Rivers & ROADS in the Roman Negev

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Introduction

This poster details efforts to map routes of movement in the Negev Desert during the Roman period. In pursuit of this goal, access to water resources was pinpointed as the key component involved in moving through the desert's arid environment. The known locations of these water resources, sourced from published excavation reports and survey projects, were mapped alongside sites dating to the study period. Many of these water resources had general rather than specific locations. To narrow these locations down, the crowd-sourced locations of plant species that signify potable water were combined with ground truthing at two case study sites, Birsama in the Negev's northern steppe and Mezad Tamar at the northern terminus of the Wadi Araba.

Study Area

While water, sites, and routes were investigated throughout the entire desert, two sites were visited to ground truth the remotely-sensed and crowd-sourced data: Birsama and Mezad Tamar, two large quadriburgium forts occupied during the Roman period (Fig. 1a-b). The two sites were chosen as case studies do to the similarity of their structures, prominence, and function as likely waystations along the Incense Route through the Negev.

Methodology

Desert plants that might signify potable water were sourced from a list compiled by the botanist Avinoam Danin (Table 1). Sightings of these plants were crowd-sourced from the Global Biodiversity Information Facility (GBIF), which houses user-submitted data in an open-access format. The plant locations were then cross-referenced with the sites of known water resources with a focus on tamarisk species (Fig 2). Tamarisk roots can grow over 50 meters, both laterally and downward, to reach groundwater tables and are often found growing in ancient cisterns and reservoirs as their seeds stick in soil accumulated at the bottom, made muddy from seasonal rains and surface runoff. Their ability to intake large amounts of water (up to 200 gallons in a day), both fresh and saline, often indicates the presence of a good water source, though salt accretions on the trees' branches may suggest non-potable salinity.

Results

The findings from the remote sensing revealed two key results:

- a clustering of tamarisk trees near ancient sites and along Roman roads
- patterns of tamarisks in areas without known roads or sites

Combining these results with ground and aerial survey at Birsama and Mezad Tamar further revealed:

- a high concentration of tamarisks associated with a possible reservoir at Birsama (Fig. 3a)
- tamarisks growing around the fort of Mezad Tamar with a concentration in the central cistern (Fig. 3b)

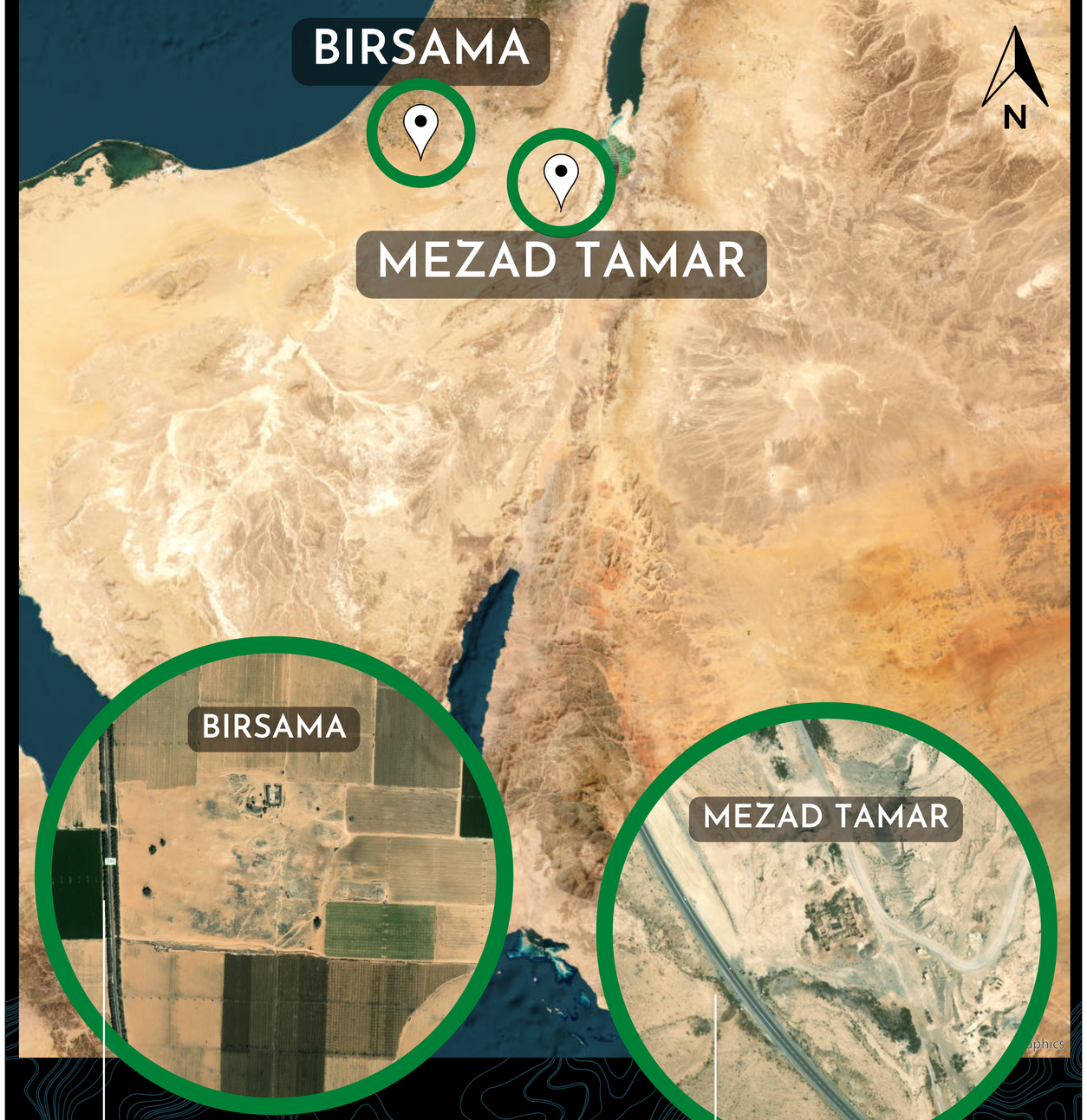

Figure 1a
Inset map of Birsama in the northwestern Negev Desert.

Figure 1b
Inset map of Mezad Tamar in the northeastern Negev Desert.

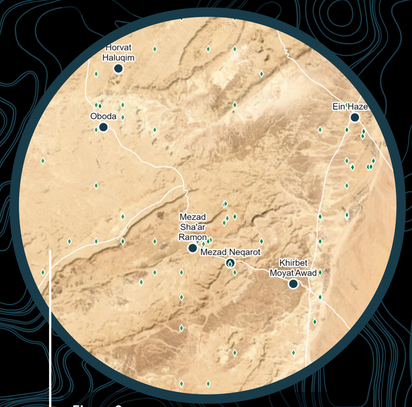

Figure 2
Tamarisk trees (green diamonds) clustered around sites with known water storages (blue circles). Roman roads are in white.

Figure 3b
Tamarisks in the central cistern at Mezad Tamar from the air.

Figure 3a
Tamarisks growing in a depression at Birsama.

Analysis

While it was not feasible to ground truth any of the specific potable water plant sightings at this stage in the project, the presence of tamarisk trees in known and posited water storage facilities dating to the Roman period provides a new technique for the further locating of these resources.

Not all tamarisks grow in ancient Roman cisterns, however, so ground-truthing the data is highly important to the verification of this methodology. Sighting the species featured in Table 1 (below) is only a first step that may help streamline archaeological surveys and the locations of ancient sites.

Salinity	Plants
Fresh	Southern cattail, smooth flatsedge, roundhead bulrush, mint, Italian sugarcane, brittleworts, willow
Fresh to Slightly Saline	Rabbitsfoot grass, date palm, Euphrates poplar, common reed, giant reed
Fresh to Saline	Hard sea rush, Japanese blood grass, camel thorn, tamarisk, nitre bush
Saline	White bean-caper, glaucous glasswort, simple-leaved bean caper, coastal grass, seablite

Table 1. *Plants that signify the presence of potable water (right column) and what range of salinity that water contains (left column). Note that* tamarisk *species can intake both fresh and saline water.*

Conclusion

To summarize, the proposed methodology has **four** key steps:

- the collection of crowd-sourced plant locations
- the cross-referencing of these plants with known sites and routes
- on-the-ground work to verify the sightings
- targeted survey based on these sightings

The rigorous verification of this information may then lead to:

- a greater understanding of water resources spaced along road networks in the ancient Negev
- the discovery of new routes through the desert
- the uncovering of new sites

This is one method towards increasing our knowledge of the Negev's past and, in particular, the water management strategies used to survive its arid environment. Further work into ground-truthing these methods and the correlation between tamarisk species and ancient water storages in the Negev will be forthcoming.

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Tamarisk tree locations were sourced from GBIF.

Photographs taken by author.