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AUULA

Wonder of Arabia

mud bricks, which let in the air to cool the hot nights while protecting the occupants' privacy. The ground floor of the houses was mainly reserved for storage and cooking. These buildings were constructed of handmade mud bricks. Palm tree and other trunks, as well as rails from the Hijaz railway, were used as beams to support the ceilings and roof terraces (fig. 9). Dried and weaved palm leaves and leafstalks covered with earth made up the floorings.

The preliminary study of the AlUla oasis has thus revealed a complex landscape shaped by the distribution of water from the qanats. UCOP has already highlighted the diversity of garden types and a very high density of archaeological remains in the historic part of the cultivated area, attesting to the centuries-old constant remodelling of the space.

Getting to know the soil of the oasis in order to understand both how it functions and its fertility

Marc Ducouso, Marc-André Sélosse, and Hassan Boukcim

The SoFunLand Project (Knowing Soil for a better understanding of its Functioning to improve Land uses and preservation at AlUla) was born from the idea that a harmonious and sustainable expansion of AlUla requires an understanding of the biological composition of the different soils of its oasis and how they function. Soil is the result of a complex alchemy between rock, air, water, and wind, led by life itself: microorganisms and plants as well as animals, from the smallest insects to the people fed by the soil. The AlUla oasis has developed because empirical know-how has enabled humans to make the most of this major component of the ecosystem. Our lack of knowledge of these poorly studied soils led us to gain an initial understanding of them by mapping. In addition to the usual physical and chemical analyses, bacteria and fungi that contribute to the soils' existence have been described thanks to their genetic legacy, with hitherto unprecedented precision for this type of study (one point for each kilometre over more than 1,000 km).

The project then focused on developing a comprehensive understanding of how plants function in interaction with the soil's microorganisms. The former developed a network of several kilometres of roots per square metre, while the latter formed networks of microscopic filaments that can reach 200 m per gram of soil. And it is often the case that roots and filaments help each other: the fungus exploits the soil in exchange for sugars from the plant. That is how the *Terfezia* species, commonly known as desert truffles and much appreciated by food lovers, came into being at AlUla. Understanding how plants function at AlUla has provided indicators for sustainable management and the tools for ecological restoration. Finally, the SoFunLand team, in consultation with



Fig. 10. Canopy of date palms (*Phoenix dactylifera* sp.) in a garden of the old AlUla palm grove, 2020.



Fig. 11.
A sedentary owner in the old AIUla palm grove holds two types of *barniyy* dates: the top quality, the *mabrûm*, in his right hand; one of inferior quality, the *abû qushayrah* (here combining the *mashrûk* and the *'ādî*), in his left.

Fig. 12.
Young accidental date palm seedlings growing in a garden, which will be removed by the grower, 2020.



archaeological teams, is attempting to identify microbial markers of past human activity. In future, these analyses may be used to identify sites that have eluded traditional methods of archaeological survey.

Varietal diversity and cultivation practices of the date palm in the AIUla oasis

Vincent Battesti and Muriel Gros-Balthazard

The date palm (*Phoenix dactylifera* sp.) (fig. 10) has been grown for millennia in Western Asia and North Africa. This palm is the flagship species of the oasis agrosystem. In the AIUla oasis, the date palm has been exploited and cultivated for more than 3,000 years for its fruit rich in sugars, and for the materials it provides for construction, basketry, etc. Dates have long been both a staple food and a product of exchange. Hundreds of varieties of date palms have been identified throughout the world. The taste, sweetness, size, shape, and colour of the dates vary according to the variety, each bearing its own name. At AIUla more than 90 varieties of date grown by farmers today have been identified and described by the AIUla Date Palm Agrobiodiversity Project. Today, the most common are the *barniyy* (fig. 11) and, to a lesser degree, the *helwah hamrâ*.



Fig. 13.
Male date palm flower harvested
for hand pollination, 2020.

Reproduction of female date palms is done by clonal propagation: the grower detaches the suckers from the foot of the female date and replants them elsewhere. In turn, these suckers produce their own propagated suckers bearing the same variety name. In this way the grower creates a cultivar, in other words a population of clones (genetically identical individuals) with dates of identical quality. Our research has recently shown that the *barniyy* is one of those cultivars. This practice enables the production of dates of the desired quality. As for the male date palms, they come from seeds that have accidentally germinated in the date palm grove (fig. 12), although the growers at AIUla do keep some clonal strains. Male date palms are generally removed because, in groves with limited soil and water resources, preference is given to the female plants, which produce the fruit. A small number (less than 5%) are spared and used to pollinate the female plants (fig. 13), a laborious but necessary manual operation to guarantee a good yield (fig. 14).

The number of varieties and the genetic diversity of the date palm are broadly unknown, with most of the studies around the world concentrating on elite cultivars without taking into consideration the knowledge and

know-how of local growers. They do not recognize the growers' system of denomination and categorization of date palms as a living system. Yet, this hidden diversity is a priceless heritage and a valuable asset because it constitutes a resource for adapting agrarian systems to global changes. At the AIUla oasis, social scientists and biologists are working together to assess this diversity and reconstruct the history of the oasis in order to preserve it for future generations.

Towards an agricultural revival of the oasis

Stéphane Forman and Élisabeth Dodinet

At the historical core of the oasis, ranging from north of Dadan to south of the Old Town, it is estimated that 600 ha are still cultivated, with about 120,000 date palms and almost 15,000 citrus fruit trees. However, the area has been partially abandoned and the crops grown today are not sustainable.

The commitment to an agricultural revival within the AIUla oasis, in the framework of a strategic plan by the Royal Commission for AIUla in cooperation with the



Fig. 14. Pollination of the female date palm: the strand (spikelet) of a male flower (browner in colour) is attached by the grower to the female flower that will soon form the date cluster, 2020.

Agence française pour le développement d'AlUla, would convert it into a space of well-being for both visitors and local communities (environment, renewal, authenticity, stimulation of the senses), as well as protect this exceptional landscape. It would also allow for the development of an economic sector with great potential, supplying products from the local land, such as the *barniyy* variety of date, the Arabian moringa, and notable citrus fruit such as the distinctive citron hybrid identified in some groves and locally called *turunj*.

The aim of this agricultural revival, guided by the knowledge generated within the framework of the oasis research programme, is to create both a model and the tools that will enable this oasis, dating back thousands of years, to respond to obligations that are sometimes difficult to reconcile. It will need to be sustainable, in other words to preserve underground water resources, protect the soils and biodiversity, contribute to a positive carbon footprint, and involve communities and local growers in an all-inclusive way. Research undertaken on the soils, water, and cultivation practices serves this objective. Farmers must be able to benefit from the economic consequences of ever-expanding tourism in the oasis, which must provide the inhabitants and visitors

with local, high-quality produce, whether unprocessed (fruit and vegetables) or processed (jams, candied fruits, oils, honey, etc.). This is especially true for the so-called priority industries—date, citrus, moringa, and small livestock farming. Ultimately, it is a case of making the agricultural sector attractive again, especially for the young people of AlUla. This also includes rationalizing and securing rights of use as well as access to the land. This process will take time but is anchored in the desire to pass on an inheritance to future generations.