



Designating the First Vernal Pool Micro-Reserve in a Buffer Zone of Wadi Qana Protected Area, Palestine

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Abstract

Vernal pools as temporary wetlands can harbor unique and interesting fauna and flora and are deserving of protection especially when urban expansion, climate change, and other human induced changes threaten them. A small vernal pool near Jinsafut and located in the buffer zone of a protected area of Wadi Qana was noted to have unique fauna and flora not found elsewhere in the West Bank (Occupied Palestinian Territories). Specifically, the Syrian Spade-footed toad (*Pelobates syriacus*) which was extirpated in Jordan is not found anywhere else in the West Bank. Rare and interesting plants noted include *Ranunculus peltatus*, *Lemna gibba*, *Eleocharis palustris*, *Crypsis factorovskyi*, *Trifolium fragiferum*, *Arum hygrophilum*, and *Glinus lotoides*. As a result of this work the Environment Quality Authority (EQA) declared this temporary wetland the first micro-reserve in Palestine. The Palestine Institute for Biodiversity and Sustainability and the EQA engaged with the local community to protect the area.

Keywords Buffer zones · Protected areas · West Bank · Palestine · Jinsafut pond

Introduction

Palestine is located between Eurasia and Africa and forms the western part of the Fertile Crescent where humans first developed agriculture (Abbo et al. 2022). The unique geography and geology gave Palestine more biodiversity than some countries many times its size (Qumsiyeh and Abusarhan 2021). The diverse habitats cover five ecozones: the central highlands, the semi-coastal region, the eastern slope, the Jordan valley and the coastal region as well as five biogeographical regions (Mediterranean, Irano-Turanian, Saharo-Arabia, coastal, and Sudanese-Ethiopian). In 2022, we engaged in reevaluation of the protected area network and we have designated 27 areas that cover these zones and help preserve our fauna and flora (data unpublished from Environment Quality Authority). Palestine has failed to meet its commitments for protection due to issues of sovereignty

and access and capacity (Garstecki et al. 2010; Qumsiyeh and Amr, 2016; EQA 2021; Qumsiyeh and Albaradeiya, 2022). While more studies are needed we note for example that about a third of the plants of the West Bank/occupied Palestinian Territories are rare, threatened, or endangered (Al-Sheikh and Qumsiyeh 2021). It is thus imperative to study fauna and flora especially in areas in or near designated protected areas (EQA 2021).

Vernal pools as “temporary wetlands” in or near protected areas are key habitats for conservation and should be managed carefully especially in light of global environmental threats including climate change (Zedler 2003; Zacharias et al. 2007; Zacharias and Zamparas 2010; Bagella et al. 2016; Boix et al. 2020; Cartwright et al. 2022). In the course of work reevaluating protected areas we found a vernal pond near Wadi Qana Protected Area that has unique fauna and flora, many not found elsewhere in the Palestinian areas. Here we discuss the findings and importance of management of this temporary wetland.

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Materials and Methods

Wadi Qana Protected Area (WQPA) is a valley in the northern West Bank located on the borders of Salfit and Qalqilia governorates (see Fig. 1). WQPA is rich in biodiversity but this biodiversity is threatened (Qumsiyeh and Alsheikh 2023). WQPA is surrounded by eight Israeli settlements and eight ancient native Palestinian communities. WQPA is a valley located near Salfit and containing seven fresh water springs draining tributaries from the hills to the West. Its habitat is characterized by mixed Mediterranean forest and scrubland. Trees are primarily maquis types like *Phillyrea latifolia*, *Ceratonia siliqua*, *Pistacia lentiscus*, *Pistacia palaestina*, *Quercus caliprinos*, and *Rhamnus palaestinus*. To the north of the valley and between the two Palestinian villages of Jinsafut and Al-Funduq, a small vernal pond was noted coordinates 32°11'4.24"N 35°08'3.69"E. The area where the vernal pool in question was found is about 425 m above sea level, receives 550–600 mm rainfall/year, and the average annual temperature average 12–15 in the winter and in the summer 27–29 C. Winters are mild with very rare periods where temperature reaches freezing points (snow is also very rare and does not usually settle).

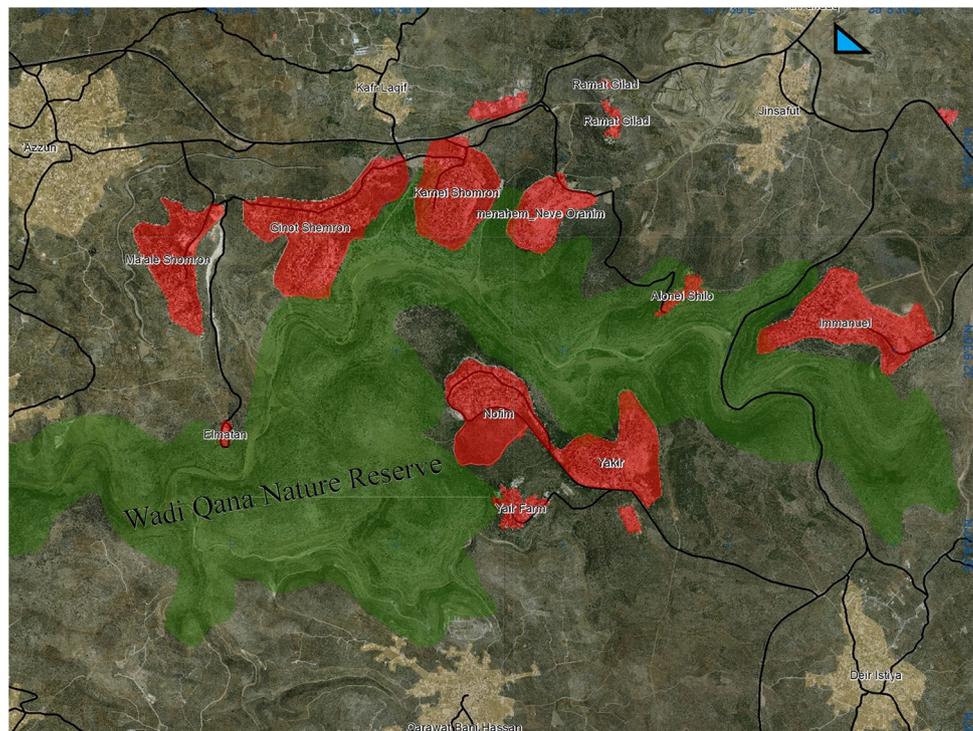
A vernal pool is found near the community of Jinsafut whose residents call this pool “Birkit Uskar”. This temporary small wetland has water from December to June and is surrounded by non-irrigated (rain-fed) agricultural fields (Fig. 2).

We investigated the area over a period of three years. Field trips and observations were done intensively during winter, spring and barely summer over the years 2018–2022. We took data both quantitative (like pool measurements, water characteristics) and qualitative (like presence of species and human interactions) including sampling flora and fauna which were investigated and analyzed in the Biodiversity center at our institute. We also took three newly hatched *Peolobates* tadpoles and five other tadpoles and raised them ex situ to observe developmental stages. Aquatic macrophytes were observed and identified in late winter and early spring and voucher plant specimens were taken for the herbarium. All data and specimens collected are preserved at the Palestine Museum of Natural History (PMNH) in Bethlehem University.

Results and Discussion

The pond is formed naturally in a depression on a mild slope facing west and the pool accumulates rain to its maximum capacity before it spills to the northwest. At the maximum size, the pool which is not quite circular reaches diameter of 38 × 32 m giving it an approximate maximum water surface area of about 950–980 square meter (about a dunum). The PH of the pond is 8.4–8.6 (basic due to the limestone rock escarpment). Elderly locals did state that there were at least two other similar pools in the area but they were developed as residential areas.

Fig. 1 Wadi Qana Protected Area shown in green with Israeli settlements (red) and Palestinian villages marked. The study site of the vernal pool is shown by blue arrow head and is expanded in Fig. 2



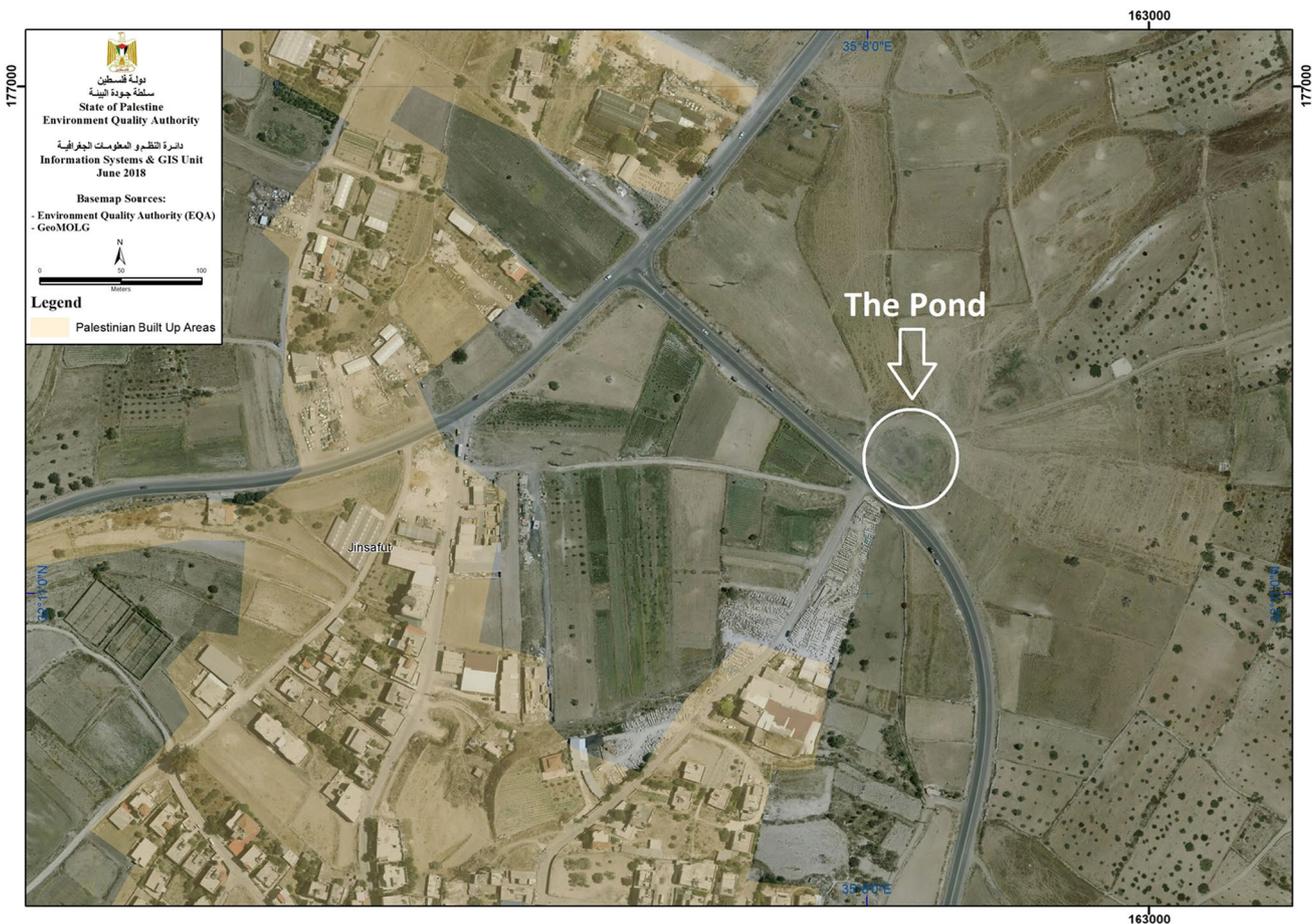


Fig. 2 Location of the Jinsafut vernal pond

Upon discovery of this vernal pool initially by our team in 2017, we commenced more detailed studies. The first thing we noticed was a presence of a threatened species of toad (Syrian Spadefoot toad *Pelobates syriacus*) and the plant (*Ranunculus peltatus*) which we could not find in any other location in the Occupied Palestinian Territories (Fig. 3).

Key Fauna and Flora

Pelobates syriacus, the Syrian Spadefoot Toad was the most obvious large faunal element inside the pond. It is limited in distribution to the unique kind of temporary ponds with characteristic fauna and flora. Adults feed on land arthropods and snails. Tadpoles feed on vegetation like the leaves of duckweed and green stems of *Ranunculus* (from our observations). Toads lay their eggs in early to late February and the tadpoles develop amazingly fast so that in 8–10 weeks they become young adults ready to dig in the slowly drying mud at the sides of the pond. The more remarkable is the appetite and fast weight gain of the tadpoles. Tadpoles of *P.*

syriacus were seen and collected on 2 March 2018 at which time they had measured < 10 mm in length. At that date, crustaceans were common. We reared tadpoles of this species from early March in special containers with Ph adjusted water and both *Ranunculus* and *Lemna* plants. This was done in parallel with tadpoles of *Bufo virides*. The latter length grew about 2–threefold over two months while the former grew some tenfold in length over a similar period. Similar observations were made by Degani (1982) who reported dramatic changes in weight of tadpoles with larva growing from some 80 fold in weight over 10 weeks. We did notice that one of the five tadpoles of equal size when collected as hatchlings metamorphosed almost three weeks after the other four (delayed development) even though they were raised under similar conditions. After metamorphosis, the unique burrowing capability of this toad is critical for its survival when their habitats are dehydrated some 8 months of the year (Degani and Carmali 1988; Székely et al. 2010). Syrian spadefoot toads thus spend much of the year deep under the ground (Goldberg et al. 2009). The Syrian spadefoot toad is critically endangered locally. It was reported

Fig. 3 Picture of the pond at its peak in March 2022 and below is the Syrian Spade-footed toad and close up of *Ranunculus peltatus*



in one vernal pond in north Jordan from 1980–1983 but has since disappeared (Disi and Amr 2010) due to human destruction of its habitat. In the West Bank, this is the only locality for this toad (Salman et al. 2014). The declining populations may relate to environmental changes around the world and is accompanied by declining genetic variation (Degani 2013).

Ranunculus peltatus Schrank (Ranunculaceae) Pond water-crowfoot is the dominant macrophyte found in the pond. It is a submerged, rooted aquatic plant with petiolated leaves with filiform lobes. Blooming: February to April. It is reported as found in northern historical Palestine and this is the only location for it in the West Bank/OPT (<https://flora.org.il/en/plants/RANPEL> Danin 2004). Like other members of the genus, it shows high morphological and phenotypic plasticity that can be partially explained by differences in chemical and physical environment (Garbey et al. 2004). The Jinsafut population consisted mainly of the capillary-leaved

growth form, although a few laminate leaves were observed in February of 2018. *R. peltatus* is not threatened or endangered globally, but is protected or rare in some areas within its range (Lansdown 2013). It is protected by Israeli legislation through the Wildlife Protection Law (Ministry of Environmental Protection, 2010) but is not included in the Israeli Red List (Shmida et al. 2011).

We did note other plants of interest in the vernal pond area:

Lemna gibba L. (Lemnaceae): In historic Palestine, *L. gibba* is most common in coastal and northern areas but extends further south to the Hebron hills (Danin 2004). *L. gibba* is a part of the diet of a broad range of organisms, from insects, to crustaceans, to anurans (including tadpoles of *Pelobates*).

Eleocharis palustris (L.) Roem. & Schult. (Cyperaceae): Found in humid habitats in the periphery of the vernal

pools in the Mediterranean. The main distribution in Historical Palestine is in the coastal Galil and in the middle coast of Palestine (<https://flora.org.il/en/plants/ELEPAL>, Danin 2004). It is extinct from the only site reported in Bethlehem (in 1984, GBIF).

Crypsis factorovskyi Eig (Gramineae /Poaceae): This species is listed mainly in the Galilee and in Sharon Plain and very rarely in other sites except West Bank (<https://flora.org.il/en/plants/CRYFAC>, Danin 2004). The is the first

record of it in the West Bank/OPT growing in the vernal pool after it dries.

Trifolium fragiferum □L. (Leguminosae/Papilionaceae): It is a perennial hemicryptophyte flowering April to October. It is Rare species in the West Bank present in humid habitats in the periphery of some springs and vernal pools. This is the first recorded location in the north of the West Bank.

Fig. 4 Sampling of interesting flora in the area of the vernal pond A *Trifolium fragiferum* B *Glinus lotoides* C *Ranunculus peltatus*, D *Crypsis factorovskyi* E *Arum hygrophylum*, F *Eleocharis palustris*





Fig. 5 Sheep drinking at pond in February 2018

Arum hygrophilum Boiss. (Araceae). This is very rare species noted in very few other localities in the West Bank (Artas, Husan, Nablus).

Glinus lotoides L. (Moluginaceae). This plant is found mostly in the Galilee and the north and is rather rare in the West Bank. Here it was found in the Vernal pool blooming and flowering after the toads aestivated and the bottom of the pond was cracking and semi-dry (see Fig. 4).

Threats to the Unique Ecosystem

There were a number of threats observed during our visits. Sheep from the surrounding area are brought to drink from

the pond, which affects water amount in the pond and the vegetation around it. More than 650 individual sheep were observed using the pond by the PMNH team in one hour (9.2.2018, Fig. 5). In 2018, digging near the pond for a water pipeline connection caused water leakage and quicker drying of the pond but our visit the year after showed presence of similar fauna and flora (recovery).

There is some solid waste dumped in the pond (plastic bottles, cans, occasional tires) which could affect the life of the species that depend on this water source. Our team removed much of this with local help regularly. We also noted wild boars wallowed in the pond frequently. If their numbers increase, they could impact or even destroy this habitat. They need to be controlled or the pond fenced.

The Israeli plans to build a road system connecting settlements with each other on the land where the pond is located would mean the end of the pond ecosystem. This was challenged by local people and the declaration of the area as protected micro-reserve by the Palestinian authority seems to have changed the Israeli planning for the time being. However, there is increased traffic in the streets nearby (the Wadi Qana to Funduq and the route 55 from Qalqilya to Nablus). Cars increased because of increased population both of the native Palestinians and of the Jewish settlers.

Management Issues and Recommendations

Buffer zones around forested areas like Wadi Qana are critical for protection (Kuglerová et al. 2014). As the population

My Dearest Visitor

You are standing in front of a natural heritage site and a rare and endangered ecosystem
Conserving it is everyone's moral and national duty

Location: Oskor pond is located north of the Qana Valley at the entrance to Jinsafut village/ Qalqilia governorate

Here is a natural pond where the rainwater collects in the winter until the beginning of the summer due to a unique geologic formation. This ecosystem contains an endangered species, as Syrian Spade-footed Toad (*Pelobates syriacus*) which is already extirpated in Jordan and found nowhere else in the West Bank except here.

Also, the Pond Water-crowfoot (*Ranunculus peltatus*) which is a flowering plant that is rare in our region. In addition, there are several types of crustaceans and water lentils that disappear with the dryness of the pond and reappear again when filled with water.

We call upon you to protect this endangered Palestinian heritage. Such protection is a national duty and enriches our ecological system and our wealth.

Environmental Quality Authority
Palestine Museum of Natural History/ Bethlehem University
State of Palestine
First Council of Services (Jourat Amra)

أخي الزائر الكريم...

أنت أمام موقع تراث طبيعي ونظام بيئي نادر ومهدد بالانقراض الحافظ عليه مسؤولية وطنية وأخلاقية، فكن ممن يساهمون في المحافظة عليه

الموقع: تقع بركة سُسُكر شمال وادي قانا على مدخل قرية جينصافوط/ محافظة قلقيلية.

هنا بركة طبيعية (بالوع) تتجمع فيها مياه الأمطار في فصل الشتاء حتى بداية فصل الصيف وذلك بسبب الطبيعة الجيولوجية والتكوين الصخري الفريد للبركة. يوجد في البركة نباتات وحيوانات نادرة لم يتم إيجادها في أي مكان آخر في الضفة الغربية وهي الضفدعة السورية ذات الأرجل الحرفية (*Pelobates syriacus*) وهي نوع انقرض من الأردن ومهدد بالانقراض في الضفة الغربية. و أيضا زهرة الحوذان الصفيف (*Ranunculus peltatus*) وهي زهرة مائية فريدة لم تسجل في أي مكان آخر في الضفة الغربية.

يوجد في البركة عدة أنواع من القشريات التي تتغذى عليها الضفادع بالإضافة إلى نبات عدس الماء التي تختفي مع جفاف البركة وتعاود الظهور عند امتلائها بالماء.

ندعوك للمحافظة على هذا الإرث الفلسطيني المهدد بالانقراض لأن الحفاظ على ثرواتنا الطبيعية واجب وطني يساعد على ازدهار بيئتنا والتنوع الحيوي الموجود فيها.

سلطة جودة البيئة
متحف فلسطين للتاريخ الطبيعي/ جامعة بيت لحم
المجلس الأول للخدمات المشتركة (جورة عمرة)

Fig. 6 Sign enacted at the new micro-reserve area

grows (of both Palestinians and settlers) in this area, the pressure on vulnerable habitats like this increases. As the only vernal pool of its type in the areas of the nascent state of Palestine (Palestinian Authority) we believe a proper management plan was needed. We worked with the local communities and created a plan. Early involvement of the communities around these areas was critical in this case. The people of Al-Funduq and Jinsafut were called to meetings and discussing findings and importance of the area. Further we approached schools and did workshops with over 200 school students to increase awareness of this natural heritage treasure in their community.

A comprehensive report including the findings above was submitted by our team to the Environmental Quality Authority (EQA) which then declared this vernal pool a micro-reserve in the buffer zone of WQPA. We believe that protection of vernal pools especially in increasingly urbanized areas is important for conserving biodiversity (Windmiller and Calhoun 2007). Protection of small areas (microreserves) can be challenging but critical to biodiversity (Baldwin and Fouch 2018).

Part of the conservation strategy has to focus on local laws and the Palestinian Authority is now revamping both legislation and local directives relating to such areas. We are also considering globally listing this and other wetlands being studied (RAMSAR convention).

A sign was erected at the pool (Fig. 6) but we believe it is worthwhile to fence in the area as it is relatively small and this will help address both the wild boar and sheep challenge discussed above under threats. The pool maybe enlarged from the higher levels to add more space to enrich the habitat and allow for larger population size (currently estimates for *Pelobates syriacus* are 50–100 individuals).

Conclusion

Working with local communities and national authorities, the project bridged science-policy-practice towards conservation. As a result of this work the Environment Quality Authority (EQA) declared this temporary wetland the first micro-reserve in Palestine protecting a unique vernal pool. The Palestine Institute for Biodiversity and Sustainability and the EQA engaged with the local community to protect the area.

Author Contributions Qumsiyeh, Al-Baradeiya worked on project Design. Handal, Najajreh, Al-Sheikh did data collections. All authors contributed to data analysis and writing. All authors read and approved the final manuscript.

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Data Availability Not applicable.

Code Availability Not applicable.

Declarations

Competing Interests The authors have no relevant financial or non-financial interests to disclose.

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