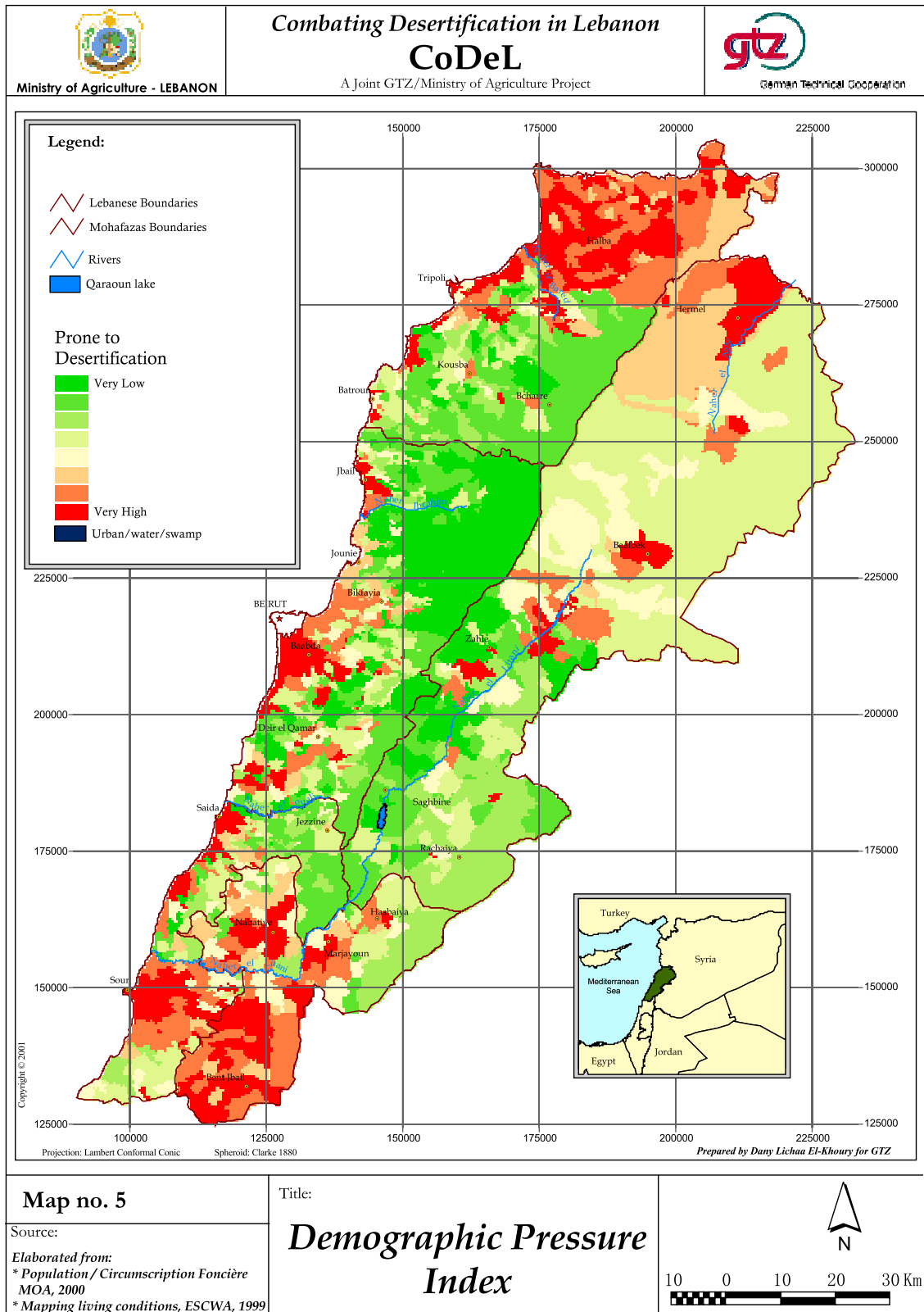
- ▶ Population pressure assessed by the means of population density;
- ▶ Poverty assessed using household satisfaction index published by UNDP.

The assessment of the demographic index was done at the caza (district) level because of data availability. The value "2" has been assigned to areas with the highest density and highest rate of dissatisfaction, and "1" to areas with the lowest. Intermediate areas were assigned values between 1 and 2.



# Identification of Desertification Prone Areas

Map 5: Demographic pressure Index





# Identification of Desertification Prone Areas

The desertification prone areas (DPA) in Lebanon are depicted in map 6. The map is the result of the overlay process in the GIS system of different indices and is estimated by the geometric mean of the individual indices.

Map 6: Desertification Prone Areas

