

Promoting agroecology as an appropriate response to the challenges of drought in oasis systems

Adeline DERKIMBA (CARI)

Adel MOULAI (association El Argoub)

In an environment that is changing climatically, economically and socially, the oases of North African countries are facing major challenges in terms of their sustainability, even though they represent the last bastions at the gateway to the desert. These agro-ecosystems are gradually deteriorating in the face of increasingly severe climatic constraints (including recurring catastrophic droughts), ill-adapted national agricultural policies, and the difficulty of seeing the emergence of an attractive form of agriculture that will drive the development of these rural areas. Today, oasis farms are particularly vulnerable and are no longer able to provide sufficient agricultural production for these areas.

In Algeria, to support the development of peri-oasis areas that are resilient in the face of climatic incidents such as drought, the principles of agroecology are a godsend, and improved support mechanisms for oasis agroecology are needed.

Algerian oases: why the principles of agroecology are a godsend to limit susceptibility to drought

Agroecology is based on management principles based on respect for natural cycles and optimal use of resources, summarised in the "10 Elements of Agroecology" (FAO, 2018^[1]). Although its practices vary depending on the context (Altieri *et al.*, 2015^[2]), its potential for improving the productivity and sustainability of agricultural systems with limited resources is recognised scientifically (Debray *et al.*, 2019^[3]) and acclaimed by civil society (GTD, 2013^[4]). Although the specific benefits of agroecology in the face of drought are still poorly documented, initial studies are showing promising results.

The viewpoint of oasis farmers

As part of the **work^[5] carried out in the M'zi valley (wilaya of Laghouat)**, local farmers have identified several expected effects of agroecological practices to reduce the sensitivity of oasis farms to drought.

Faced with the environmental impact of drought, agroecology has a favourable effect on saving water resources.

→ In arid environments, water resources are structurally crucial in the construction of farmers' strategies for their production systems and are one of their major concerns: the need to limit crop water requirements, optimise water use and limit losses in the production system. This concern has traditionally been managed through the staged system in the oasis agrosystem, but still represents a challenge requiring innovation in peri-oasis systems.

^[1] FAO, (2018.) The 10 Elements of Agroecology: Guiding the Transition Towards Sustainable Food Systems. <https://www.fao.org/agroecology/overview/the-10-elements-of-agroecology/en>. Those elements are: Diversity, Synergies, Recycling, Human and social values, Responsible governance, Resilience, Efficiency, Co-creation and sharing of knowledge, Culture and food traditions, Circular and solidarity economy.

^[2] Altieri, M.A., Nicholls, C.I., Henao, A. & Lana, M.A. (2015). Agroecology and the Design of Climate Change-Resilient Farming Systems. *Agronomy for Sustainable Development*, 35, 869–890. <https://doi.org/10.1007/s13593-015-0285-2>

^[3] Debray, V., Wezel, A., Lambert-Derkimba, A., Roesch, K., Lieblein, G. & Francis, C.A. (2019). Agroecological Practices for Climate Change Adaptation in Semiarid and Subhumid Africa. *Agroecology and Sustainable Food Systems*, 43, 429–456. <https://doi.org/10.1080/21683565.2018.1509166>

^[4] GTD (2013). Agroecology, a transition towards sustainable lifestyles and development - Stakeholder voices. https://www.google.com/url?sa=t&source=web&rct=j&opi=89978449&url=https://www.avsf.org/app/uploads/2023/12/agroecologie_paroles_acteurs_gtd_cari_avsf_2013.pdf

^[5] In the NATAE project (www.natae-agroecology.eu), this qualitative analysis of what farmers in the area had to say was carried out through a participatory workshop organised in 2024, with the aim of characterising and prioritising the relevance of 8 agroecological practices in relation to the specific issues facing the area. The methodology was developed by the project's scientists.

Three agroecological practices are prioritised by farmers as potentially relevant to meet this challenge: the use of **humidity sensors and precision irrigation equipment** to provide the exact amount of water required by the date palm, improving the soil's water retention capacity through **composting, and planting multi-species windbreaks** to limit losses linked to evapotranspiration and provide a complementary source of income. According to the farmers, these three practices are particularly well-suited to meet the challenges posed by water resources, and they also emphasise the beneficial collateral effects that combining these practices could have on soil preservation and the maintenance of biodiversity.

Faced with the economic impact of drought, agroecology has a favourable effect on improving farm productivity and securing income.

→ Farm productivity, which is a major concern for farmers, can be improved by combining a number of agroecological practices directly linked to **production** (increasing soil fertility through composting and precision irrigation equipment) and product **processing** (dates downgraded to jam and vinegar, for example).

→ Farmers' incomes, for their part, are strongly correlated with **their capacity to process** products such as milk and dates, but also with the way in which **the organic matter content of the soil is managed** (composting).

According to the farmers, composting, the use of windbreaks/wooded strips and date processing would be particularly well suited to meet the challenges of economic resilience in the face of drought, by improving the diversity of sources of income and limiting the impact of drought on the productive capacity of the oasis system.

Results of a situational assessment

As part of a **study^[6] carried out in the M'Zab valley (wilaya of Ghardaïa)**, in the peri-oasis area of N'Tissa, CARI identified a number of factors illustrating the reduced sensitivity of agroecological farms to drought.

Faced with the environmental impact of drought, agroecology is demonstrating its positive effect on soil quality and water management.

→ The nutritional balance of the soils in the N'Tissa valley is very fragile: analyses reveal alkalinisation of the soils and a very low organic matter content. The results show that a better balance is possible when several agroecological practices are combined on the same plot (regular inputs of manure, inputs of silt, drip irrigation). These plots have a more favourable physical structure, with a water infiltration capacity described as 'rapid' (75mm/hour), as well as better availability to assimilable mineral elements and water retention.

→ The systems that make the best use of water resources combine three essential practices: multi-storey farming with date palms, generating a microclimate that reduces water consumption by 40% compared with conventional systems; the use of manure and silt to improve soil structure and moisture; and the use of windbreaks to protect crops from hot winds and limit evapotranspiration.

These combined practices optimise soil quality and water management, resulting in more stable yields with less inter-annual variability.

^[6] This study, commissioned by COSTEA (Comité Scientifique et Technique Eau Agricole), was carried out between 2021 and 2022 by GTAE on 6 irrigated systems in three countries. The Algerian part was carried out by CARI (Centre d'Actions et de Réalisations Internationales) in partnership with APEB (Association pour la Protection de l'Environnement de Beni-Isguen) and with the support of CREAD (Centre de Recherche en Économie Appliquée pour le Développement) : https://www.cariassociation.org/wp-content/uploads/2026/05/L2_COSTEA_Rapport-evaluations_ALGERIE_VF2.pdf

Faced with the economic impact of droughts, agroecology is showing its favourable effect by diversifying income, reducing costs and reducing dependence on energy.

→ The main sources of income for agroecological farms are arboriculture (36%), date palm (32%) and goat rearing (21%). This diversification makes it possible to take advantage of the combined effects of the date palm's shade, the exploitation of by-products and the contribution of manure by the livestock.

→ In terms of the breakdown of costs, the largest item is inputs, particularly the purchase of manure (35% of costs), which the farm cannot produce itself. On the other hand, energy costs (electricity and diesel) are limited to 3% compared with 8.5% for conventional farms, thanks to water optimisation through the multi-storey system and improved soil water retention.

→ Overall, these farms show the best profitability per hectare and the best gross and net added values. Indeed, comparative analyses in the M'Zab valley show that highly agroecological farms generate a profit/expense ratio of 1.95, higher than conventional systems. Agroecological systems also consume less water (25,363 DA/ha/year of electricity for irrigation, compared with 40,031 DA/ha/year for conventional systems) and use inputs more efficiently. Although yields are slightly lower (but more regular over time) in agroecological systems, the lower chemical input costs (only 11.9% compared with over 35% in conventional systems) mean better overall profitability.

Promoting agroecology as an appropriate response to the challenges of drought in oasis systems

An analysis of oasis farming systems, particularly in Algeria, demonstrates the significant potential of agroecology as a response to the growing challenges of drought (both in terms of what stakeholders say and in terms of evaluation results). This approach is relevant on several levels. In environmental terms, agroecological practices are demonstrating their effectiveness through remarkable optimisation of natural resources (water, soil, etc.). Economically, the strength of agroecological systems lies in their strategic diversification, their capacity to improve productivity, reduce costs and retain added value in production areas.

The results observed in the M'Zi and M'Zab valleys show how agroecology can reduce the vulnerability of farming systems to drought. This reduction is achieved both by reducing sensitivity to direct impacts and by strengthening the overall resilience of the system. By building on traditional principles while adapting them to contemporary challenges, the agroecological approach offers a viable model for agricultural development in these areas. It demonstrates that it is possible to reconcile agricultural productivity, preservation of natural resources and economic resilience, even in restrictive environmental contexts. However, the widespread adoption and development of these agroecological practices will require appropriate institutional support and greater recognition of their potential in national agricultural policies. This institutional support is crucial as the agroecological transition is facing concrete challenges on the ground. Farmers have to overcome an adaptation period of 2 to 3 years, during which yields may temporarily fall before the full benefits become apparent. In addition, dependence on external organic inputs could limit the spread of these practices on a large scale without an appropriate supply strategy. These technical constraints are also accompanied by financial barriers, with the need to install water-efficient irrigation systems, set up moisture measurement instruments to ensure efficient irrigation management and establish windbreaks and/or wooded strips requiring substantial initial investments that are rarely accessible to smallholders.

→ Towards the necessary improvement of agricultural research and advisory systems:

- Research and development work on agroecological practices and systems and the resulting innovations in the oasis environment must be stepped up, while creating interfaces to facilitate the transfer of techniques to all actors in the agricultural world.
- Local facilitators from decentralised State structures (Agricultural Services Department, etc.) need to be trained in the results of research (agroecological reference systems in oasis environments) to be able to support farmers in transition.
- A specialised oasis agroecology advisory service, staffed by technicians trained in local practices, should be able to provide personalised support.
- Farmers need to be brought up technically on the agroecological transition, through extension, training and support for this transition, but also through experiments on their farms to encourage collective capitalisation.
- Establishing a network of pilot demonstration farms should facilitate peer learning, while integrating an agroecological curriculum specific to drylands into existing agricultural training courses would ensure that knowledge is passed on.

→ Towards urgent changes in public support systems to facilitate the transition:

- The agroecological transition must be seen as a priority in development programmes, and as a tool for sustainability that helps to ensure food sovereignty for local areas.
- Incentives, public aid and support for the transition of farms to agroecology must be integrated into the State's agricultural development programmes.
- Specific financial mechanisms need to be created, such as targeted subsidies for irrigation management and windbreaks, subsidised loans for the agroecological transition, and systems of payments for environmental services to promote carbon sequestration and the preservation of oasis biodiversity.
- The contribution of agroecological production systems to improve the quality of food products and their positive impact on consumer health must be better promoted and highlighted by agricultural development campaigns.
- The creation of an "Oasis Agroecology" label would enable products to be marketed more effectively, complemented by the development of collective processing units and the establishment of short circuits between oasis producers and urban consumers. These initiatives could increase the added value captured locally.
- The social value and attractiveness of agricultural professions, particularly those geared towards agroecology, must be integrated into public policies, thereby facilitating the creation of jobs in these eco-social niches.



Funded by the European Union under grant agreement no. 101084647. However, the views and opinions expressed are those of the author(s) only and do not necessarily reflect those of the European Union or the European Research Executive Agency (REA). Neither the European Union nor the granting authority can be held responsible for this. For the partner associated with the NATAE project, this work received funding from the Swiss State Secretariat for Education, Research and Innovation (SERI).

Project funded by
Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra
Swiss Confederation
Federal Department of Economic Affairs
Education and Research ERM
State Secretariat for Education,
Research and Innovation SERI