BIODIVERSITY MONITORING

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LEMNOS

Northern wheatear (*Oenanthe oenanthe*) © Lefteris Kakalis

LEMNOS IS AN ISOLATED GREEK ISLAND IN THE NORTH AEGEAN SEA.

Unlike other islands in the area, it is characterized by an extensive network of wetlands and a generally low topography. Apart from wetlands, its surface of 477 km^2 possesses a great variety of landscapes, from volcanic formations to inland sand dunes or extensive grazing areas.

Agriculture and pastoral activities are deeply tied to the history and culture of the island: arable lands account for a third of land use, while another third is used as grazing areas covered with low vegetation. One important cultural feature is the traditional ***mandra***[1], a complex farming structure using natural materials and sheltering the *kehaghiades*[2] and their herds. *Mandra* agricultural system in Lemnos is also characterized by an extensive agricultural system, crop diversity, fallow land practices and grazing land rotation using local breed creating a notable mosaic.

Landscape diversity and agricultural practices give Lemnos a high ecological value, with 1,050 plant species, 222 bird species, and a wide variety of insects and arthropods.

However, the transformation of the agricultural landscapes as a result of farming intensification in the lowlands and land abandonment in the remote areas, together with neglect of traditional *mandras* being replaced by modern greenhouse-like constructions, is linked to environmental problems such as biodiversity loss, soil erosion or desertification, which in turn impact the cultural value of the island.

1 traditional farms built to house and serve the needs of the Lemnian "kehaghiades"

2 traditional Lemnian stock-breeders and farmers

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Alliance for Mediterranean Nature & Culture

MAVA FONDATION POUR LA NATURE

Common corn-cockle
(*Agrostemma githago*)

1. OBJECTIVES

The general aim of the project is to build a common vision for sustainable development of Lemnos island based on conservation of the traditional *mandra* system by:

- supporting the extensive agro-pastoral practices which favor local biodiversity and shape the landscape of Lemnos,
- re-establishing the links between arable farming and stock-breeding.

Restoring the *mandra* system would allow the conservation of biodiversity, halt the degradation of soil (desertification) and enhance resilience to climate change by reversing landscape homogenisation. The aim is not to maintain the agriculture of the past but conversely to adapt the traditional agricultural system to the evolving socio-economic context.

However, the detailed impacts of different cultural practices implemented in the island remained insufficiently documented and more information was needed to implement adaptive management. Therefore, an important target of the project was to build the knowledge base for the agro-pastoral practices of the traditional *mandra* system and to document their impacts on biodiversity and local welfare.

The surveys took place in 25 Sampling Areas (SAs) selected for being representative of three major landscape types of Lemnos:

(a) Mosaic agriculture: Areas dominated by a patchwork of arable fields, with limited presence of grazing lands in soft hills. Three sub-categories were distinguished based on cultivation type: cereals, legumes, mixed crops (mixed cereals and mixed cereals-legumes).

(b) Mixed rangelands: Areas characterized by close integration of natural grasslands (mostly, but not exclusively, phrygana) and arable fields.

(c) Uniform rangelands: Areas dominated by the presence of natural grasslands (phryganic grazing lands).

SELECTED INDICATORS

Indicators were chosen to highlight changes in the landscape and biodiversity. Various fauna and flora indicators, both wild and domestic, were studied, as well as the abiotic factor of soil (composition, texture, etc).

Cultural features were also taken into account through traditional and semi-natural constructions, since their evolution can give information on environmental prospects.

2. METHODS

The methodology applied to Lemnos is based on a strong naturalist expertise from local, national and international multidisciplinary experts.

150 plots, distributed in the 25 SAs, have been selected by the expert team. Among them, 57 were used for bird sampling, 107 for plants and insects and 61 for soil studies.

2.1. AVIFAUNA

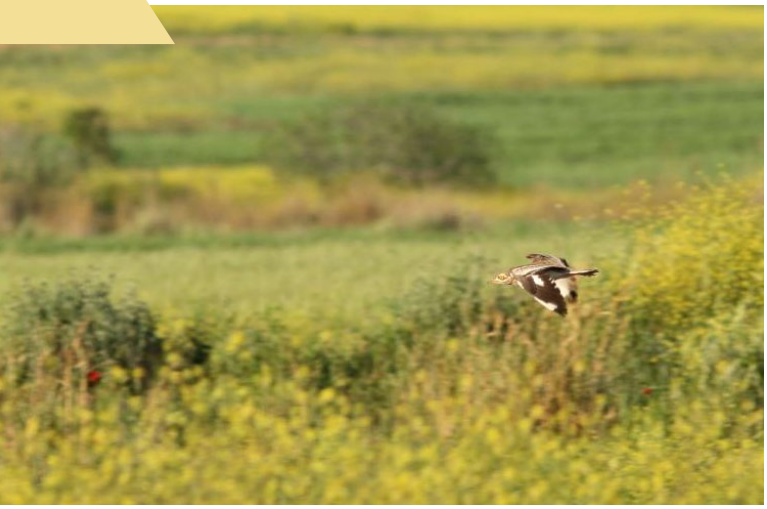
The survey aimed to census bird communities or individual species, to relate them to specific agricultural practices and then to use them as indicators.

METHODS FOR AVIFAUNA DATA COLLECTION

In the 25 sampling areas, 46 sampling plots were surveyed in 2018 and 57 in 2019, each separated by at least 400 meters from each other. Two trips were conducted during these years, one in April to target migratory and breeding sedentary species, and a second one in the end of May to focus on late breeding migratory birds.

Each sampling point was classified into a category corresponding to the surrounding landscape:

- Mix cultivated: Rather complex agricultural landscape with high coverage of trees and shrubs, densely vegetated field edges or Arundo donax edge lines or recently abandoned fields. Presence of small parts of ploughed fields or bare ground or vineyards. Grazing seems to be non-intensive.
- Mix cultivated 2: Scattered large trees and tree line along small streams, parts of land with bushes, cultivated or mixed landscape with meadows or phrygana, grazing by sheep not intensively.
- Dry range: Open landscape mainly rangeland (dominated by phrygana) or mixed with cereal cultivations (in small percentage), lack of bushes or trees (few scattered trees may be present), large part of bare ground or rocky areas, dry and shallow soil, intensively grazed by sheep and/or goats.



Bird monitoring: Eurasian stone-curlew (*Burhinus oedicnemus*) © MedINA

- Open cultivated: Open cultivated landscape or meadows, densely vegetated crops (winter cereal cultivations), open areas with or without scattered trees, more productive and deep soil, low or moderate grazing mostly seasonal.

Each plot was visited for each date at the peak of bird activity, namely early morning or late afternoon. All bird species either visually or acoustically observed were recorded and classified depending on their distance from the observer (<25m, 25 to 100m, >100m). After a minute of silence, the record period lasts for 5 minutes.

DATA ANALYSIS

After a selection in the species, Non-Metric Multidimensional Scaling was performed to analyze the locally breeding bird community. Diversity indexes and species richness was calculated for each plot.

2.2. ARTHROPODS AND BENEFICIAL INSECTS

The survey aimed to see the potential effects of agricultural practices on insect communities by monitoring several insect species which contribute to control agricultural pests, and get a general idea of the species present in different habitat in Lemnos.

METHODS FOR ARTHROPOD DATA COLLECTION

In April and May 2018, plots in 5 study areas were surveyed to have a picture of the present species, and define which agricultural practice may have the most effects on insect fauna.

In May 2019 the insect fauna on the edge and in the center of sprayed and unsprayed field were compared, the use of herbicide being the practice defined as the most impactful to insect fauna according to the results of 2018.

Each time, 3 different methods were used to monitor the insect fauna (traps stayed 6 days on each plot):

- Pitfall traps, two per plot and separated by 3.5 meters. Epigeal insects and other arthropods were captured when they fell into the container where no liquid or other material was added.
- Yellow sticky traps (20x25 cm), targeting flying insect fauna. One trap was placed close to the pitfall trap, 10 cm above the vegetation cover.
- Sweep netting, realizing 10 sweeps along the diagonal of each plot the day of the trap removal, to record insects on plants.

The collected arthropods were separated into insects, spiders and other arthropods. Insects were further separated to Orders and at a family or species level, for the most important ones. The beneficial insects (i.e. natural enemies of crop pests and pollinators) caught on each yellow trap were identified to family or genus level. The identification was based on Borror et al. (1989), DeLong (1996).

DATA ANALYSIS

Two indexes were used to compare the diversity of the field edge and center of each field:

Shannon index (H'): used to estimate species diversity within each community. Its value, usually between 0 and 5, increases with the community heterogeneity, 0 describing a community made of only 1 species.

Simpson Index (D): this index represents the probability that 2 random individuals belong to the same species. Its value goes from 0 to 1 and takes into account the number of species and their relative abundance. The closer the value is to 1, the higher is the dominance of one species and the lower the diversity.

Arthropod monitoring: Ladybird on pea plant © MedINA

2.3. PLANTS

The aim of the survey was to identify bio-indicator species and monitor them in different agricultural environment, and to expand the knowledge of floristic diversity on the island.

METHODS FOR PLANT DATA COLLECTION

In 2018, 69 sampling plots were studied in 25 sampling areas of 5 ecosystems, in April and May. A second trip was performed in 2019 at the same period and in mid-October, with some added plots for a total of 107 sampling plots. The Braun-Blanquet method (1928) was used for floristic and vegetation sampling. Information concerning agricultural practices such as the use of herbicide, pesticide or grazing were noted for each plot, depending on their location.

Different subcategories were defined for each plant taxon:

Wild arable plant: A major proportion of occurrences in cultivated or fallow fields

Wild rangeland plant: Occurs chiefly in phryganic or herbaceous rangelands

Wild ruderal plant: Occurs chiefly in synanthropic habitats but not chiefly in arable fields

Crop wild relative: Congener of crop plant species

Insect-pollinated plant: Commonly visited by insects for pollen or nectar

Crop plant: Crop plant occurring generally as cultivated plant or escape.

DATA ANALYSIS

The contribution of each group was calculated and related to agricultural practices and locations (landscape).

Plant monitoring: Common poppy (*Papaver rhoeas*) © MedINA

2.4. MAMMALS (WILD-RABBITS)

The study was focused in the distribution and abundance of wild rabbits, a potential important ecological disturbance on the island.

METHODS FOR RABBIT DATA COLLECTION

Population density was estimated using the pellet counting technique. Assuming a production of 300 pellets per day and a ranging radius of 80-100 m around their warrens, the average number of rabbits per ha was calculated by assessing the average density of pellets/m^2.

Vegetation and soil characteristics were compiled to assess the ecological preferences of wild rabbit and which areas might be more favorable to its expansion.

2.5. SOIL CHARACTERISTICS

The survey aimed to see the potential effects of soil characteristics on agricultural production and biodiversity. The soil characteristics studied were studied at two different levels, soil mapping at large scale and local soil characteristics on individual plots.

METHODS FOR DATA COLLECTION

Soil mapping was carried out using Soil Mapping units drawn on ortho-photo maps, which distinguishes the landscape based on different morphological characteristics such as drainage conditions, soil texture, depth, slope gradient...

61 soil samples were taken in 25 sampling areas, chosen for being characteristic of different agricultural land management practices.

On each plot, for laboratory analyses, a soil sample is extracted from the surface horizon (0-25cm) then dried, grinded and passed through a 2mm screen. They are then analyzed for organic carbon content, available phosphorus, pH and exchangeable potassium.

3. REFERENCES

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4. CONTACT

Alliance for Mediterranean Nature and Culture

https://www.mednatureculture.org/

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International Union for Conservation of Nature and Natural Resources

https://www.iucn.org/

Tour du Valat

https://tourduvalat.org/

MAVA Foundation

https://mava-foundation.org/oaps/promoting-sustainable-land-use-practices-2/