

Nature Museums and Botanical Gardens for Environmental Conservation in Developing Countries

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Developing countries face many unique challenges that affect the environment, including in economics, in postcolonial development and poor governance structures, in responses to global climate change, and in impoverished educational structure (Kremer et al. 2013). Despite these challenges, we must try to do some things in our countries. The natural-history museums and botanical gardens found in most developed countries promote science, culture, education, and conservation (Suarez and Tsutsui 2004). Their paucity in developing countries, if addressed, can potentially address some of the challenges noted above.

Palestine was subjected to foreign rule for hundreds of years: Ottoman (1516–1917); British (1917–1948); Israeli, Jordanian, and Egyptian (1948–1967); and finally, Israeli (1967–the present). Decades of de-development, the lack of Palestinian sovereignty over natural resources, and politics that trump environmental issues create environmental challenges in Palestine. Significant demographic shifts developed in the past several decades of Israeli–Palestinian conflict. Habitat destruction and environmental declines are notable (Qumsiyeh 1996, Qumsiyeh et al. 2014, Amr et al. 2016). But the question remains: Can little be done on the environmental and science front while we wait for the political situation to be resolved?

During conflicts such as World War II, which lasted a few years, environmental issues are put on hold. But in situations such as this one, in which the conflict is prolonged for decades, we simply cannot afford to wait. The first step is to do proper scientific

research on the status of the environment. In areas such as the West Bank and Gaza, there has been minimal research of any sort, and most of the meager work done is not in areas such as healthcare, agriculture, and the environment. Environmental education and awareness are also minimal and face many challenges (Qumsiyeh and Amr 2016).

Although many countries now recognize Palestine as a state, it is a state under foreign military occupation. The “state” is dependent on foreign aid and without sovereignty, including over its natural resources. But a group of nature enthusiasts decided that we must try some things, even under occupation. The Palestine Museum of Natural History (PMNH) and its Palestine Institute of Biodiversity and Sustainability (PIBS) at Bethlehem University were established in 2014 with the mission to research, educate about, and conserve our natural world, culture, and heritage and to use knowledge to promote responsible human interactions with our environment. Ambitious goals were set, including the following:

- explore the diversity of the fauna, flora, and human ethnography via collections and scientific research that includes morphology and genetics;
- protect the environment and promote responsible interaction between people and the environment;
- use the knowledge gained, as well as books, databases, and collections, to promote science education;
- develop and increase respect (a) for ourselves (self-empowerment),

(b) for our fellow human beings (regardless of background), and (c) for all living creatures and our shared Earth; and

- use research results in areas such as history, culture, permaculture, and biological control to nurture sustainable communities.

PMNH/PIBS depended mostly on volunteers and local donations but now has begun to garner outside interest and support and is growing rapidly. Even in the situation of occupation and with minimal resources, we were able to study the biodiversity of mammals (see the references cited in Qumsiyeh 1996), scorpions, lepidoptera, orthoptera, freshwater snails, amphibians, and reptiles. We also measured the loss of biodiversity in the Bethlehem region (Qumsiyeh 1996, Qumsiyeh et al. 2014, Amr et al. 2016). We published more than 20 research papers in areas ranging from taxonomic studies and biodiversity to environmental pollution and museology (see www.palestinature.org/research).

We used the museum, botanical garden, and permaculture facility for a number of educational projects for area schools and universities. Several student-led initiatives at area schools have begun already, including environmental clubs and school gardens. We reached out to isolated and underprivileged communities and improved science education at both the primary school and university level. We developed an environmental impact assessment unit and contributed to a management plan for the first OPT protected area. We provided consultancy services to

the nascent Palestinian governmental agencies (e.g., Ministry of Health, Environmental Quality Authority, Ministry of Tourism, and Ministry of Agriculture) that also helped in compliance with international treaties such as the Convention on Biological Diversity. We also transformed a neglected 0.12-hectare area into a nascent botanical garden and permaculture facility (including beekeeping, aquaponics, and aquaculture). This site was used to develop ideas (e.g., green walls and composting) that are now being transferred to farmers and other members of the community. For a short video of our activities over the past 2 years, see <https://youtube/BPhFLOsEIMO>.

Future directions

Rooted in grassroots actions and volunteerism, the PMNH/PIBS structure ensured a broad base of support to create the change we desire, even in very difficult circumstances. Our ambitious plans going forward include doing more applied research in areas such as biological control, permaculture, and sustainability. We can use existing research data to advance wider conservation efforts (e.g., using data on

potential economic benefits; Görlach et al. 2011). We plan to expand our educational efforts to more schools and universities and leverage this and our wider network in the direction of environmental conservation (thinking globally and acting locally). Our experiences, which we are happy to share in more detail with others in developing countries, provide hope. Even in conflict zones, much can be achieved with good will and collaborative volunteer efforts.

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