

## Investigation of Natural Resource Sufficiency for Development of a Sustainable Agriculture Strategy Based on Permaculture in Malta

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**Abstract :** Typical of the Mediterranean region, the Maltese islands exhibit calcareous soils containing low organic carbon content and high salinity, in addition to being relatively shallow. This has led to the common practice of applying copious amounts of artificial fertilisers as well as other chemical inputs, together with the use of ground water having high salinity. Such intensive agricultural activities, over a prolonged time period, on such land has led further to the loss of any soil fertility, together with direct negative impacts on the quality of fresh water reserves and the local ecosystem. The aim of this study was to investigate whether the natural resources on the island would be sufficient to apply ecological intensification i.e. the use of natural processes to replace anthropological inputs without any significant loss in food production. This was implemented through a sustainable agricultural system based on permaculture practices. Ecological intensification following permaculture principles was implemented for two years in order to capture the seasonal changes in duplicate. The areas dedicated to wild plants were only trimmed back to avoid excessive seeding but never mowing. A number of local staple crops were grown throughout this period, also in duplicate. Concomitantly, a number of practices were implemented following permaculture principles such as reducing land tilling, applying only natural fertiliser, mulching, monitoring of soil parameters using sensors, no use of herbicides or pesticides, and precision irrigation linked to a desalination system. Numerous environmental parameters were measured at regular intervals so as to quantify any improvements in ecological conditions. Crop output was also measured as kilos of produce per area. The results clearly show that over the two year period, the variety of wild plant species increased, the number of visiting pollinators increased, there were no pest infestations (although an increase in the number of pests was observed), and a slight improvement in overall soil health was also observed. This was obviously limited by the short duration of the testing implementation. Dedicating slightly less than 15% of total land area to wild plants in the form of borders around plots of crops assisted pollination and provided a foraging area for gleaning bats (measured as an increased number of feeding buzzes) whilst not giving rise to any pest infestations and no apparent yield losses or ill effects to the crops. Observed increases in crop yields were not significant. The study concluded that with the right support for the initial establishment of a healthy ecosystem and controlled intervention, the available natural resources on the island can substantially improve the condition of the local agricultural land area, resulting in a more prolonged economical output with greater ecological sustainability. That being said, more comprehensive and long-term monitoring is required in order to fully validate these results and design a sustainable agriculture system that truly achieves the best outcome for the Maltese context.

**Keywords :** ecological intensification, soil health, sustainable agriculture, permaculture

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