

Efforts towards a more collaborative and anti-colonial research, co-constructing mycorrhizal research in the Atacama Desert

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In December 2023 we set out on a joint expedition between the Society for the Protection of Underground Networks (SPUN) and the Environment Unit of the Council of Atacameños Peoples. SPUN is an international nonprofit scientific organization dedicated to the study and conservation of mycorrhizal fungi. The Indigenous Association Council of Atacama Peoples (CPA) is an organization of traditional authorities and leaders from the 18 communities of the “Atacama La Grande” territory in the Salar de Atacama basin (in northern Chile). Currently, the CPA has an Environment Unit which is constituted of environmental representatives

from the same communities and professionals, mostly from the Lickanantay community, who ensure the protection of the water and ecosystems of the Lickanantay territory in the Salar de Atacama basin and in the highlands of the Andes Mountain Range. For more than 30 years, this Indigenous organization has been the entity that has ensured the defense and interests of the territory, and particularly since 2015 the work expanded to fulfill environmental compromises to support the communities that are part of it.

This expedition was neither the beginning nor the end of the joint work: it was the meeting space to



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better understand the diversity of mycorrhizal fungi in the Lickanantay territory, in what today is deemed as “the Antofagasta Region of Chile”. This territory is part of the Lickanantay peoples ancient lands, way before Chile existed as an State. For this purpose, a transdisciplinary team was brought together to share expert knowledge from the Lickanantay and Western scientific perspectives at the anthropological, mythological,

ecological, and local knowledge levels.

The collaboration began in March 2023 after defining the common interest in exploring mycorrhizal fungal biodiversity of the middle zone of the Atacama Desert, about which very little or practically nothing is known in terms of the biodiversity and functioning of mycorrhizal fungi (Marín et al. 2022). The information gap and the need to better grasp the role of this group of fungi in these

ecosystems gave rise to a project that involved several phases. Regarding agricultural systems, the CPA's Environment Unit was interested in better understanding the effect of traditional flood irrigation on the soil when compared to newer technical irrigation methods. As drought becomes an increasingly menacing problem, particularly in this region, new irrigation technologies can serve to maintain higher levels of yield production. This is particularly

important since arbuscular mycorrhizal fungi have been shown to increase grain yield at a global scale (Zhang et al. 2019) and drought tolerance in crops (Mathimaran et al. 2017).

This collaboration is part of a series of efforts to move beyond dominant ways of doing extractive and colonial science and instead co-construct science. As Whitt (2009), Kimmerer, (2020), Trisos et al. (2021), Ferdinand and Smith (2022), and Hirschfeld et al. (2023), have already highlighted,

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the scientific practice of ecology is embedded in deeply colonial roots. This practice is particularly strong in global soil research, “where scientists from wealthier nations collect soil samples from less-developed countries, take the samples back to their country for analysis and publish the results with little involvement of local researchers” (Minasny et al. 2020). Thus, it is urgent to decolonize what we consider “expert knowledge”, the very access to science –today highly concentrated in white male scientists from the Global North (Crisos et al., 2021)– and the motivations and methods to carry out research and scientific expeditions.

To begin the dialogue, the first phase consisted of workshops where we explored how the biological sciences understand soil, its components, and its relationship, effects, and interactions with the Fungi kingdom. In turn, these spaces allowed the exchange of ancestral knowledge about these concepts and Atacama Desert ecosystems, where the need to challenge the

dominant references of what constitutes “poor” ecosystems and soils, and the quantitative bias of approaches to “biodiversity” became evident. For the people of the desert, these are not “poor” ecosystems, but rather the expression of sacredness and abundance, where they have lived and thrived for thousands of years. As such, it was vital to re-frame Western science terms so that they could adapt to understanding each territory in its context, and thus encourage respectful dialogue between different knowledge systems.

In this way, the expedition carried out had several different characteristics associated with the recognition of what it means to carry out scientific work in ancestral indigenous territories. We consider it essential to connect with the Indigenous organizations of the territories and follow their protocols. The Environment Unit of the CPA works with several protocols according to what each community has defined for entering their specific territories, along with the ways in which research should be carried out and

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information should be safeguarded. Thus, for all sampling points, there was previous work done by the Environment Unit of the CPA; this previous work allowed us to contextualize the communities about the research to be carried out and the samples and protocols to implement (that is: what, why, and how to research before sampling in their territories). Similarly, we worked together to define when the sampling could be carried out, and who would attend

from the Environment Unit of the CPA, SPUN, and members of each community.

The sampling sites were defined primarily by the Environment Unit of the CPA and consulted by the environmental representatives of the communities involved, given the work that they already carry out in the territory and the existing sampling points that the Unit constantly monitors, regarding water and biodiversity, among others. This not only points out local places of interest but also

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provides consistent information with a greater temporal scope. When carrying out the expedition, this not only allowed us to interact on the basis of respect for the ancestral practices and their relationship with the territory, but also allowed us to have local experts who not only knew the species of fauna and flora that were present in each site, but also had knowledge regarding the social, climatic, and ecological changes and challenges that had affected those areas over time (Soto Hernández, 2023).

Considering that for the Lickanantay – Atacameños, the relationship they have with their environment is important, respecting Puri (water), the tutelary hills, and the Patta Hoiri (Mother Earth) was key in the sampling process itself. As such, we followed protocols to better relate with the non-human beings, asking permission from Mother Earth to take samples and therefore, ensuring the health of the human group and the non-human beings in each site, alongside the effectiveness of our expedition. Part of the protocols involved the accompaniment of local community members of the different places where the

samples were taken, with the involvement of those who know their territory best, and with the commitment to return the information to the communities.

At the moment, we are processing the samples. So far, we can say that 35 out of the 41 soil samples collected showed high DNA concentration – something very good and surprising for the driest place on Earth! Subsequently, the scientific analysis work will give way to meetings with the Environment Unit of the CPA to define what results are of interest to them and how to communicate them in ways that are accessible and relevant to the CPA communities. Thus, this experience constitutes a blueprint and an invitation to the scientific community to retrace the colonial practices of the scientific disciplines and build new ways to engage with the local communities that have ancestrally inhabited territories of scientific interest. It is possible that, in this new ecology of knowledge, we will learn much more about the ecology that we seek to expand.

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