

**SHORT REPORT**

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The indigenous Bedouin farmers as land rehabilitators—Setup of an action research programme in the Negev

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Abstract

The Negev suffers from enhanced land degradation, mostly due to lack of awareness about its state, and hostility between the region's indigenous Bedouin farmers and the authorities. In order to examine a potential solution to this 'Lose-Lose' situation, a unique project is underway, with the collaboration of the Yeroham Municipality and the adjacent Rahma Bedouin farmers' village. The concept of this ongoing Programme is based on bidirectional knowledge transfer of farming data between the farmers and land scientists, aimed to adapt Bedouin traditional cultivation methods and transform them into methods that restore the environment and are also profitable. In order to reach this goal, a highly knowledgeable Bedouin liaison person was appointed to carry out the project together with the Coordinating Team. A comprehensive study and tour were carried out in order to analyze the different landforms and Bedouin cultivation preferences. An initial survey was carried out and data from literature collected in order to determine the ecological and archaeological characteristics of the ecosystem. The area was then prepared for agricultural utilization by removing widespread garbage and dealing with wadis that have been filled with construction waste. This project, which integrates soil enhancement, agriculture utilization, and traditional Bedouin farming, aims for rehabilitation of the northern Negev gullied areas. However, the implementation of the study concept in the field is accompanied by many challenges related to Bedouin interclan communication and the diverse types of degraded lands.

KEYWORDS

farmers, in situ land rehabilitation, Rahma Bedouin, stakeholder involvement, wadi reclamation, youth

1 | INTRODUCTION

For many years, and even today, the northern Negev, in spite of its history of plentiful agricultural utilization and increased urbanization (expansion of cities and establishment of industrial parks and paved roads), has been considered by the authorities to be the 'backyard of Israel'. The expanded urbanization processes have led to huge amounts of construction waste. This waste (local and imported soil

dumps, cemented ground, etc.) has spread to the surrounding open lands and led to changes in topography and groundwater balance, enhanced erosion, and problematic influences on natural ecological processes (Portnov & Safriel, 2004). This situation has led to a decrease in the agricultural utilization of these areas and a need to use alternative agricultural practices (Portnov & Safriel, 2004). In addition, the lack of waste disposal services in the unrecognized Bedouin settlements has led to widespread garbage, which is

dumped in wadis near the homes of the Bedouin, the indigenous farmers of the Negev.

Until the previous century, Bedouin farmers used to migrate with their herds between rangelands along the Arabian Peninsula and Mediterranean region, acquiring knowledge about arid rain-fed agriculture, grazing, and cereals breeding (Meir, 2009). In the second-half of the 20th century, parallel to the settlement of population in towns such as Arad, Dimona, and Yeruham, the Bedouin, similar to other indigenous farmer populations worldwide (Smith, Herlihy, Kelly, & Viera, 2009), preferred to keep their traditional agricultural customs and established rural settlements, many of them unrecognized by the authorities (Meir, 2009, 2019). The formerly nomadic Bedouin, who focused primarily on herding of sheep, goats, and camels, began a process of sedentarization, including rain-fed agriculture; however, their claims to land they settled on have not for the most part been recognized by the authorities (Meir, 2019).

After meeting and talking with many Bedouin farmers all over the Negev and similar to Meir's (2019) findings, we noticed that the Bedouin farmers are less concerned about the Israeli-Arab conflict; one of their main concerns is their inability to cultivate the Negevlands according to their age-old agricultural practices, which they regard as the most suitable and profitable. Although there are some local and limited successes (Abu Rabia, Solowey, & Leu, 2008), rapid changes in the ecosystem due to processes such as global warming and increased urbanization have rendered these traditional practices inadequate and may have even increased their damage to the ecosystem (Zent & Simpson, 2009). The enhanced degradation of the Negev open lands also contributes to the hostility between the Bedouin and the authorities and results from it, as described in the outline of interrelations shown in Figure 1.

The public (and the authorities) have been influenced by two prejudices. One relates to the open lands of the northern Negev as badlands without the potential for profitable agricultural utilization, and the other claims that this state is a result of the inadequate farming practices of indigenous Bedouin farmers (Mor-Mussery, Shuker, & Zaady, 2019). These prejudices lead to seek a 'Win-Win' solution, in which the Bedouin farmers, the ecosystem and the public will benefit, and further contamination of these open lands by contractors, factories, and so on will be limited.

The above two prejudices lead the authorities to limit the allocation of lands for Bedouin farming and refrain from investing in scientific study of Bedouin traditional farming practices and ways to make them sustainable.

The authorities' approach leads in many cases to the Bedouin's unawareness of the ecosystem's state, which leads in turn to continuing utilization of unsustainable and unprofitable agricultural practices.

The Bedouin younger generation 'translates' this situation into unwillingness to deal with or work in agriculture, though this could be an opportunity to alleviate widespread unemployment in the Bedouin sector (Abu Rabia, 2000).

The whole situation works to the detriment of all (a 'Lose-Lose' situation) in which environmental damage and negative influences only increase with time.

2 | PROGRAMME SCHEME

The 'White Hill Farm' is an urban agricultural center for the communities of Yeruham and Rahma. In order to examine a possible solution for the 'Lose-Lose' situation described above, the Atid Bamidbar

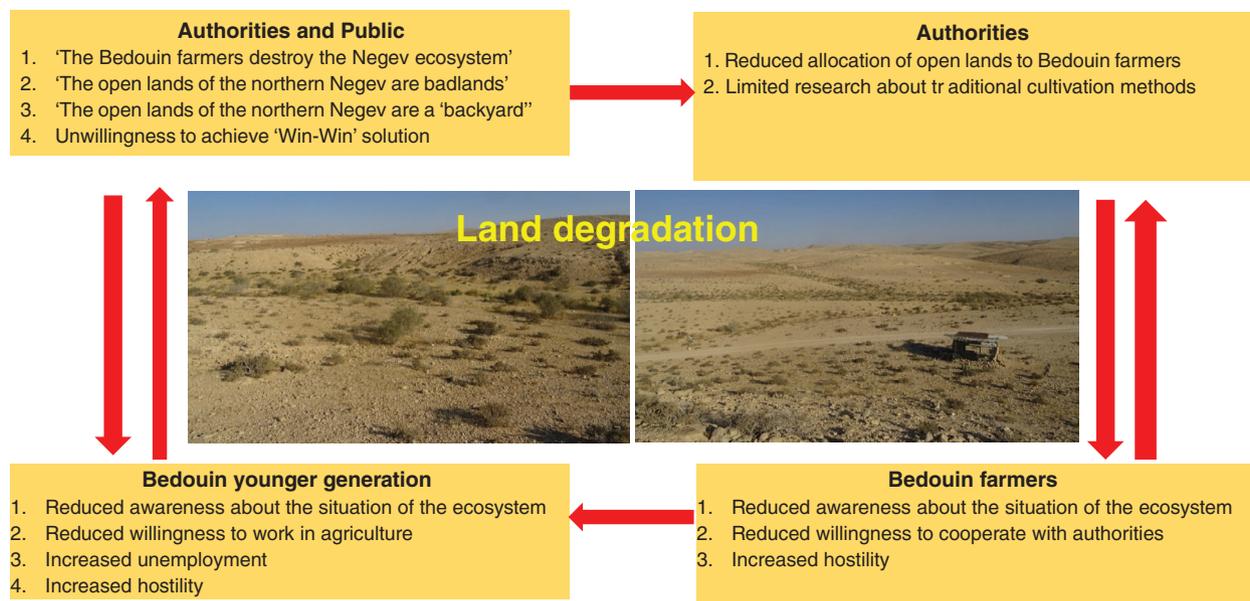
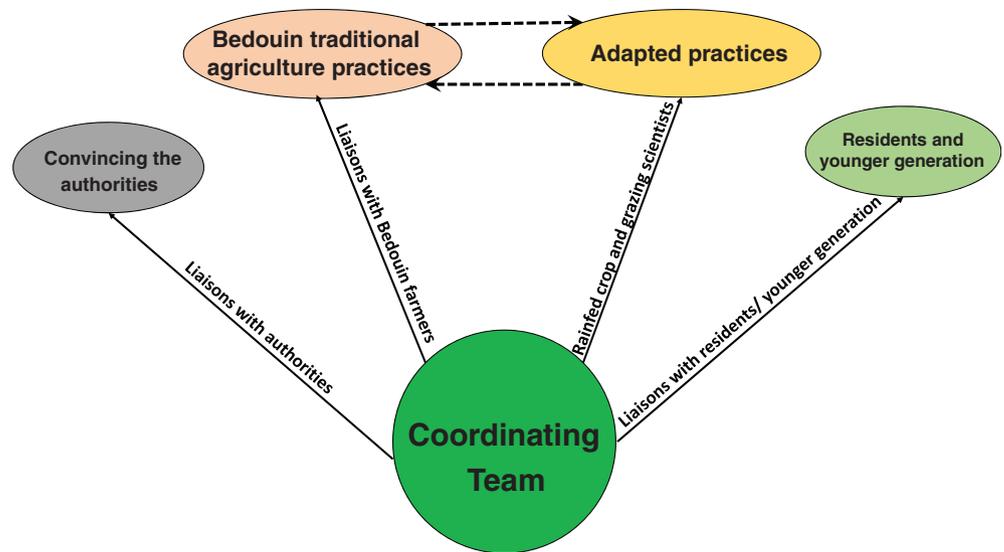


FIGURE 1 The current 'Lose-Lose situation' between the public, Bedouin farmers, Bedouin youth, and the authorities has resulted in severe degradation of the northern Negev open lands near Rahma. Common prejudices appear between single quotation marks [Colour figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com)]

FIGURE 2 The outlines for the Rahma Programme [Colour figure can be viewed at wileyonlinelibrary.com]



nonprofit association, which runs the 'White Hill Farm', initiated in 2018 a unique agricultural, intercultural and ecological project (Figure 2). The Atid Bamidbar Project is similar to a project carried out in Wadi Kharouba in Egypt (Coppola, Abdallah, Dragonetti, Zdruli, & Lamaddalena, 2019; Zdruli, 2016). The outlines for this study are summarized in Figure 2. This project works toward improving relations between the Bedouin, the authorities, and the wider public, as contributing and essential factors to land rehabilitation; this is why liaisons with the authorities and the Bedouin are part of the Coordinating Team and built into the project from its outset.

The following outlines for the study were defined (Figure 2).

Coordinating team. This team includes scientists with multi-disciplinary knowledge regarding soil, agriculture (with focus on rainfed cultivation), and geomorphology; experts with anthropological knowledge about Bedouin social and familial patterns; liaisons with Rahma, in preparation for the interaction with indigenous farmers; and liaisons for the interaction with the authorities and relevant municipalities.

Liaisons with Bedouin residents and the younger generation. Training indigenous Bedouin residents and especially the younger generation about sustainable cultivation practices and raising their awareness about the ecosystem, using suitable courses, study tours, and so on (Grenier, 1998; Zent & Simpson, 2009).

Liaisons with the authorities. Convincing the authorities that the adapted Bedouin agricultural practices can contribute to the ecosystem.

Liaison with the Bedouin farmers. The interaction with the Bedouin farmers and joint implementation of the adapted practices are the core of the plan, to be carried out in the following three phases: (a) the training will be carried out by liaisons from the Coordinating Team and the farmers; (b) the collected data will be analyzed by the Coordinating Team scientists; and (c) proposed adaptations will be suggested to the Bedouin farmers, implementing bidirectional, consistent, and continuous 'data transfer' between the Bedouin farmers and the Coordinating Team (Zent & Simpson, 2009).

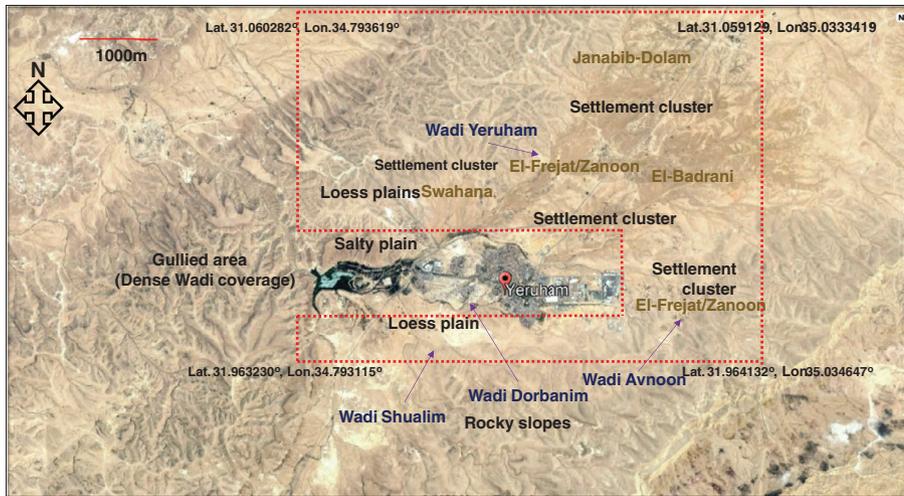
2.1 | On site implementation

On site implementation. The Bedouin settlement of Rahma is located 20 km south of Beer Sheva, surrounding the town of Yeruham on three sides, and measures 2,000 ha including its settlements and cultivated lands (South-West: Lat. 31.060282°, Lon. 34.793619°; South-East: Lat. 31.963230°, Lon. 34.793115°; North-East: Lat. 31.964132°, Lon. 35.034647°; North-West: Lat. 31.059129°, Lon. 35.0333419°. The area represents the 'struggle' over land utilization between the indigenous Bedouin farmers using traditional Bedouin arid cultivation practices, and the intensive urban growth in Yeruham, as in other regions in the Negev (Amara, 2016; Portnov & Safriel, 2004). The Bedouin residents of Rahma belong to four main *Hamula*, an Arabic term for extended families with internal marriage patterns (Meir, 1988), as follows: Swahana, El-Frejat/Zanoon, Janabib-Dolam, El-Badrani. Each *Hamula* is separately located over the site. Rahma has a total of 1,500 inhabitants; more than 50% are below the age of 18, and of these, 370 in the first–eighth grades. Rahma was chosen as a case-study as it is characteristic of other agricultural Bedouin settlements in the Negev (Figure 3a,b).

We encountered several unique local characteristics that challenged us to adapt the Programme to the specific Bedouin community and the site studied.

2.1.1 | Communicating with the Bedouin farmers and identifying the best Bedouin liaison for the Programme

The first and foremost step for such a project, as is the case with other indigenous populations, is developing a relationship with the local farmers, as stressed by Blaikie and Brookfield (2015). In many site-visits and informal meetings with Rahma residents, we saw that the village residents are practically and intellectually influenced by two leaderships, one official–political, and one religious. Therefore,



(a)



(b)

FIGURE 3 (a) Site of study—Rahma. Geographically, the site of the study is within the jurisdiction of the Yeruham Municipality and includes eroded landforms such as wadis (marked in blue), gullies, salty and loess plains, flood plains, and rocky slopes (marked in black). The Bedouin residents belong to four *Hamula* (Arabic term for extended families with internal marriage patterns), which are separately located in the area (marked in yellow). GoogleEarth®. (b) Typical view for Rahma (El-Frejat/Zanoon-East) [Colour figure can be viewed at wileyonlinelibrary.com]

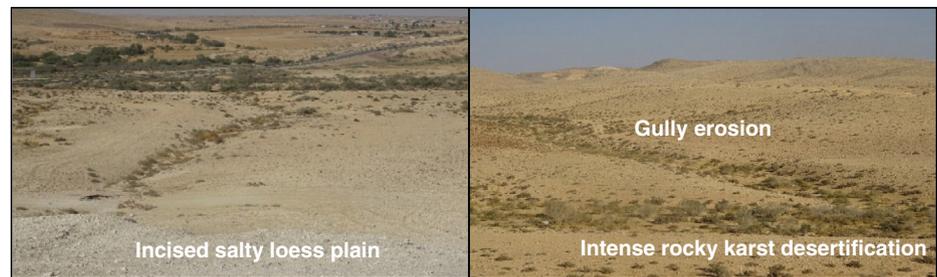
we concluded that any interaction with the Rahma farmers, which number ~150, and the younger generation, has to be preceded by preliminary interaction with these leaderships. The official-political leadership is composed mainly of 50- to 60-year-old men who are well versed with Israeli society; therefore, we decided to strengthen the interaction with them by carrying out additional communal, agricultural, and ecological projects involving the Bedouin and Jewish younger generations, in order to deepen acquaintance, improve relations, and reduce hostility between the populations, from childhood. The interaction with the religious leaders was more challenging, due to their conservative character. Therefore, we decided to conduct ongoing informal meetings, using liaisons who are knowledgeable with Bedouin traditions, to explore their willingness to be involved in the Programme. The long-term interactions with these two leaderships led us to several farmers who were willing to cooperate with this

project. In order to identify the chief liaison from among the Bedouin farmers, we conducted several conversations with the Chair of the Rahma Residents' Committee and selected older farmers with wide practical knowledge of traditional cultivation and grazing methods in the area, but more importantly, who are respected and popular among all the families and clans in Rahma.

2.1.2 | Mapping the landforms and studying the cultivation preferences of the Bedouin farmers

The intensive soil erosion and incision over the years resulted in a multi-landform ecosystem, which has become unusable for agriculture. Therefore, first, a wide field survey was carried out by geomorphologists from the Coordinating Team as well as one of the Bedouin liaison

FIGURE 4 The main eroded landforms in the Rahma region; all have been exacerbated by gully erosion [Colour figure can be viewed at wileyonlinelibrary.com]



farmers, who gave the historical perspective of the geomorphologic processes that have occurred. The most common landforms are rocky slopes, gullied (and waded) areas, loess and salty plains, and flood plains. We realized that all of these landforms have been affected by gully erosion (Avni, 2005; Ionita, Fullen, Zgłobicki, & Poesen, 2015); therefore, we concluded that our study site must rely foremost on the wadi and gully systems, if rehabilitation is the ultimate goal (Figure 4).

The Bedouin liaisons suggested as the baseline for the adapted practices the following potential traditional crops: rain-fed wheat in the open lands, olive and grape vines in the wadis, and the integration of controlled grazing of small ruminants and camels in these areas.

In addition, the scientists on the Coordinating Team collected data from previous publications regarding the types and location of ancient agricultural facilities, for example, terraces and facilities dating back to the Byzantine Period, and possibly constructed at that time by Bedouin (Ashkenazi, Avni, & Avni, 2012; Kedar, 1967). The data will be used to adapt cultivated plots to the topographical patterns and water flow directions (Ashkenazi et al., 2012). Nevertheless, additional and more comprehensive analysis using satellite remote sensing data (e.g., Helman, Lensky, Mussery, & Leu, 2014; Helman, Mussery, Lensky, & Leu, 2014; Helman & Mussery, 2020), as well as monitoring through spectral-based imaging from drones will be used (see Manfreda et al., 2018).

2.1.3 | Analyzing the ecosystem characteristics

A preliminary ecological survey was carried out in 2018–2019 by the Society for the Protection of Nature in Israel. In this survey, patches of rare flora and fauna species were identified (e.g., *Iris petrana* along Wadi Yeruham, *Eremopyrum bonaepartis* in Wadi Avnoon salt plain, and *Suaeda vera* along Wadi Avnoon). These natural ecological patches in the cultivated areas may supply 'ecological services', which can benefit the crops (Barral, Benayas, Meli, & Maceira, 2015). In addition, the site of study is densely covered with ruins of agriculture systems dated back mostly to Byzantine–Early Islamic Era (Avni, Porat, & Avni, 2013; Beckers, Berking, & Schütt, 2013); some of them have been designated for conservation. Therefore, data regarding the locations and patterns of the ruins was collected and summarized, in order to prevent damage and in order to prepare a better rehabilitation design for the whole area (Londoño, Williams, & Hart, 2017).

2.1.4 | Initial preparation of the study sites for widespread agricultural utilization by waste collection and clearing of gullies

Wide parts of the study sites are covered by unregulated waste and garbage or filled with earth. The latter, when accumulated in the gullies, leads to flash floods spreading all over the area and to ground water contamination, as documented in regions settled by indigenous farmer populations in China (Han et al., 2016) and Nigeria (Chukwudebelu, Igwe, Taiwo, & Tojola, 2013). Therefore, a plan for garbage removal was designed together with the Bedouin younger generation, including the introduction of large garbage bins and contracting with a company to deal with periodical garbage disposal. Clearing and remodeling the wadis affected by the landfills was begun.

2.1.5 | Building a training course for the Bedouin farmers

The training course aims to present the principles of cultivated land rehabilitation and sustainable practices on the one hand, and on the other hand, collect data about traditional agricultural Bedouin practices and their potential adaptation for land rehabilitation. The planned course includes nine weekly lecture/workshops and three study-tours, some of them in other Bedouin agricultural sites around the Negev (such as Wadi Atir and Zarnuga).

2.1.6 | Motivating the Bedouin younger generation through use of remote sensing tools

The study site covers dozens of hectares, therefore we decided to use satellite and drone images to determine biomass, as well as incision changes (e.g., Helman & Mussery, 2020). In addition, and as previously described in Figure 1, the 'Lose-Lose' current situation leads also to unemployment and reduced integration into the Israeli society (Meir, 2019). Therefore, in order to motivate the younger generation of Rahma to take an active role in future agricultural work, we built a training plan involving the young people for carrying out drone flights and analyzing satellite and drone images of the study area (Chou, 2018; Yaun, 2016).

3 | DISCUSSION

Only in the in-field implementation of the study principles, we became aware of the magnitude of two aspects: (1) the need to rehabilitate nearby areas, which are affected by different erosion phenomena; and (2) the need to invest time to determine the kinship structure and personal communication networks of Rahma residents.

3.1 | Need for catchment rehabilitation

As previously stated, the degraded state of many areas in the study site has been exacerbated by gully erosion, so we are focusing in the initial stage of the study on the rehabilitation of gullies and wadis. In the future, however, in order to enhance the rehabilitation of the whole area and make agricultural activity in it profitable for the Bedouin farmers, we will have to implement the 'integrated watershed management' (IWM) approach. This approach is based on mapping a wide range of watershed characteristics, such as land use, land cover, runoff, and soil losses, before carrying out the integrated watershed management, in our case wadi reclamation, and during the years after that. This approach is been studied in several regions, such as Ethiopia (Gebregziabher, Abera, Gebresamuel, Giordano, & Langan, 2016) and China (Wang et al., 2016), but not in the Negev. We too want in the future to build an integrative model which takes into consideration all the erosion types and landforms in the study site.

3.2 | Kinship structure and personal communication networks of Rahma residents

Warriner and Moul (1992) stated that, "...kinship and personal communication networks influence the adoption of agricultural conservation technology." Indeed, after beginning the study, we became aware of the critical importance of analyzing these communication networks in the Rahma Bedouin community, to ensure the success of the rehabilitation efforts. For example, due to long-term disagreements between brothers, who have been cultivating adjacent lands, two different liaisons will have to be appointed for our communication with them. Therefore, considerable time has been allocated for this analysis, with hope that the resultant data will enable a better rehabilitation design.

The data acquired from the course participants will be used to design rehabilitation and cultivation plans in Rahma, which will be continuously monitored and analyzed by the Coordinating Team scientists. In the future, if funding is obtained, Atid Bamidbar staff, a nonprofit organization, will use its connections with Bedouin farmers and social activists in the Negev in order to replicate the project in other Bedouin localities and convince the authorities to support it.

4 | CONCLUSIONS

This project is designed to rehabilitate the degraded northern Negev lands, using sustainable cultivation in collaboration with and implemented by indigenous Bedouin farmers.

The study is replete with many challenges, mostly related to the influence of different cultivations on land rehabilitation. Nevertheless, improved relations and reduced hostility between Rahma Bedouin and Yeruham residents, which can easily be observed even at this initial stage, will enhance the rehabilitation plan by turning the 'Lose-Lose' situation into a 'Win-Win' one (additional information on this Programme is provided in the Supporting Information).

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REFERENCES

- Abu-Rabia, A. (2000). Employment and Unemployment among the Negev Bedouin. *Nomadic Peoples*, 4(2), 84–93. <https://doi.org/10.3167/082279400782310520>
- Abu Rabia, K., Solowey, E., & Leu, S. (2008). Environmental and economic potential of Bedouin dryland agriculture. *Management of Environmental Quality*, 19(3), 353–366. <https://doi.org/10.1108/14777830810866464>
- Amara, A. (2016). Beyond stereotypes of Bedouins as 'nomads' and 'savages': Rethinking the Bedouin in ottoman southern Palestine, 1875–1900. *Journal of Holy Land and Palestine Studies*, 15(1), 59–77. <https://doi.org/10.3366/hlps.2016.0129>
- Ashkenazi, E., Avni, Y., & Avni, G. (2012). A comprehensive characterization of ancient desert agricultural systems in the Negev highlands of Israel. *Journal of Arid Environments*, 86, 55–64. <https://doi.org/10.1016/j.jaridenv.2012.02.020>
- Avni, Y. (2005). Gully incision as a key factor in desertification in an arid environment, the Negev Highlands, Israel. *Catena*, 63(2–3), 185–220. <https://doi.org/10.1016/j.catena.2005.06.004>
- Avni, G., Porat, N., & Avni, Y. (2013). Byzantine–early Islamic agricultural systems in the Negev Highlands: Stages of development as interpreted through OSL dating. *Journal of Field Archaeology*, 38(4), 332–346. <https://doi.org/10.1179/0093469013Z.00000000052>
- Barral, M. P., Benayas, J. M. R., Meli, P., & Maceira, N. O. (2015). Quantifying the impacts of ecological restoration on biodiversity and ecosystem services in agroecosystems: A global meta-analysis. *Agriculture, Ecosystems & Environment*, 202, 223–231. <https://doi.org/10.1016/j.agee.2015.01.009>
- Beckers, B., Berking, J., & Schütt, B. (2013). Ancient water harvesting methods in the drylands of the Mediterranean and Western Asia. *eTopoi*, 2, 145–164. <http://www.topoi.org/wp-content/uploads/2013/06/174-693-1-SM.pdf>
- Blaikie, P., & Brookfield, H. (2015). *Land degradation and society* (1st ed., Vol. 1, pp. 1–295). New York, NY: Routledge.

- Chou, P. N. (2018). Smart technology for sustainable curriculum: Using drones to support young students' learning. *Sustainability*, 10(10), 3819. <https://doi.org/10.3390/su10103819>
- Chukwudebelu, J. A., Igwe, C. C., Taiwo, O. E., & Tojola, O. B. (2013). Recovery of pure slaked lime from carbide sludge: Case study of Lagos State, Nigeria. *African Journal of Environmental Science and Technology*, 7(6), 490–496. <https://doi.org/10.5897/AJEST12.093>
- Coppola, A., Abdallah, M., Dragonetti, G., Zdruli, P., & Lamaddalena, N. (2019). Monitoring and modelling the hydrological behavior of a reclaimed Wadi basin in Egypt. *Ecohydrology*, 2019, e2084. <https://doi.org/10.1002/eco.2084>
- Gebregziabher, G., Abera, D. A., Gebresamuel, G., Giordano, M., & Langan, S. (2016). *An assessment of integrated watershed management in Ethiopia* (1st ed., Vol. 170, pp. 1–21). Colombo, Sri Lanka: International Water Management Institute (IWMI). ISSN: 2012-5763.
- Grenier, L. (1998). *Working with indigenous knowledge: A guide for researchers* (Vol. 1, pp. 1–110). Ottawa, Canada: IDRC Press. ISBN: 0-88936-847-3.
- Han, Z., Ma, H., Shi, G., He, L., Wei, L., & Shi, Q. (2016). A review of groundwater contamination near municipal solid waste landfill sites in China. *Science of the Total Environment*, 569, 1255–1264. <https://doi.org/10.1016/j.scitotenv.2016.06.201>
- Helman, D., Lensky, I. M., Mussery, A., & Leu, S. (2014). Rehabilitating degraded drylands by creating woodland islets: Assessing long-term effects on aboveground productivity and soil fertility. *Agricultural and Forest Meteorology*, 195–196, 52–60. <https://doi.org/10.1016/j.agrformet.2014.05.003>
- Helman, D., Mussery, A., Lensky, I. M., & Leu, S. (2014). Detecting changes in biomass productivity in a different land management regimes in drylands using satellite-derived vegetation index. *Soil Use and Management*, 30(1), 32–39. <https://doi.org/10.1111/sum.12099>
- Helman, D., & Mussery, A. (2020). Using Landsat satellites to assess the impact of check dams built across erosive gullies on vegetation rehabilitation. *Science of the Total Environment*, 730, 138873. <https://doi.org/10.1016/j.scitotenv.2020.138873>
- Ionita, I., Fullen, M. A., Zgłobicki, W., & Poesen, J. (2015). Gully erosion as a natural and human-induced hazard. *Natural Hazards*, 79, 1–5. <https://doi.org/10.1007/s11069-015-1935-z>
- Kedar, Y. (1967). *The ancient agriculture in the Negev Mountains* (Vol. 1, pp. 1–50). Jerusalem: Mosad Bialik (Hebrew).
- Londoño, A. C., Williams, P. R., & Hart, M. L. (2017). A change in landscape: Lessons learned from abandonment of ancient Wari agricultural terraces in Southern Peru. *Journal of Environmental Management*, 202, 532–542. <https://doi.org/10.1016/j.jenvman.2017.01.012>
- Manfreda, S., McCabe, M., Miller, P., Lucas, R., Pajuelo Madrigal, V., Mallinis, G., ... Toth, B. (2018). On the use of unmanned aerial systems for environmental monitoring. *Remote Sensing*, 10(4), 641. <https://doi.org/10.3390/rs10040641>
- Meir, A. (1988). Nomads and the state: The spatial dynamics of centrifugal and centripetal forces among the Israeli Negev Bedouin. *Political Geography Quarterly*, 7(3), 251–270. [https://doi.org/10.1016/0260-9827\(88\)90015-8](https://doi.org/10.1016/0260-9827(88)90015-8)
- Meir, A. (2009). Contemporary state discourse and historical pastoral spatiality: Contradictions in the land conflict between the Israeli Bedouin and the state. *Ethnic and Racial Studies*, 32(5), 823–843. <https://doi.org/10.1080/01419870801918755>
- Meir, A. (2019). *As nomadism ends: The Israeli Bedouin of the Negev*. London: Routledge.
- Mor-Mussery, A., Shuker, S., & Zaady, E. (2019). New approach for sustainable and profitable grazing systems in arid open lands—A case study in the northern Negev. *Geography, Environment and Sustainability*, 12(2), 106–127. <https://doi.org/10.24057/2071-9388-2019-15>
- Portnov, B. A., & Safriel, U. N. (2004). Combating desertification in the Negev: Dryland agriculture vs. dryland urbanization. *Journal of Arid Environments*, 56(4), 659–680. [https://doi.org/10.1016/S0140-1963\(03\)00087-9](https://doi.org/10.1016/S0140-1963(03)00087-9)
- Smith, D. A., Herlihy, P. H., Kelly, J. H., & Viera, A. R. (2009). The certification and privatization of indigenous lands in Mexico. *Journal of Latin American Geography*, 8(2), 175–207. <https://doi.org/10.1353/lag.0.0060>
- Wang, G., Mang, S., Cai, H., Liu, S., Zhang, Z., Wang, L., & Innes, J. L. (2016). Integrated watershed management: Evolution, development and emerging trends. *Journal of Forestry Research*, 27(5), 967–994. <https://doi.org/10.1007/s11676-016-0293-3>
- Warriner, G. K., & Moul, T. M. (1992). Kinship and personal communication network influences on the adoption of agriculture conservation technology. *Journal of Rural Studies*, 8(3), 279–291. [https://doi.org/10.1016/0743-0167\(92\)90005-Q](https://doi.org/10.1016/0743-0167(92)90005-Q)
- Yaun, K. (2016). *Drones in the classroom* (Vol. 1). New York, NY: The Rosen Publishing Group, Inc. ISBN: 9781508173458.
- Zent, E. L., & Simpson, B. B. (2009). The importance of traditional ecological knowledge for palm-weevil cultivation in the Venezuelan Amazon. *Journal of Ethnobiology*, 29(1), 113–129. <https://doi.org/10.2993/0278-0771-29.1.113>

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

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