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Mapping the severity of soil salinization potential in Israel

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Introduction

Irrigation is one of the main drivers for soil salinization especially in the case of poor drained soils. The threat becomes grater with intensive irrigation of marginal water. This is the case in Israel where more than 60% of the irrigation water is based on treated wastewater [1]. This situation lead to installation of tile drainage systems in order to be able continue growing crops. The investment in these systems accumulated to more than nine million USD in the last five years only.

Methodology

A mapping effort based on a GIS analysis has been performed in order to estimate the extent of risk for soil salinization in the agricultural land as a result of intensive irrigation with low water quality and high water table. Agricultural plots soils were categorized by three groups of severity (Table 1) as predictors of salinity and drainage problems. This was based mainly on soil texture and field slope, for example clayey soils in valleys. This division categorized the risk for soil salinization of agricultural plots by severity [2]. The presented work is an addition to the categories presented by Rabikovitch (1969) that presented natural soil salinity.

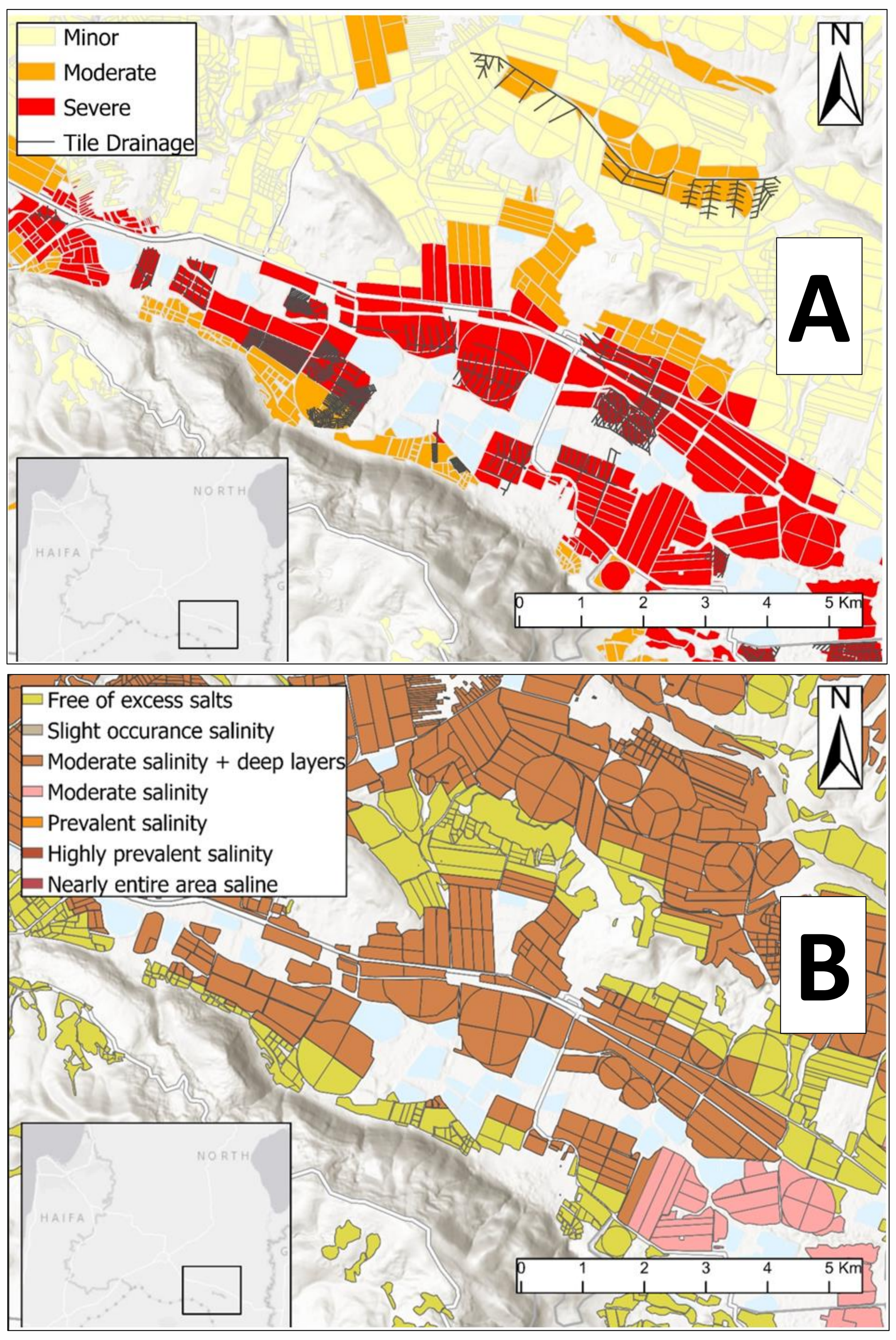

Figure 1: An example of the maps in the Harod valley.
A: The agricultural plots categorized in this work (2022) and the tile drainage systems.
B: The plots categorized by Rabikovitch (1969).

Table 1: selected soil associations categorized by expected severity of salinity potential.

Severe problems expected	Moderate problems expected	Minor problems expected
E1 – Hamric alluvial soil and gley	H1 – Alluvial Brown Grumosol	A7 – Brown Grumosol
H4 – Hydromorphic Grumosol and Grumosolic gley	H2 – Accumulative Brown and Reddish Brown Grumosol	B6 – Brown Grumosol and Brown Rendezina
H5 – Alluvial Brown Grumosols and Hydromorphic Grumosol	H3 – Calcareous accumula-tive Brown Grumosol and residual dark Brown	D3 – Basaltic very dark Brown Grumosol
H8 – Organic Soils	H6 – Light colored chalky colluvial alluvial soils	D4 – Basaltic reddish Brown Grumosol
L2 – Calcareous sierozem	H7 – colluvial alluvial soils and Grumosols	H9 – Very dark Brown Bazaltic Grumosol and Brown Grumosol
L3 – Calcareous sierozem, marly hydromorphic Grumosol, and highly calcareous Grumosol	H12 – Gravelly Nazzaz and Brown Hamra	H10 – Very dark Brown Bazaltic Grumosol
L4 – Lacustrine gley		H11 – Reddish Brown Bazaltic Grumosol
Y7 – Marly Solonchak		
Z2 – Solonchak		

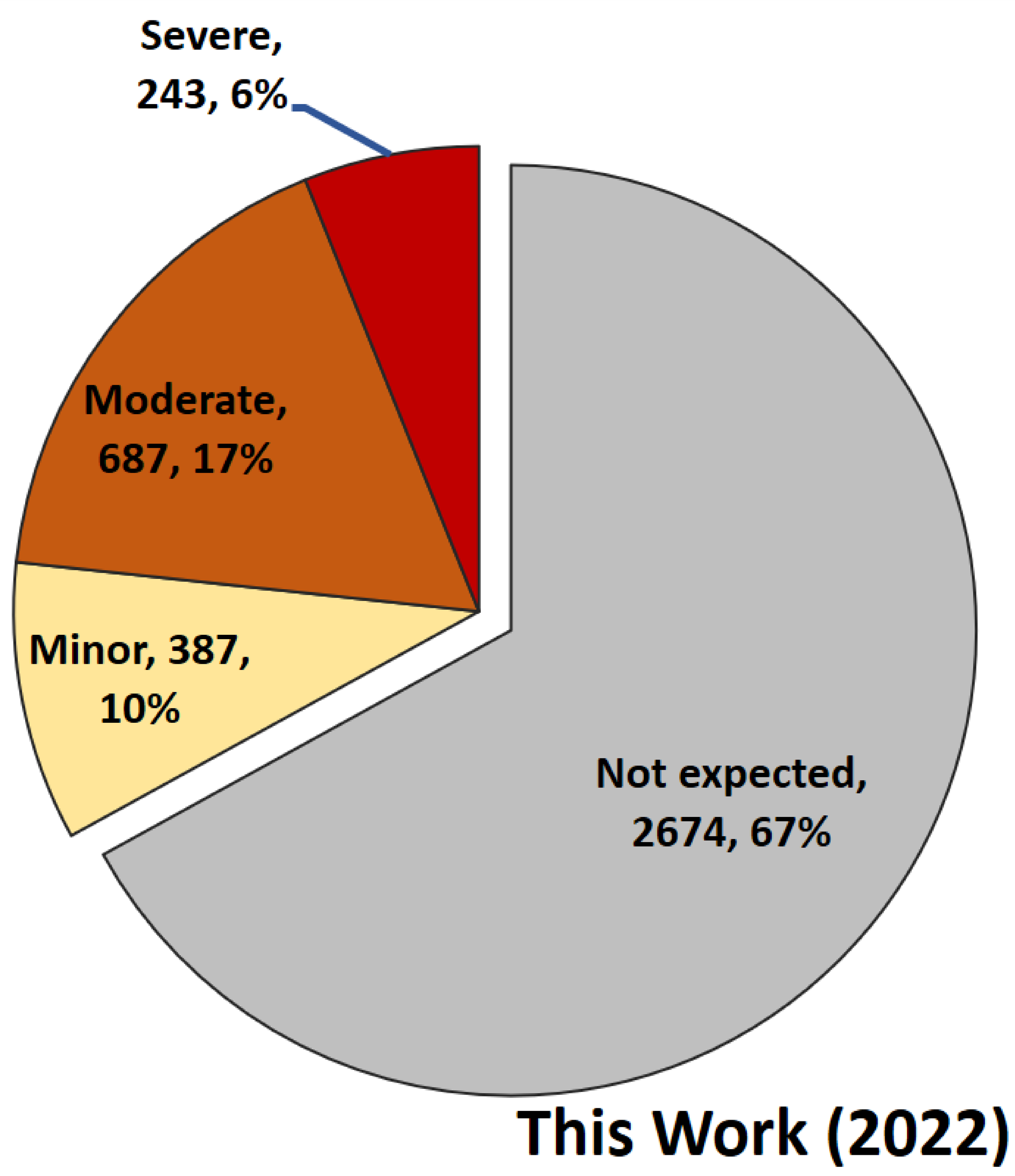

Figure 2: Distribution of the severity categories in this work. Performed for 163,037 agricultural plots that included all necessary data for comparison (3.9 million Dunam of 4.2 Million Dunam). The first value presents the area in KM^2.

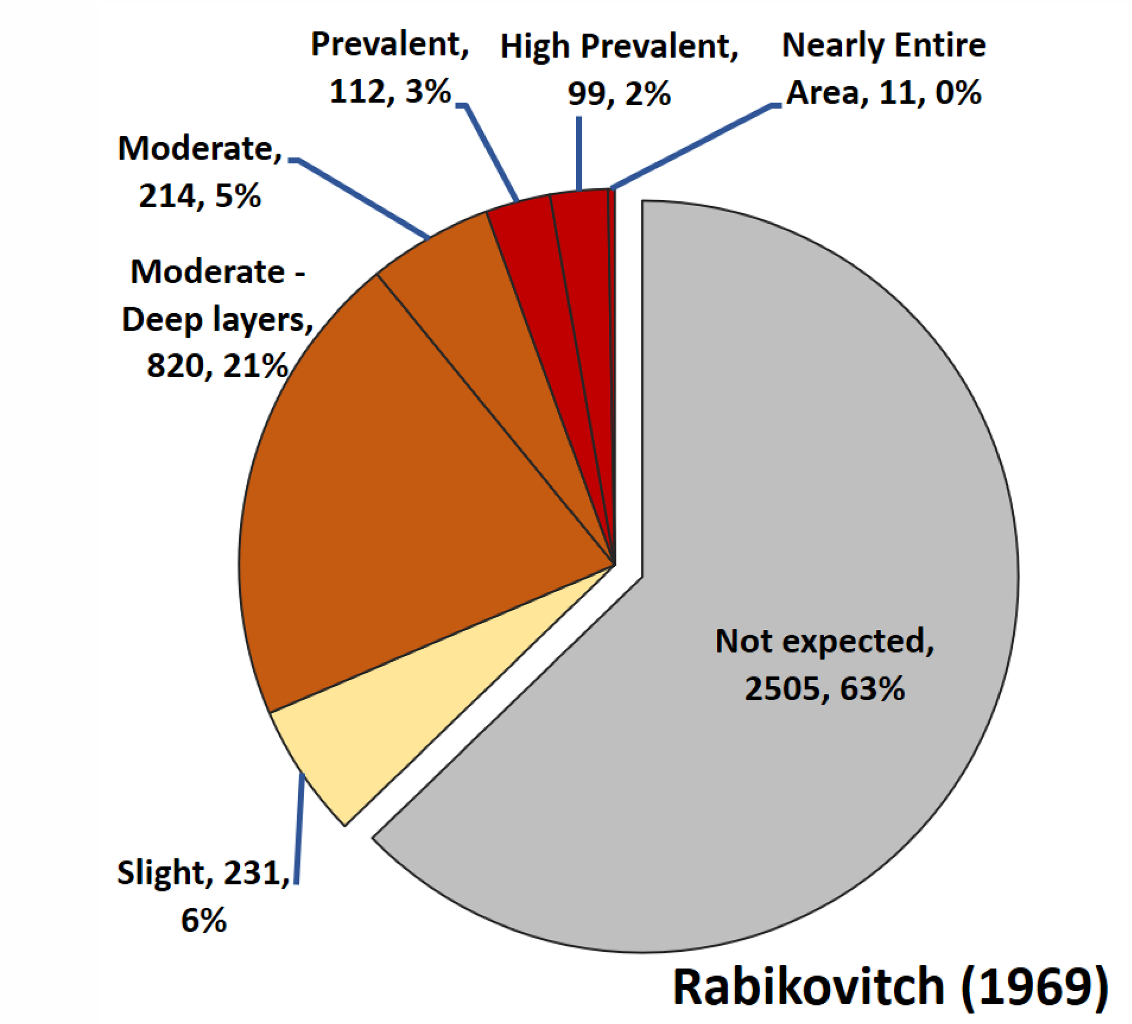

Figure 3: Distribution of the plots presented in Figure 2 in to the categories presented by Rabikovitch (1969)

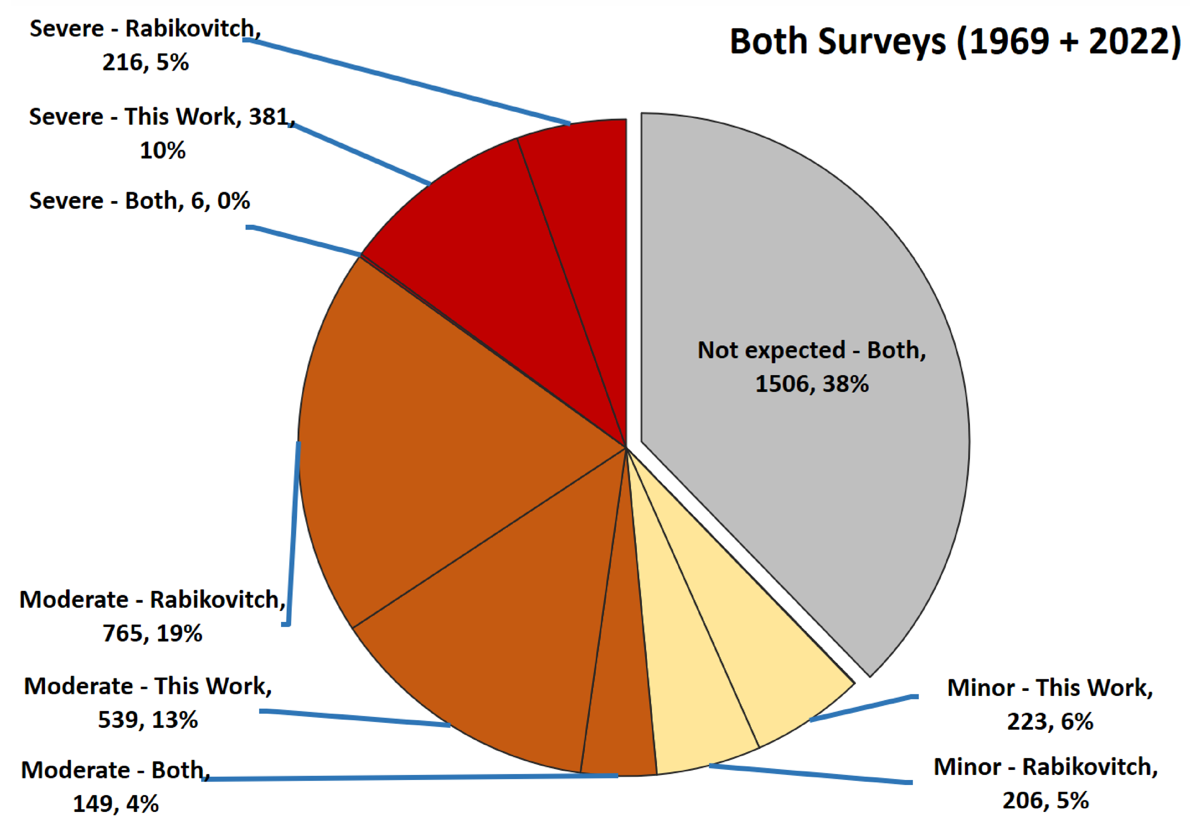

Figure 4: Distribution of plots presented in Figure 2 comparing the categories in this work (2022) and Rabikovtch (1969)

Results and Discussion

This analysis suggests that 6% of the agricultural land in Israel is expected to suffer from severe risk of salinization as a result of high water table. An additional 27% of the agricultural land is of a moderate risk.
The GIS classification shows an agreement between the plots classified with severe problems to plots containing massive tile drainage systems. Similarly, the plots classified as expected to have moderate problems contain less massive tile drainage systems, and the plots classified to have minor expected problems contain small systems.

Conclusions

While this work is preliminary, adding up the plots (Figure 4) shows that the majority of the agricultural plots in Israel are at high and moderate risk of being affected by salt.
This kind of analysis may serve as a policy tool for future treated waste water quality allocation.
In order to make this information accessible to the public, we created an interactive online map showing the potential groups.
https://arcg.is/1mW9Xa0

References

[1] Hopmans, J.W., Qureshi, A.S., Kisekka, I., Munns, R., Grattan, S.R., Rengasamy, P., Ben-Gal, A., Assouline, S., Javaux, M., Minhas, P.S. and Raats, P.A.C., 2021. Critical knowledge gaps and research priorities in global soil salinity. Advances in agronomy, 169, pp.1-191.

[2] Eshel, G., Volk, E., Maor, A., Argaman, E. and Levy, G.J., 2022. Degradation of Agricultural Lands in Israel.