ARPHA Conference Abstracts 8: e155246
doi: 10.3897/aca.8.e155246

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Conference Abstract

An integrated socio-techno-ecological framework to address desertification in Crete

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Received: 08 Apr 2025 | Published: 28 May 2025

Citation: Nikolaidis N, Lilli MA, Nikolaidis K, Efstathiou D, Nikolaidis NP (2025) An integrated socio-techno-ecological framework to address desertification in Crete. ARPHA Conference Abstracts 8: e155246. https://doi.org/10.3897/aca.8.e155246

Abstract

Science has documented a long list of alternative solutions that relate to sustainable land use practices that can be adapted to reverse the adverse impact of climate change and desertification. In addition, there are tools and models that can be used to evaluate the trade-offs between the different alternatives and identify optimal solutions that restore soil ecosystem services. As part of the IRISCC project (https://www.iriscc.eu/), these tools and solutions will be used to develop integrated research and knowledge services that will drive effective climate action.

The overall objective of this work is to **develop an integrated socio-techno-ecological methodology to address soil degradation and desertification** in the Messara and Asterousia regions of Crete by identifying key adaptation and mitigation actions and facilitating regional government agencies to develop local level Strategic Plans to mitigate desertification. This methodology has the potential to be the backbone of a service to local and regional authorities for the development of strategic planning that would be co-designed with stakeholders to address local challenges. Land degradation in the study area is primarily caused by unsustainable agricultural practices, animal grazing and anthropogenic pressures that have been extenuated by the impacts of climate change. The natural topography is characterized by steep slopes which in combination with extensive grazing create conditions prone to soil erosion (Jucker Riva et al. 2017). Land use and vegetation cover have had a severe effect on water run-off

causing land degradation and soil erosion especially during olive and vineyard tillage period (Karamesouti et al. 2015). The consequences of over-grazing are high water run-off, sediment loss and high soil temperature (Kairis et al. 2015Table 1).

Table 1.

IRISCC Science proposition.

Water Security	**Environmental Sustainability**
Reduce losses (repair the water network infrastructure)	Phytoremeditation of contaminated water and soils
Efficient irrigation practices, through for example drip irrigation, using of soil moisture sensors, or irrigate the tree and not the field.	Plant trees//perennial grass strips for run-off and flooding mitigation
Rain harvesting from greenhouses	Restore wetlands in areas of groundwater recharge
Brackish groundwater desalination	Rivers and streams rehabilitation (e.g. floodplains connectivity for flood mitigation)
Wastewater and tertiary treatment and reuse	Re-vegetation of riverbanks
Runoff reservoir management	Re-meander rivers to reduce speed and mitigate flooding
Water diversions	Constructed wetland for wastewater treatment, water management and carbon sequestration
Energy Security	**Policy Strategies**
Solar power (e.g. grounded PV, floating PV, agri-photovoltaic)	Reduce fragmentation and enhance connectivity in terrestrial ecosystems
Wind power	Maintain and enhance natural ecosystems
Food Security	Establish new protected areas where relevant/possible
Agro-ecological practices	Monitoring (Assessment of NBS benefits, Ecosystem services valuation methods, Bio-indicators)
Grazing management	Farmers capacity training / Information and awareness
Enrichment planting in degraded and regenerating forests	Financial incentives
Hedge and planted fence for biodiversity and soil erosion prevention	Reformulating policies and regulations (Regulations for land planning and land conservation, Biodiversity loss mitigation regulations)
Agroforestry	Adapt innovative business models (Promote cooperatives to create economies of scale, Adapt innovative approaches to value chain)

The methodological approach implemented has three phases (Fig. 1). In the first phase, co-design engagement efforts are initiated with the regional government of Crete and a framework is developed addressing soil degradation and desertification in the Messara and Asterousia regions of Crete. In collaboration with the regional government, the objective of action is defined, and stakeholders are identified. The co-design engagement approach is established, and all relevant knowledge input is identified. In the second phase, a baseline narrative is created from the existing knowledge and data collected and a science proposition is developed. The objective of the science proposition is to develop a list of alternatives (Table 1) that can be used alone or in combination to alleviate the impacts of desertification. These solutions address all the aspects of the Water-Energy-Food-Ecosystem NEXUS aiming for security of resources while maintaining and enhancing ecosystem sustainability. These solutions will be presented to stakeholders in order to assess their viability, what roadblocks are preventing their implementation, which ones are most appropriate for the region and to assess if the community has the capacity to implement these solutions. Based on the science proposition, stakeholders are asked to set priorities which will be evaluated based on similarities and to select alternative solutions; again, evaluated based on similarities and whether there were conflicts in perceptions. Certain scenarios will be run, this will be done through multi-criteria analysis and ranking. The co-design strategy is modified and improved to the stakeholder needs and perceptions and the selection of alternatives/ solutions is designated. Accordingly, a roadmap for implementation is created, including measures in legislation and funding mechanisms. The third phase concerns scaling up the knowledge and includes two parts: the education and training phase and communication and dissemination phase. A communication strategy will be launched through social media and a webpage and training workshops.

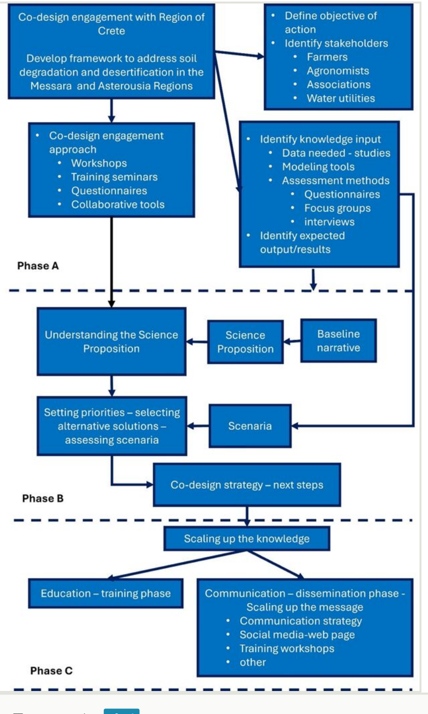

Figure 1. doi

Innovative framework for the co-design of strategic planning to combat desertification.

The integrated socio-techno-ecological framework that will be used in Crete will be widely applicable and developed as a research infrastructure service. The service will benefit, in addition to the Regional Government, the local water utility companies by reducing cost of production, the agronomists by promoting collaborations and increasing profit, the farmers by improving soil fertility and increasing production and quality of produce and the regional government by improving environmental management, mitigating desertification and encouraging social cohesion.

Keywords

Socio-techno-ecological framework, stakeholder engagement, desertification, strategic planning, science proposition, nature based solutions

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Presented at

ORAL

Acknowledgements

This work was supported by the European Union through its Horizon Europe programme (GA number 101131261 — IRISCC — HORIZON-INFRA-2023-SERV-01).

Funding program

Horizon Europe programme

Grant title

101131261

Conflicts of interest

The authors have declared that no competing interests exist.

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