Delineating Arable Land and Groundwater Potential in the Palestinian-Israeli Landscape:
An Insight into Resource Contestation and Territoriality

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Introduction

- Territorial conflicts often driven by access to natural resources

- Two primary approaches to understanding this:
  Scarcity of essential resources (e.g., groundwater, arable land)
  Global resource value (e.g., oil reserves)

- Struggle over arable land and groundwater resources since 1917

- Post-War immigration of Jewish refugees in Palestine intensified competition over these limited resources

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Historical Context

- British occupation divided land into three quality classifications:
  First quality , Medium quality, Poor quality
- **1948 Armistice lines**: Israel gained control of 95% of fertile soil
- Pre-Israel agriculture predominantly Arab Palestinian
- Establishment of Israeli **Kibbutz settlements** over fertile lands

- **Water scarcity** exacerbated territorial disputes, key water sources:
  Lake Galilee, coastal aquifers, mountain aquifers
- Water-sharing tensions with neighbouring countries

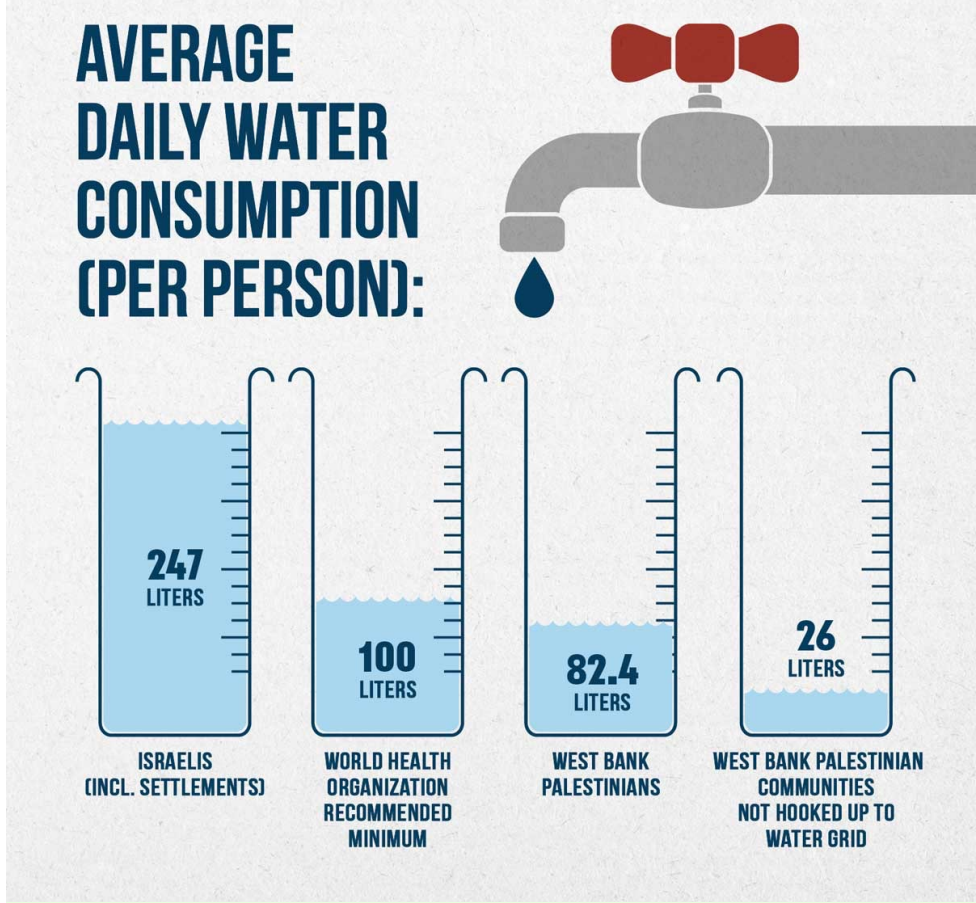

Fig.1 (TOP) Unequal Water Access in the regions
Source: **B'Tselem -** The Israeli Information Center for Human Rights in the Occupied Territories

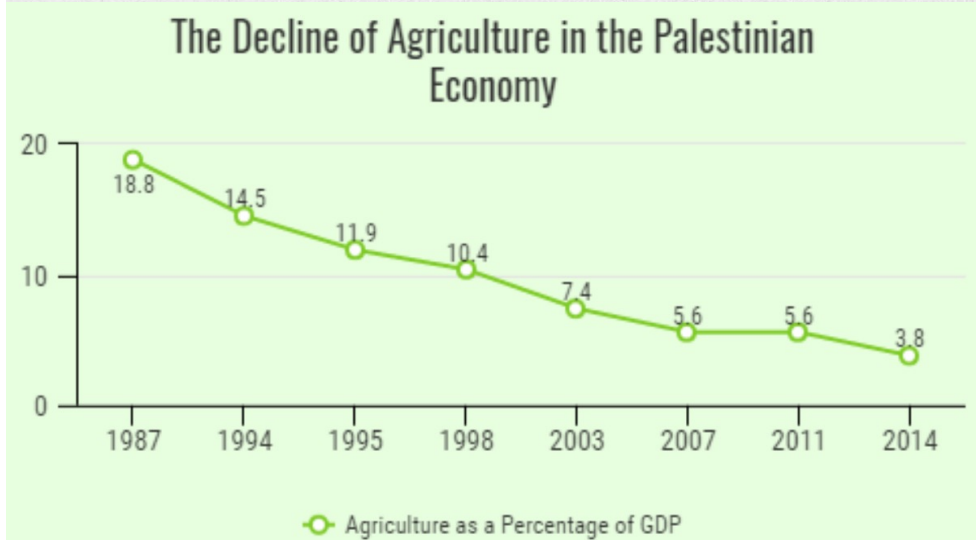

Fig. 2 Decline of Agriculture in Palestinian Economy
Source: UNDP Report, 2017

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Research Gap

- Existing studies (Willatts, 1946; Asadi, 1976; Efrat, 1988) highlight geographic factors in territorial struggles
- Focus mainly on descriptive statistical account of groundwater availability, arable land, and settlement patterns
- **Gap**: Lack of quantitative geographic and spatial approach to assess the spatial distribution of resources over time
- **GIS advancements** provide opportunities for empirical, data-driven analysis

Aim and Research Questions

The paper aims to delineate arable land and groundwater potential in the Palestinian-Israeli landscape using Analytical Hierarchy Process and Weighted Overlay Analysis and
Identify how the territorial accessibility to these resources has changed over time?

RQ 1: What role do geographic factors, such as precipitation, soil type, and aquifer distribution, play in shaping arable land and groundwater potential across the Palestinian-Israel landscape?

RQ 2: How has access to arable land and groundwater in the Palestinian-Israeli landscape changed over time, and how have these changes influenced territorial disputes?

Study Area and Data

- **Palestine:**

West Bank (5,640 sq. km) and Gaza (365 sq. km)

West Bank divided into:

Area A: Palestinian Authority control (18%)
Area B: Joint control (21%)
Area C: Israeli control (60%)

- **Israel:**

22,145 sq. km (includes 6,015 sq. km of occupied territories)

Table 1: Data Source for Thematic Maps and AHP

Attributes	Data and source	Resolution
Precipitation and Temperature	'prec 2.5m' and 'tavg 2.5m', Worldclim (2017)	2.5 min
Landuse	ESRI Landcover (2021)	10 m
Lithology	GLiM V 1.1 (2012)	0.5 deg
Soil	Harmonised World Soil Database (2008)	30 arc sec
Lineament Density	Landsat 8, Band 8 C2 L1,USGS (2021)	15 m
Slope, Drainage density	Digital Elevation Model, USGS (2015)	3 Arc-Sec/90m

Methodology

Analytical Hierarchy Process (AHP): Multi-criteria decision analysis to assign weights to factors like precipitation, soil, slope

Weighted Overlay Analysis (GIS): Combines spatial data to assess groundwater and arable land potential

Groundwater Potential:

Precipitation, lithology, drainage density, land use, slope, soil type, lineament density

Arable Land Potential:

Precipitation, soil type, slope, temperature

Table 2 : Pairwise Comparison Matrix for groundwater potential

Parameters	Prec.	Lithology	Drainage D.	Soil	LULC	Slope	Linea. D.	NPEV (%)
Precipitation	1	3	3	5	5	5	7	38.14
Lithology	1/3	1	3	3	5	5	5	24.54
Drainage D.	1/3	1/3	1	1	3	5	5	13.11
Soil	1/5	1/3	1	1	1	2	3	8.93
Landcover	1/5	1/5	1/3	1/2	1	1	1	6.61
Slope	1/5	1/5	1/3	1/2	1	1	1	5.00
Lineament D.	1/5	1/5	1/3	1/3	1	1	1	3.67

Table 3: Pairwise Comparison Matrix for arable land potential

Parameters	Precipitation	Soil	Slope	Temperature	NPEV (%)
Precipitation	1	3	7	9	58.30
Soil	1/3	1	5	7	29.10
Slope	1/7	1/5	1	3	8.40
Temperature	1/9	1/7	1/3	1	4.20

Results: Thematic Maps

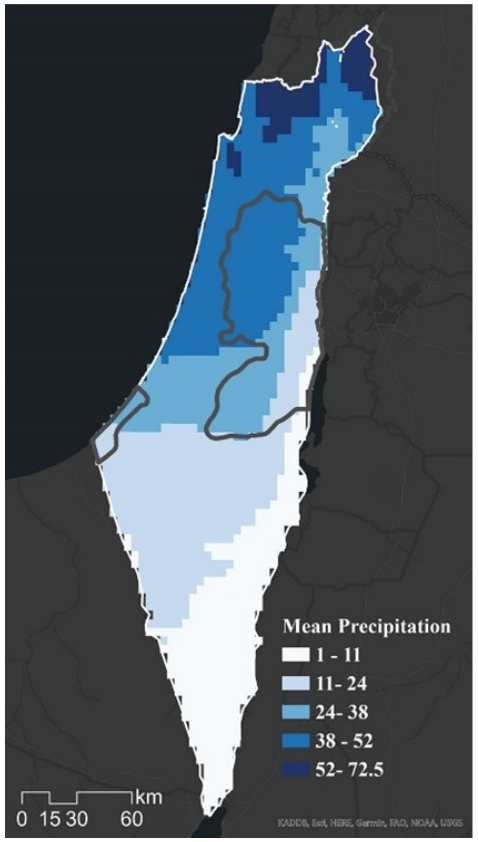

Fig 3: Mean Precipitation

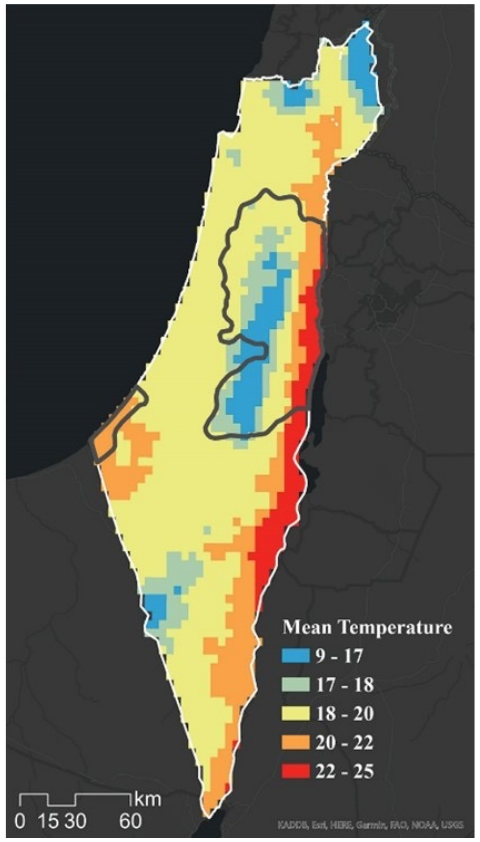

Fig. 4: Mean Temperature

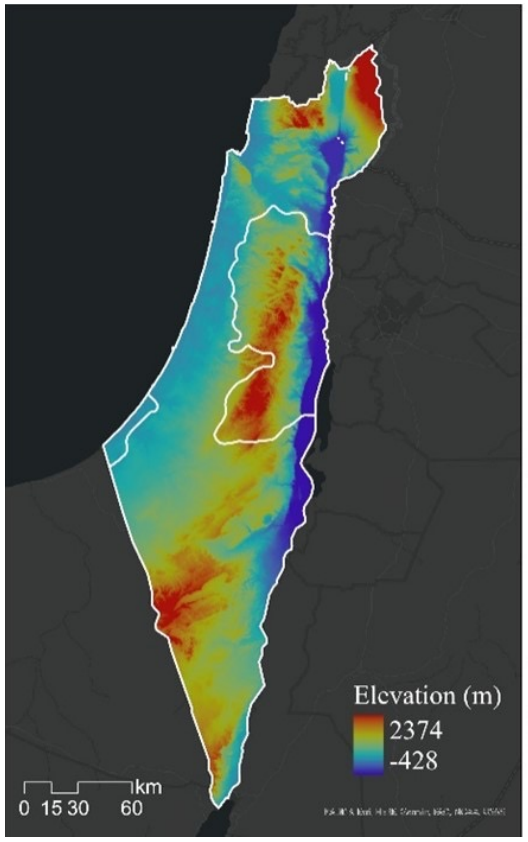

Fig.5: Elevation

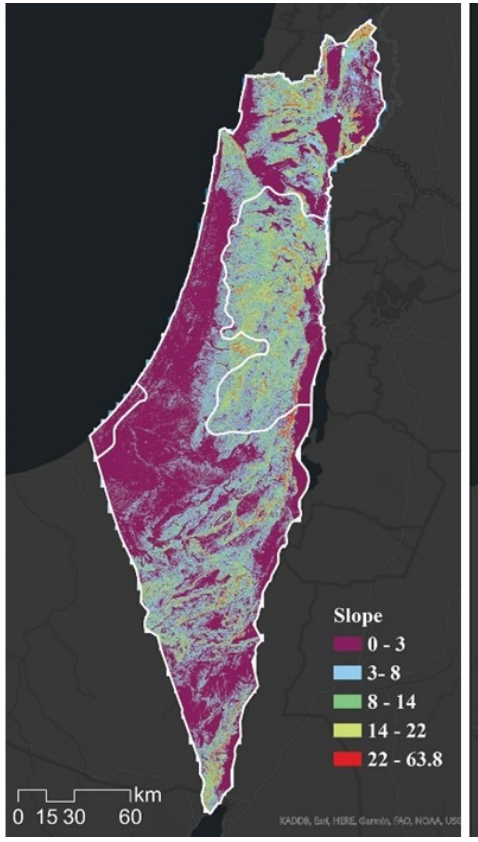

Fig. 5. Slope

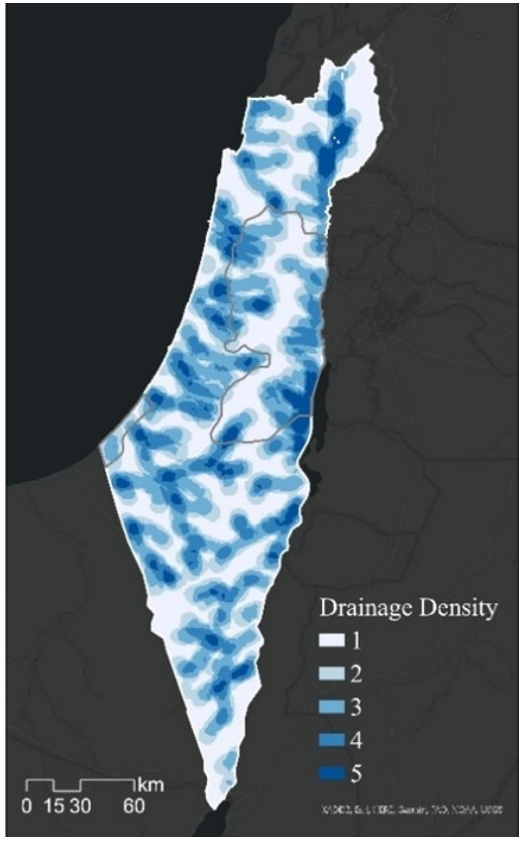

Fig. 7 Drainage Density

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Results: Thematic Maps

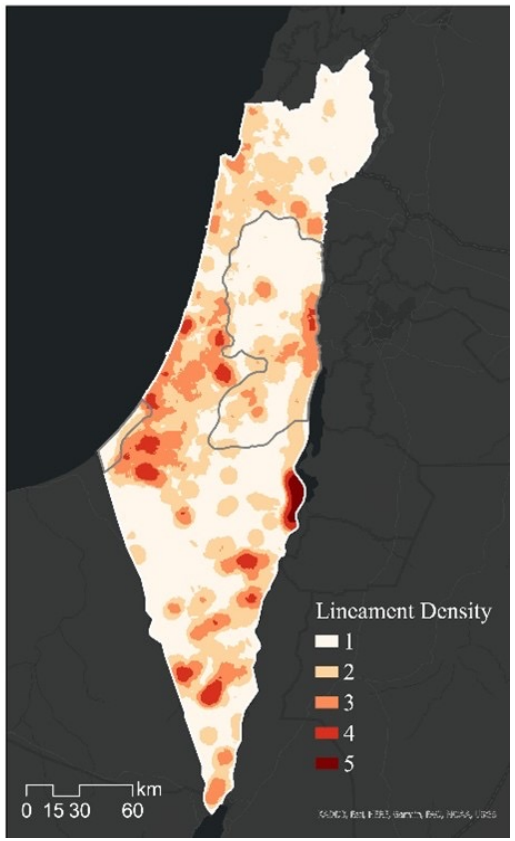

Fig. 8: Lineament Density

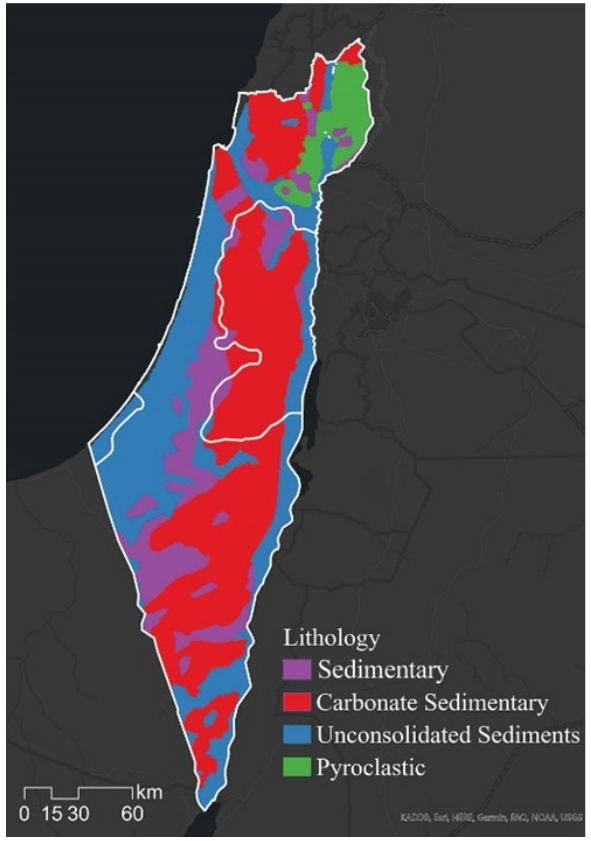

Fig. 9: Lithology

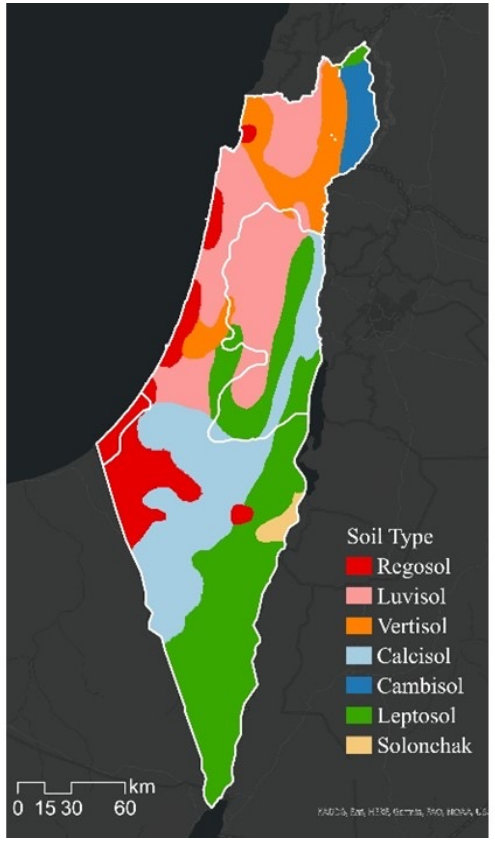

Fig. 10: Soil Type

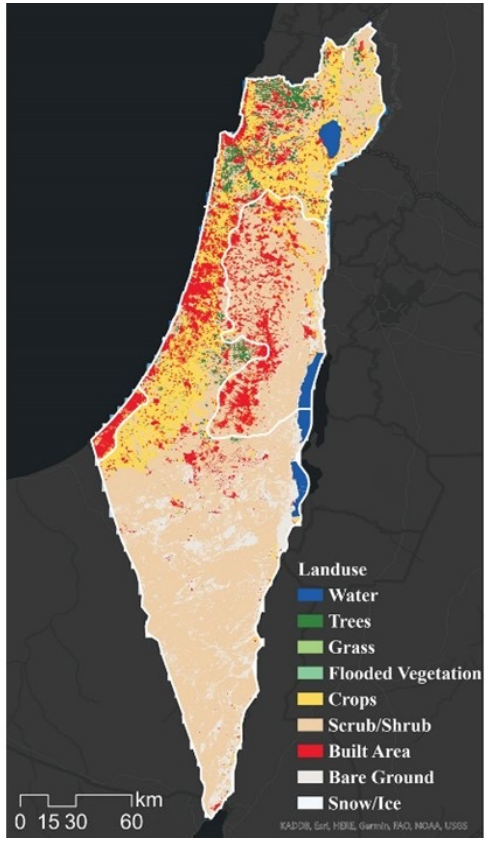

Fig. 11: Landuse

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Results

- **Arable Land Potential**:
  Categories: Highest (2,169 sq. km), Good (12,224 sq. km), Moderate, Poor
  Highest potential: Western coastal plains (fertile soils)
  Comparison: High potential areas align with farms and crops
- **Groundwater Potential**:
  Categories: Highest (423 sq. km), Good (4,604 sq. km), Moderate, Poor
  Highest potential: Coastal aquifers, mountain regions
  Comparison: Wells concentrated in high-potential areas

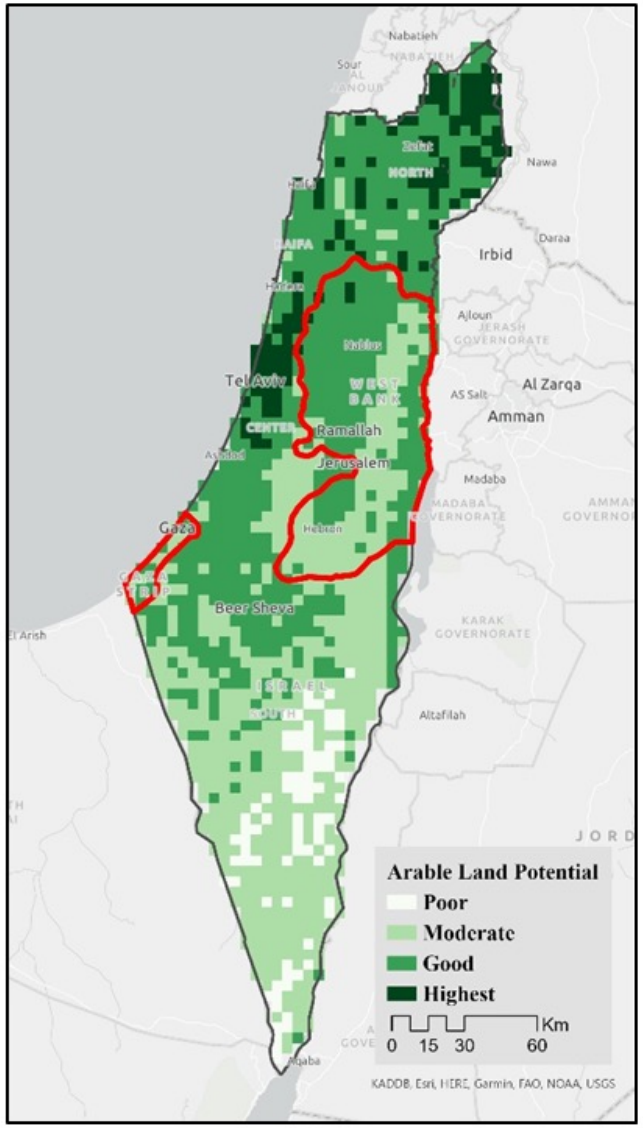

Fig. 12 Arable Land Potential zones

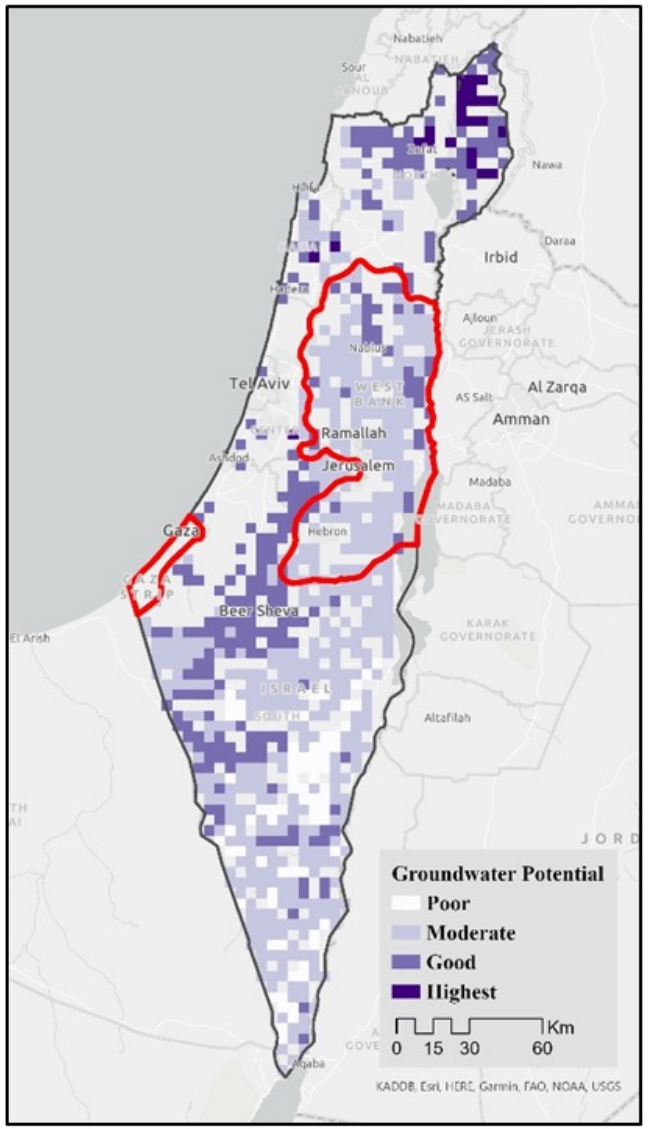

Fig. 13. Groundwater Potential zones

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Results

Shifts in territorial access to the resources (1917-present)

- Israel has increasingly gained access to high potential arable land and water
- Resources concentrated in Israeli-controlled coastal plains and Galilee
- Palestinian access to these resources has diminished

Driven by **settlement patterns**, control over key resources

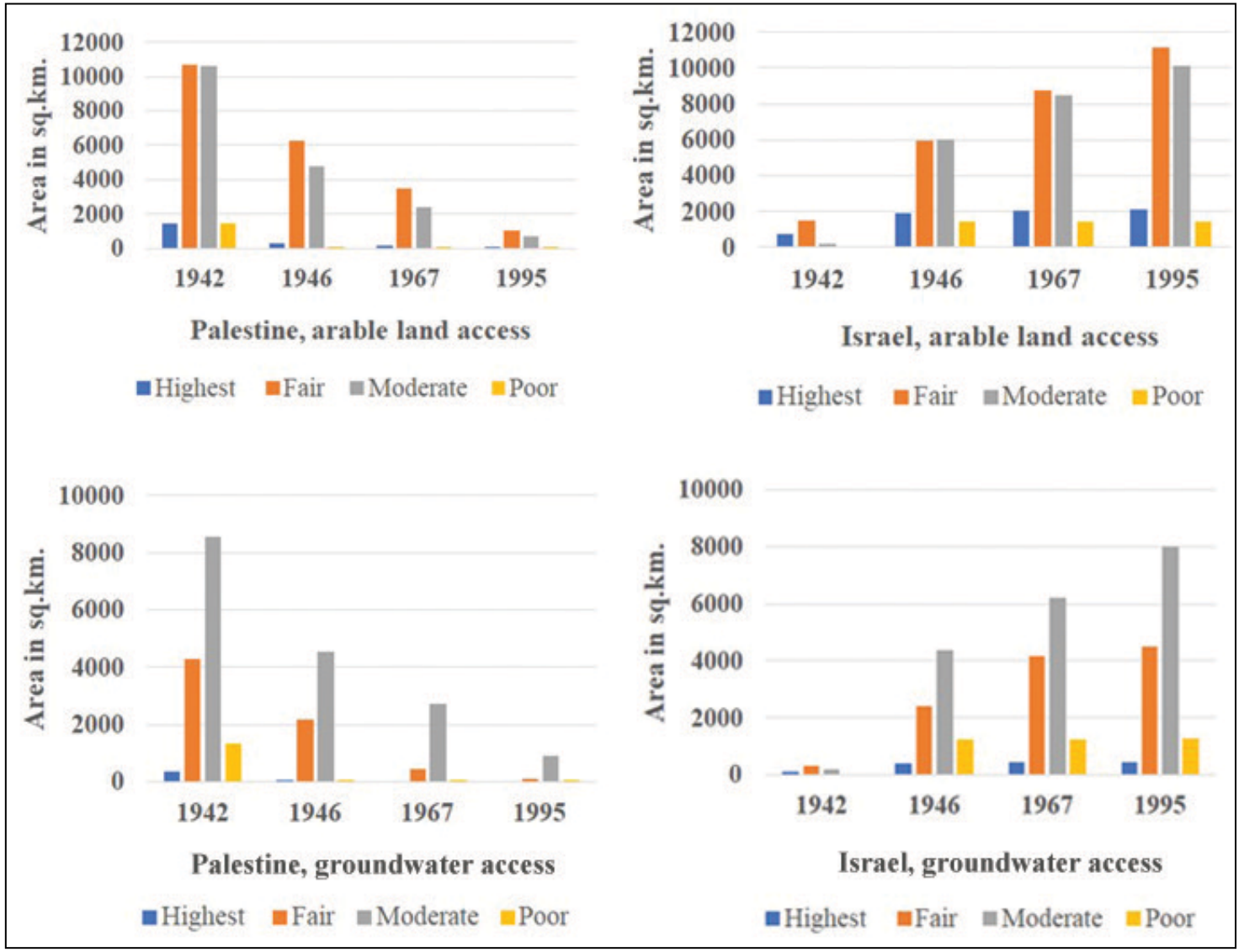

Fig. 14: Shifting Access to groundwater and arable land

Limitations

- **Anomaly in Golan region**: Unexpected high potential for arable land and groundwater, likely due to precipitation weight in AHP analysis.
- **Lack of field data**: Lacks robust statistical validation between potential zones and actual resource use due to absence of field data
- **Scale:** The analyses were conducted on a large scale bringing in a certain degree of generalisation
- **Exclusion of resource related violence** that further skew the disproportionate access to these resources

The results are however consistent with the broader statistics and reports of the study area, and generate robust and a quantitative spatial insight into descriptive the literature on the issue

Conclusion

- **Main finding**: Resource accessibility (arable land and groundwater) has shifted significantly in favour of Israel over time
- These shifts have influenced the balance of territorial control and power
- **Geographic factors** (e.g., precipitation, lithology, soil types) are crucial in determining access to resources
- **Policy implications**: Need for better resource management to reduce tensions in the region

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