TERRA LEMNIA STANDARD OF PRACTICES

RURAL MANAGEMENT MEASURES FAVOURING THE LANDSCAPE AND BIODIVERSITY OF LEMNOS

terra lemnia project / STRATEGIES 3.2, 4.2 / ACTIVITIES 3.2.2, 4.2.3

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SEPTEMBER 2020
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Loss of biodiversity by abandonment of cultural practices

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Contents

Introduction .......................................................................................................................... 2

Terra Lemnia Standard of Practices: Rural management measures favouring the landscape and biodiversity of Lemnos ................................................................. 3

Guide for implementation .................................................................................................. 5

A. Crop management ............................................................................................................ 5
A.1. Crop diversity and fallow land practice ....................................................................... 5
A.2. Crop rotation .................................................................................................................. 6
A.3. Intercropping.................................................................................................................. 6
A.4. Use of crop landraces ................................................................................................... 7

B. Input Reduction and Sustainable Use of Natural Resources .................................. 7
B.1. Rational use and reduction of agrochemicals ............................................................... 7
B.2. Sustainable management of crop residue ..................................................................... 8
B.3. Mild and reduced ploughing ......................................................................................... 8
B.4. Rational use and reduction of synthetic fertilisers ....................................................... 9
B.5. Use of natural fertilizers (green manure and manure) ............................................. 9

C. Livestock management and grazing .............................................................................. 10
C.1. Free range grazing on a natural grasslands ................................................................. 10
C.2. Own production of fodder and grazing on arable land ............................................... 11
C.3. Grazing on sown pastures and/or cultivated fields ................................................... 11
C.4. Maintain indigenous or locally adapted breeds .......................................................... 11
C.5. Welfare of farmed animals .......................................................................................... 12

D. Management of natural and semi-natural elements ................................................... 13
D.1. Maintain uncultivated field boundaries (‘trafoi’) .......................................................... 13
D.2. Maintain trees and bushes in field edges .................................................................... 13
D.3. Maintain uncultivated patches and coarse materials (stones and gravel) within fields 13
D.4. Enrich and/or re-introduce natural elements within fields ........................................ 14

E. Maintenance of traditional pens (mandras) and other traditional farming structures ...... 15
E.1. Maintain traditional mandras and other stone constructions ........................................ 15
E.2. Restore traditional mandras and/or construct new, traditional-styled, ecological farming structures ........................................................................................................ 15
E.3. Maintain or construct small water ponds for rainwater storage .................................. 16
Introduction

The Mediterranean Institute for Nature and Anthropos (MedINA), in cooperation with scientists from the Agricultural University of Athens, the University of the Aegean, the University of Patras, and the University of Göttingen (Germany), developed the following Guide and Standard of Good Practices in the framework of the Terra Lemnia project (https://terra-lemnia.net/). The Guide of Good Practices is based on the traditional practices used by farmers of Lemnos, which have shaped the island’s landscape and biodiversity, capitalizing on the results of extensive field research carried out by the Terra Lemnia team since 2017. According to the scientific data collected by the team, the implementation of these practices benefits biodiversity, soil and landscape, while improving the quality of local products, presenting potential for increased income for farmers.

The Guide of Good Practices is designed to be used as the basis for operation of the ‘Land Stewards Network’, a voluntary network of practitioners, and to create an environmental / landscape label. The condition for joining the network is to implement all practices characterized as ‘mandatory criteria’ (M) and collect at least 30 points by applying some of the practices characterized as ‘optional criteria’ (O).

The Practices are divided into five categories, as illustrated in the following Standard, namely:

A. Crop management
B. Input reduction and sustainable use of natural resources
C. Livestock management and grazing
D. Management of natural and semi-natural elements
E. Maintenance of traditional pens (mandras) and other traditional farming structures

Network operation will be supervised by a responsible agronomist. A dedicated precision farming system, consisting of a Geodatabase and Smartphone App, will be developed to allow recording of farm inputs and outputs and monitoring of practice implementation. Network members, assisted by the responsible agronomist, will be responsible to keep record of practice implementation using the precision farming tools of the system. Details for the application of the Standard are provided in this Guide.

This ‘Good Practices Guide’ has been created to respond to the needs and realities of Lemnos Island. However, thanks to its multiplier effect, it can also be applied to other North Aegean islands, as well as to parts of mainland Greece. Further to being used for the needs of the Land Stewards Network in Lemnos, it is also intended to inform the policy dialogue for establishment of locally adapted agri-environmental measures by the competent authorities in the new Programmatic Period of the Common Agricultural Policy (CAP) after 2020.
Terra Lemnia Standard of Practices: Rural management measures favouring the landscape and biodiversity of Lemnos

<table>
<thead>
<tr>
<th>Principles</th>
<th>Criteria (Practices)</th>
<th>Status</th>
<th>Guideline – Indicator</th>
<th>Monitoring – Control</th>
<th>Environmental / Landscape benefits</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Crop management</td>
<td>A.1. Crop diversity and fallow land practice</td>
<td>Mandatory</td>
<td>Maintain at least 3 different crops or 2 crops and one fallow field/year in at least 60% of the farm’s total cultivated area.</td>
<td>Monitoring through TL precision farming system and/or macroscopic control in the field by network agronomist.</td>
<td>Wild flora species, invertebrates (especially beneficial insects), soil protection, landscape structure and diversity</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>A.2. Crop rotation</td>
<td>Mandatory</td>
<td>Systematic crop rotation in at least 20% of the farm’s total cultivated area/year.</td>
<td>Monitoring through TL precision farming system and/or macroscopic control in the field by network agronomist.</td>
<td>Annual flora species, invertebrates, soil protection, reduced agrochemical use, landscape structure and diversity</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>A.3. Intercropping (planting two or more crop species in the same field during the same growing season)</td>
<td>Optional</td>
<td>Intercropping in at least 40% of the farm’s total cultivated area/year.</td>
<td>Monitoring through TL precision farming system and/or macroscopic control in the field by network agronomist.</td>
<td>Soil protection, reduced agrochemical use, beneficial insects</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A.4. Use of crop landraces (local seed varieties)</td>
<td>Optional</td>
<td>Maintain at least one crop landrace across 0.5ha of cultivated land (maintain more landraces for extra points)</td>
<td>Monitoring through TL precision farming system and/or macroscopic control in the field by network agronomist.</td>
<td>Wild flora species, invertebrates, soil microfauna, reduced agrochemical use</td>
<td>5-10</td>
</tr>
<tr>
<td>B. Input reduction and sustainable use of natural resources</td>
<td>B.1. Rational use and reduction of agrochemicals</td>
<td>Mandatory</td>
<td>Follow the guidance set by the network responsible agronomist</td>
<td>Monitoring through TL precision farming system (cross checking with hardware supply store records). Macroscopic control in the field after harvest by network agronomist.</td>
<td>Wild flora species, invertebrates, avifauna, water and soil protection</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>B.2. Sustainable management of crop residue</td>
<td>Mandatory</td>
<td>Prohibition of burning stubble</td>
<td></td>
<td>Soil protection, wild flora species, invertebrates</td>
<td>-</td>
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<tr>
<td></td>
<td>B.3 Mild and reduced ploughing</td>
<td>Mandatory</td>
<td>Follow the guidance set by the network responsible agronomist</td>
<td>Macroscopic control in the field. On site monitoring during ploughing and/or soil sampling. Monitoring through TL precision farming system (cross checking with hardware supply store records). Lab analysis, if required.</td>
<td>Soil protection</td>
<td>-</td>
</tr>
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<td></td>
<td>B.4 Rational use and reduction of synthetic fertilisers</td>
<td>Mandatory</td>
<td>Follow the guidance set by the network responsible agronomist</td>
<td>Monitoring through TL precision farming system (cross checking with hardware supply store records). Lab analysis, if required.</td>
<td>Soil and water protection, soil microfauna</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>B.5. Use of natural fertilisers</td>
<td>Optional</td>
<td>Use of green and/or liquid manure in at least 20% of the total cultivated area/year</td>
<td>Macroscopic control in the field by network agronomist.</td>
<td>Soil protection, wild flora species, invertebrates</td>
<td>5</td>
</tr>
<tr>
<td>C. Livestock management and grazing</td>
<td>C.1. Free range grazing on natural grasslands</td>
<td>Mandatory</td>
<td>Maintain sustainable grazing standards (set by TL grazing capacity study)</td>
<td>Macroscopic control (vegetation monitoring) in the rangeland by network agronomist.</td>
<td>Soil protection, wild flora species, invertebrates, avifauna, landscape structure and diversity</td>
<td>-</td>
</tr>
<tr>
<td>Principles</td>
<td>Criteria (Practices)</td>
<td>Status</td>
<td>Guideline – Indicator</td>
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<td>Points</td>
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<td>(only for livestock and mixed farms)</td>
<td>C.2. Own production of fodder</td>
<td>Mandatory</td>
<td>Cover at least 40% of annual feeding needs through own fodder production (unless covering at least 50% from free ranging)</td>
<td>Monitoring through TL precision farming system.</td>
<td>Wild flora species, soil protection, landscape structure and diversity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C.3. Grazing on sown pastures and/or cultivated fields</td>
<td>Optional</td>
<td>Cover at least 25% of annual feeding needs through foraging (includes grazing on stubble after harvest)</td>
<td>Monitoring through TL precision farming system and/or macroscopic control in the field by network agronomist.</td>
<td>Wild flora species, soil protection</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>C.4. Maintain indigenous or locally adapted breeds</td>
<td>Optional</td>
<td>Maintain locally adapted breeds (5 points) or Lemnos breed (10 points)</td>
<td>Phenotypical animal control. Lab analysis, if required.</td>
<td>Soil protection, wild flora species, invertebrates, avifauna</td>
<td>5-10</td>
</tr>
<tr>
<td></td>
<td>C.5. Welfare of farmed animals</td>
<td>Mandatory</td>
<td>Compliance with animal welfare requirements</td>
<td>Macroscopic control in the mandra</td>
<td>Farmed animals</td>
<td></td>
</tr>
<tr>
<td>D. Management of natural and semi-natural elements</td>
<td>D.1. Maintain uncultivated field boundaries ('trafoi')</td>
<td>Mandatory</td>
<td>Maintain all trafoi between fields</td>
<td>Monitoring through TL precision farming system and macroscopic control in the field by network agronomist.</td>
<td>Wild flora species, invertebrates, avifauna, landscape structure and diversity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D.2. Maintain trees and bushes in field edges</td>
<td>Mandatory</td>
<td>Maintain all trees and bushes in field edges</td>
<td>Monitoring through TL precision farming system and macroscopic control in the field by network agronomist.</td>
<td>Wild flora species, invertebrates, avifauna, landscape structure and diversity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D.3. Maintain uncultivated patches and coarse materials (stones and gravel) within fields</td>
<td>Optional</td>
<td>Maintain uncultivated patches and coarse materials within fields</td>
<td>Monitoring through TL precision farming system and macroscopic control in the field by network agronomist.</td>
<td>Wild flora species, invertebrates, avifauna, landscape structure and diversity</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>D.4. Enrich and/or reintroduce natural elements within fields</td>
<td>Optional</td>
<td>Enrich fields with natural elements of local flora</td>
<td>Macroscopic control in the field by network agronomist.</td>
<td>Wild flora species, invertebrates, avifauna, reptiles, landscape structure and diversity</td>
<td>5</td>
</tr>
<tr>
<td>E. Maintenance of traditional pens (mandras) and other traditional farming structures</td>
<td>E.1. Maintain traditional mandras and other stone constructions</td>
<td>Mandatory</td>
<td>Maintenance of all traditional constructions within the farm</td>
<td>Monitoring through TL precision farming system and macroscopic control in the mandra by network agronomist.</td>
<td>Invertebrates, avifauna, reptiles, landscape structure and diversity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E.2. Restore traditional mandras and/or construct new, traditional-styled, ecological farming structures</td>
<td>Optional</td>
<td>Restoration and/or construction works</td>
<td>Macroscopic and administrative control (i.e. building permits).</td>
<td>Invertebrates, avifauna, reptiles, landscape structure and diversity</td>
<td>5-10</td>
</tr>
<tr>
<td></td>
<td>E.3. Maintain or construct small water ponds for rainwater storage</td>
<td>Optional</td>
<td>Water ponds in the farm</td>
<td>Macroscopic control by the network agronomist.</td>
<td>Wild flora species, invertebrates, avifauna, reptiles, amphibians, landscape structure and diversity</td>
<td>5</td>
</tr>
</tbody>
</table>

Baseline for participation ➔ Implement all Mandatory Practices + Obtain 30 points from Optional Practices

Maximum available points from implementation of all Optional Practices | 60
Guide for implementation

A. Crop management

A.1. Crop diversity and fallow land practice

What it is: Crop diversity is the cultivation of different crop types, in relatively small quantities per type, as opposed to monoculture, which refers to the cultivation of one crop in large quantities. Fallow land practice is the temporary interruption of cultivation of a field in order to regain its productivity.

Why / Significance: Crop diversity contributes to ecological stability and to sustainable use of natural resources. The variety of cultivated species found in Lemnos is an example of a production system that has not been fully intensified and is directly linked to the mosaic that characterises the island's rural landscape. Fallow land practice contributes to the increase of moisture stocks, the enrichment of the soil and the colonisation of the field by wild species of plants and animals, which thus find their way for their introduction into areas where otherwise they would be difficult to exist in.

Implementation guidelines and indicators: Mandatory criterion (M). Each farm must maintain at least three (3) different eligible crops per year or two (2) crops and one (1) fallow field per year. Minimum cultivated area: 60% of the farm’s total cultivated area per year. Each farm must keep detailed record of all its fields and crop types in the Terra Lemnia Geodatabase.

Environmental / landscape benefits include increasing native species (annuals) and invertebrate populations (beneficial insects), increasing plant cover, improving soil structure, reducing erosion, and preserving the structure and diversity of the landscape.

The eligible crops of criterion A.1 are the following:

<table>
<thead>
<tr>
<th>Cereals:</th>
<th>Annuals (rare)³</th>
<th>Perennials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Durum wheat (Triticum durum)</td>
<td>• Rovi (Vicia ervilia)</td>
<td>• Grape vine (Vitis sp.)</td>
</tr>
<tr>
<td>Barley (Hordeum vulgare)</td>
<td>• Sesame (Sesamum indicum)</td>
<td>• Fig (Ficus sp.)</td>
</tr>
<tr>
<td>Oat (Avena sativa)</td>
<td>• Lafyri (Lathyrus sativus)</td>
<td>• Almond tree (Prunus sp.)</td>
</tr>
<tr>
<td>Triticale (Triticosecale)</td>
<td>• Anise (Pimpinella anisum)</td>
<td></td>
</tr>
<tr>
<td>Legumes:</td>
<td>• Peanut (Arachis hypogaea)</td>
<td></td>
</tr>
<tr>
<td>Alfalfa (Medicago)</td>
<td></td>
<td>Fallow land practice</td>
</tr>
<tr>
<td>Aspromytika beans (Vigna unguiculata)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vetch (Vicia sativa)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Afkos (Lathyrus ochrus)</td>
<td></td>
<td></td>
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<tr>
<td>Pea (Pisum sativum)</td>
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</tbody>
</table>

1 Eligible crops are all those that have shaped the landscape and biodiversity of Lemnos. These include mainly annual rainfed crops (cereals and legumes), but also some perennials (vines, figs, almonds). They do not include crops with high water requirements (those that require systematic irrigation) and inputs, such as irrigated clover and sorghum, as well as some perennials that are not traditionally found on Lemnos (e.g. olive groves).

2 60% shall be calculated cumulatively for the three (3) or more eligible crops, provided that each constitutes at least 5% of the total cultivated area. Crops grown to a lesser extent are included only if they fall into the category of ‘rare crops’ (see criterion A.4). For fallow fields, if 100% of the arable area is cultivated in one year, the minimum requirement for the following year is to keep at least 40% fallow.

3 Rarity is determined by the number of hectares cultivated by each producer and the number of farmers cultivating the specific crop. The list of rare crops presented here will apply for the first application of the Standard, but the list will be reviewed on a regular basis. In any case, eligible rare crops refer only to crop landraces (see also criterion A.4).
A.2. Crop rotation

What it is: Crop rotation is the systematic rotation of arable crops in the same field for a sequenced period (of 2 to 3 years). Rotation cycle takes into account specific factors, such as soil and climatic conditions, but also socio-economic factors, in order to achieve the best results.

Why / Significance: Crop rotation seeks to maintain and enhance soil fertility, improve soil structure, and biodiversity-friendly weed and pest control. As a result, biodiversity and especially annual plants and invertebrates that depend on them are favoured.

Implementation guidelines and indicators: Mandatory Criterion (M). Each farm must implement the appropriate crop rotation programme, coordinated by the project’s local agronomist, across 40% of the farm’s total arable land per year. This criterion may be combined with criterion A.1 and is also monitored through the Terra Lemnia Geodatabase. The minimum requirement is to change the crops, regardless of their type (including alternate cultivation of two different types of cereals). In the first certification period, if the application of the criterion cannot be proven, the certificate will be issued with reference to its mandatory application in the second certification period.

Environmental / landscape benefits include increasing annual plants and invertebrates, improving soil fertility, reducing agrochemicals, improving production and preserving the structure and diversity of the landscape.

A.3. Intercropping

What it is: Intercropping is the practice of growing two or more plant species in the same field during the same growing season. The plant species in intercropping practice need not necessarily be sown at the same time, and the harvest may also vary. However, the species must coexist for part of their growing period in the field.

Why / Significance: Intercropping systems are used to achieve productivity and stability. Compared to monocultures, these systems reduce soil erosion, increase organic matter and contribute to nitrogen uptake by plants. In addition, the rate of weeds in the field, plant pathogens and plant insect populations decrease, which reduces the need for the use of herbicides and pesticides, as well as inorganic fertilizers, which adversely affect the environment. Finally, they increase the populations of pollinators and other beneficial insects.

Implementation guidelines and indicators: Optional Criterion (O). Five (5) points are awarded for its implementation in at least 25% of the total arable land of the farm per year.

Environmental / landscape benefits include increasing organic matter, improving soil fertility, reducing erosion, contributing to the reduction of agrochemicals, increasing pollinators and other beneficial insects.
A.4. Use of crop landraces

What it is: Crop landraces are populations of cultivated plant species that have emerged through choice of farmers and nature over long periods. Being heterogeneous they exhibit adaptability and resistance to pests and diseases.

Why / Significance: Crop landraces are integral parts of biodiversity on their own, while they also favour it across the whole spectrum of the agro-ecosystem (crop diversity, native plants, insects, soil microbial diversity, etc.). Crop landraces co-develop with symbiotic soil microorganisms and thus contribute to the preservation and enhancement of agrobiodiversity. At the same time, the use of crop landraces leads to low inputs and the potential to exploit poor arid soil with all the positive effects that this entails (e.g. the fields would remain uncultivated resulting in desertification or the dominance of fewer plant species). In addition, in such environments these varieties can provide unique, high value added products (PDOs, PGIs, TSGs) with an economic benefit to local communities.

Implementation guidelines and indicators: Optional Criterion (O). Five (5) points are awarded for a single landrace cultivated in at least 0,5 ha and ten (10) points for 2 or more landraces in at least 0,5 ha each (minimum cultivated surface requirement does not apply for the rare landraces of criterion A.1). It is recommended to combine crop landrace cultivation with crop rotation and low input farming methods in the traditional way. The list of eligible crop landraces is defined by the Terra Lemnia project. Implementation control will be carried out by the corresponding Seed Certification Center (Local Office of Agricultural Economy), while the voluntary producer network will also be monitored / certified by the cooperating agronomist.

Environmental / landscape benefits include increasing native species, invertebrates and soil microbial diversity, and reducing agrochemicals.

B. Input Reduction and Sustainable Use of Natural Resources

B.1. Rational use and reduction of agrochemicals

What it is: Agrochemicals include all chemical substances -herbicides, insecticides, fungicides, etc.- used to combat various crop pests and diseases and increase crop yields.

Why / Significance: Much of the agrochemicals applied to crops are either taken up by plants and animals or degraded by microbial or chemical processes. However, a significant part of agrochemicals is dispersed to the environment by wind, rinsing or water runoff and are thus found in soils and in ground and surface water. There are numerous bibliographic references that point to the negative impacts of agrochemicals on wildlife and biodiversity by reducing the populations of birds, insects, amphibians and aquatic communities. Moreover, there are many reports on the adverse effects of agrochemicals on human health that cause acute or chronic pathological conditions.

Implementation guidelines and indicators: Mandatory criterion (M). Each farm must follow the instructions provided by the responsible agronomist for types and quantities of substances per crop (which in all cases must respect the requirements of the Code of Good Agricultural Practices of the Ministry of Agriculture). Each farm must keep detailed record of all agrochemical use in the Terra Lemnia Geodatabase (Farm-plot; date and time of application; type, concentration and total quantity of each product; volume of spray liquid used).
Environmental / landscape benefits include increasing native species, invertebrates and birds hunting in the field.

B.2. Sustainable management of crop residue

What it is: Plant residue (called “kalamia” in Lemnos) refers mainly to the residues of annual crops, such as cereals, which remain in the field after the crop is harvested.

Why / Significance: Proper management of plant residue is very important for soil protection and enrichment. The technique of plant residue burning is a frequent practice which has very significant negative effects on soil and the environment, as it contributes to: (a) a decrease in soil organic matter, (b) a lack of the basic soil component for good structure, (c) a decrease in soil productivity, (d) an increased soil sensitivity, in water and wind erosion; and (e) biodiversity reduction. In addition, plant residue burning produces intermediate chemicals that contribute to the greenhouse effect (carbon oxides, nitrogen and sulfur).

Implementation guidelines and indicators: Mandatory Criterion (M). It is forbidden to burn plant residue after harvesting. Instead, it is recommended to graze the residues (criterion C.4) and/or to crush the remaining crop residues in the field and to incorporate them in the soil with a plowing depth usually up to 25 cm.

Environmental / landscape benefits include increasing soil organic matter, improving soil structure, reducing water erosion, increasing native species and invertebrates.

B.3. Mild and reduced ploughing

What it is: Mild ploughing refers to minimising the depth of ploughing with the plough. Minimising ploughing refers to limiting the number of ploughings to the absolutely necessary ones or even avoiding ploughing where possible.

Why / Significance: Intensive tillage (more frequent and deep ploughing) increases the energy required by the tractor, results in high and unnecessary fuel consumption and at the same time causes adverse effects on the soil, such as structural damage, subsoil compression and soil erosion in sloping areas. The erosion caused by agricultural tools, called mechanical erosion, has been shown by measurements to be much greater than the water erosion caused by surface runoff.

Implementation guidelines and indicators: Mandatory Criterion (M). Regardless of slope, ploughing depth must be maintained up to 20 cm (deeper ploughing subject to permission by the supervisor agronomist). It is recommended to avoid tractor’s high speeds. It is recommended to replace the plough with the cultivator or to use a plough with “fins”.

In sloping fields (slope> 5%), the following must be also followed:

• Ploughing, where the slope allows it, parallel to the contours.

• Invert the soil once down and three times up when ploughing is taking place vertically to the slope.

Environmental / landscape benefits include the reduction of mechanical erosion (estimation made by observing soil colour changes within the same plot) and the prevention of soil depth reduction.
B.4. Rational use and reduction of synthetic fertilisers

What it is: Laboratory analysis of soil samples from 22,000 sites distributed throughout Greece have shown that soils have, in most cases, become over-fertilized in recent decades, particularly with the nitrogen, phosphorus and potassium macronutrients (Greece soil map 2014). Phosphorus and potassium bind to the soil and are attributed to subsequent crops. Nitrogen does not bind to the soil and if not absorbed by the plant it is usually removed from the soil system by rain water or irrigation. Nitrogen is added to each growing season, but usually in excess of the actual crop requirements with adverse economic and environmental impacts. Therefore, special attention should be paid to the use of inorganic fertilizers and in particular to their reduction where necessary.

Why / Significance: The irrational use of fertilizers and especially nitrogen, which exceeds the crop's needs for optimum production, is associated with high levels of residual nitrogen in the soil, potentially polluting underground water reservoirs and the atmosphere through nitrate ions rinsing or ammonia gases (denitrification and gasification). Often, excessive crop fertilisation appears to have adverse effects on fruit production and quality, fruiting and fruit growth, which is mainly due to excessive vegetation growth.

Implementation guidelines and indicators: Mandatory Criterion (M). Each farm must follow the instructions for quantities and products provided by the responsible agronomist for each crop (which in all cases must respect the requirements of the Code of Good Agricultural Practices of the Ministry of Agriculture).

As a general instruction for the use of nitrogen in cereal crops, 8-12 kg per 0,1ha is recommended depending on the soil. In cereals it is also recommended to avoid nitrogen fertilization during sowing. It is advisable to add nitrogen in one or two doses during the twinning period of the plant (February, March) in order to avoid the loss of nitrogen with the leaching observed after sowing due to the rainfalls. The use of phosphorus and potassium should be based on soil analysis.

Each farm must keep detailed record of all data related to the application of fertilizers in the soil or in the foliage in the Terra Lemnia Geodatabase.

In the first certification period, if the application of the criterion cannot be proven, the certificate will be issued with reference to its mandatory application in the second certification period.

Environmental / landscape benefits include the reduction of inorganic forms of nitrogen in the soil, increased availability of phosphorus and exchangeable potassium in the soil, protection of soil fauna.

B.5. Use of natural fertilizers (green manure and manure)

What it is: Green manure refers to the development of biomass by growing legumes or cereals or combining them and incorporating them into the soil after full growth. Similarly, manure is the natural organic fertilizer created by the feces of animals, especially sheep, goats, cattle and equidae.

Why / Significance: The technique of green manure helps to improve the chemical and physical properties of soils. For example, it improves the availability of nutrients and especially nitrogen for the crop to follow. In addition, it increases soil organic matter (a very important component affecting productivity), creates good soil structure conditions, resulting in better soil ventilation and increases resistance to soil erosion.

Accordingly, manure is an excellent material for plant growth because it contains various nutrients necessary for plant growth, in the proportions and quantities required. Adding manure to cultivated...
soils reduces the cost of fertilization with the gradual release of nutrients and is an excellent way to increase soil organic matter, which significantly improves soil structure and soil water storage capacity.

Both of these practices contribute to the conservation and protection of biodiversity, especially native species and invertebrates.

Implementation guidelines and indicators: Optional Criterion (O). Five (5) points are awarded for its implementation in at least 20% of the total cultivated area of each farm. Green manure mainly relates to the cultivation of a legume that is incorporated into the soil at an early stage with ploughing. It is recommended that green manure be applied once every five or ten years. Accordingly, manure can be applied to the soil either in its primary form or after some processing (e.g. maturation - composting) depending on the type of manure. The manure is dispersed into the soil and then incorporated for better degradation and yield of nutrients to the plants. When the manure is not well decomposed, nitrogen feedstocks are likely to develop. In this case, the nitrogen decomposes and competes for nitrogen to be decomposed by microorganisms. Following the decomposition of the manure, the nitrogen that is bound by the micro-organisms is slowly assimilated to the plants.

Environmental / landscape benefits include increasing soil organic matter, improving soil structure, reducing water erosion, increasing native species and invertebrates.

C. Livestock management and grazing

C.1. Free range grazing on natural grasslands

What it is: Livestock breeding animals in Lemnos are ruminants, which implies they daily need to consume a significant amount of roughage feed, which is most economically obtained through grazing. However, grazing must respect the norms of sustainable use, to avoid devastating effects on rangeland condition, both from an environmental and a productive point of view. When grazing is practiced in a sustainable manner it presents many benefits for biodiversity and soil. Rotation of grazing lands over a period of time is an important factor in preventing rangeland degradation.

Why / Significance: Grazing ecosystems contain a significant part of European biodiversity as they provide ideal conditions for a huge variety of habitats and species, hosting many plant and animal species, while being particularly important for birds and many invertebrates, providing vital habitat for their breeding and living. Rangelands are also the source of a wide range of public goods and services, ranging from animal products to recreational and tourism opportunities. In addition, they are ‘carbon storages’ and therefore a vital tool for reducing greenhouse gas levels in the atmosphere. Most of these areas are maintained in their current form by grazing. However, changes in agricultural practices and pressures on land use have made these areas disappear at an alarming rate, today being considered among Europe’s most endangered ecosystems.

Implementation guidelines and indicators: Mandatory Criterion (M). Each farm must comply with the conditions for normal rangeland use defined by the grazing capacity study of the Terra Lemnia project. Each farm must keep detailed record of natural grasslands it is managing in the Terra Lemnia Geodatabase. Photo documentation of grassland condition will be provided by the farmers.

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4 Applies only for livestock farms and mixed farms.
Environmental / landscape benefits include reduction of soil erosion, increasing native species, invertebrates and birds.

C.2. Own production of fodder

What it is: Own production of fodder consists of cultivating arable land for forage plants used either in the form of harvested feed (hay, silage, straw), or grazed directly in the field, supplementing grazing on natural grasslands.

Why / Importance: Own production of fodder is a key factor of the Lemnian agro-pastoral system and contributes to the productive use of rural areas and to crop diversity, indirectly protecting natural grasslands from overgrazing. In addition, the cultivation of patches of forage crops within larger areas dominated by natural grasslands creates a distinct agricultural mosaic and ensures good quality food for other organisms of the local agro-ecosystem.

Implementation guidelines and indicators: Mandatory Criterion (M). Each farm must produce at least 40% of the required feed (animal needs per year in kilos of dry matter) from own fodder crops, unless it covers at least 50% of its needs from grazing in natural grasslands (combined with criterion C.1) and/or arable land (combined with criterion C.3). Monitoring of the criterion is done by cross referencing the total nutritional needs of the farm with the needs covered by purchased fodder as recorded in the Terra Lemnia Geodatabase.

Environmental / landscape benefits include increasing native plant species in the cultivated fields, and preserving the structure and diversity of the landscape.

C.3. Grazing on sown pastures and/or cultivated fields

What it is: The practice of grazing cultivated areas by productive animals, can be distinguished in two types: (a) grazing on stubble ('kalamia'), where the animals are allowed to graze crop residues after harvesting; (b) grazing on grasses ('tsairia'), where farmers sow pastures (usually located near the mandras), for grazing by their animals without harvesting the crops.

Why / Significance: Animals grazing on cultivated land naturally enrich the soil with their manure, contribute to the spread of a number of living organisms over significant areas (transport and dispersal of seeds and other organisms), and indirectly contribute to reduced need for fuel.

Implementation guidelines and indicators: Optional Criterion (O). Five (5) points are awarded if the farm covers at least 25% of its feeding requirements through grazing in such lands. Grazing in neighboring farmland is accepted to fulfill the criterion.

Environmental / landscape benefits include increasing native plant species in the cultivated fields, and preserving the structure and diversity of the landscape.

C.4. Maintain indigenous or locally adapted breeds

What it is: Livestock raised for animal production has a diverse genetic composition and is practically categorized into homogeneous groups recognized as 'breeds'. Breeds, depending on selection goals
and the environment they were selected in, may be more or less resilient to the environmental conditions in which they are eventually reared or more depended to external inputs.

**Why / Significance:** In the distant past, specific breeds of animals were prevalent in each area, which were more resistant to local climatic and soil conditions. In recent decades, less durable, 'improved' breeds of livestock are being bred, which are able to yield more product when appropriate farming conditions are met (i.e. modern farming practices and housing / intensification of production). These breeds are often crossed by farmers with local animals leading to change of the genetic composition of a large part of the livestock. However, the unsustainable nature of this option is gradually revealed, as unadapted 'improved' breeds cannot graze under marginal conditions (of specific topography and climate), require high-cost housing, consume high nutritional value crops, lack a strong immune system, which often requires therapies and medicines, while consuming significant amounts of energy to ensure their breeding. At the same time, their absence (or reduced presence) from grazing lands implies a reduction in biodiversity in these areas (as discussed in criterion C.1 above).

**Implementation guidelines and indicators:** Optional Criterion (O). This criterion initially applies to sheep populations. Five (5) points are awarded for maintaining locally adapted breeds (Lesvos breed, Chios breed, or interbreeding with local sheep); ten (10) points are awarded for maintaining the native Lemnos sheep breed. The application of the criterion is checked by farmer declaration and phenotypic on-farm control by the responsible agronomist. Genetic composition of animals is described and followed according to genetic analyses carried out under the Terra Lemnia project.

**Environmental / landscape benefits** include prevention of soil erosion, increasing of native species, invertebrates and avifauna.

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**C.5. Welfare of farmed animals**

**What it is:** Livestock breeding regulates the way animals live, with the animals being completely dependent, in many cases, on the breeder for food, water, shelter, rest, health and pain management.

**Why / Significance:** Human intervention on the conditions of breeding animal populations, for our benefit (production of goods), creates the obligation to ensure a minimum of welfare conditions for them. In addition, animals that score low in one or more of the well-being indicators do not function normally, thus failing to yield the expected environmental benefits and productive capacity presented in the other criteria.

**Implementation guidelines and indicators:** Mandatory criterion (M). Each farm must comply with the legal requirements; in particular: Guarantee a minimum percentage of roughage feed in their diet, ensure good quality drinking water on a daily basis, provide immediate care for diseases, wool shearing, hoof treatment etc.

**Environmental / landscape benefits** include the health of farmed animals.
D. Management of natural and semi-natural elements

D.1. Maintain uncultivated field boundaries (‘trafoi’)

What it is: The ‘trafoi’ of Lemnos are uncultivated -usually elevated- narrow strips of land that serve as field borders, constituting a particular type of micro-ecotone which characterizes the island’s rural landscape.

Why / Significance: The ‘trafoi’ are islands of biodiversity with native vegetation, often mixed with cultivated plants. They are a habitat and shelter for many species of animals (mainly invertebrates), while also serving as ‘banks’ of genetic material in a homogeneous rural landscape. In addition, they help to keep populations of pests low. This is because the beneficial insects that feed on the pests find shelter and alternative sources of food in the ‘trafoi’ and can thus move more easily to the crop and feed on the pests present in them. These micro-ecotones also help to preserve the populations of pollinating insects but also of high aesthetic value such as Lepidoptera (butterflies). Consequently, most insects are food for several birds hunting on the island’s fields.

Implementation guidelines and indicators: Mandatory criterion (M). Each farm must preserve all existing ‘trafoi’ in the fields it manages, for conservation of native plants (if no ‘trafoi’ exist in the area managed by the farm, then the criterion is not applicable). Each farm must record in the Terra Lemnia Geodatabase, all the ‘trafoi’ in its field boundaries. The recording will be done by the responsible agronomist in collaboration with the farmers using the geodatabase.

Environmental / landscape benefits include increasing native species, invertebrates, birds hunting in the field, and preserving the structure and diversity of the landscape.

D.2. Maintain trees and bushes in field edges

What it is: Native and/or planted trees and shrubs in field borders.

Why / Significance: As with the case of ‘trafoi’, the maintenance of trees and shrubs contributes to the conservation and enhancement of biodiversity; in addition, it also serves as wind protection barrier. Trees and shrubs are habitats (shelter and observation points) for many birds, while they also contribute to increasing beneficial insects’ populations. In addition, they provide shadow for grazing animals.

Implementation guidelines and indicators: Mandatory Criterion (M). Each farm must maintain groups, strips or isolated trees and shrubs in field edges (if no such elements exist in the area managed by the farm, then the criterion is not applicable). Each farm must record in the Terra Lemnia Geodatabase, all the trees and bushes in the field it manages. The recording will be done by the responsible agronomist in collaboration with the farmers using the geodatabase.

Environmental / landscape benefits include the increase of invertebrates, and birds that hunt in the fields, and preserving the structure and diversity of the landscape.

D.3. Maintain uncultivated patches and coarse materials (stones and gravel) within fields

What it is: Patches of land within fields which are not cultivated, either because they are difficult to plough (high slope, large quantities of stones, etc.), or because there are natural and / or artificial
obstacles around them (columns, individual trees and shrubs, rocky outcrops, etc.), or because the farmer voluntarily agreed to it. In addition, this criterion also includes the preservation of coarse materials (gravel and stones from 0.2 to 25 cm in diameter) in cultivated areas.

**Why / Significance:** Conservation of uncultivated patches in the fields offers many advantages in terms of enrichment and protection of both biodiversity and soil. As with the case of ‘trafoi’, these areas are islands of biodiversity with native vegetation, also hosting beneficial insects. The invertebrates also attract many birds that feed on them, but also on insects harmful to farming. These micro-ecotones also help to preserve the populations of pollinating insects but also of high aesthetic value such as Lepidoptera (butterflies). In addition, rocks and rocky outcrops in the fields are a habitat for various reptiles, as well as for some chasmophytic species, while contributing significantly to protecting the soil from erosion and protecting soil moisture from intense evaporation.

**Implementation guidelines and indicators:** Optional Criterion (O). Five (5) points are awarded for its implementation. Farmers are advised to record in the Terra Lemnia Geodatabase, all uncultivated patches maintained in their farms during the first certification process. The recording will be done in collaboration with the network supervisor. The application of the criterion will be checked by comparing with the previous situation and can be documented by taking photos.

**Environmental / landscape benefits** include the growth of native species and invertebrates, the increase of birds that hunt in the field, as well as reptiles that take refuge in rocky outcrops and rocks, the increase in biomass and the reduction of soil erosion.

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**D.4. Enrich and/or re-introduce natural elements within fields**

**What it is:** These are patches of fields that are enriched with additional natural elements (biotic or abiotic) to increase local biodiversity and protect the soil. Such enrichment can include planting indigenous plant species (trees, shrubs and annuals) in thickets, lines or even individually, layering stones from adjoining fields, creating zones where no herbicides have been used, to achieve symbiosis of native and cultivated plants and the introduction of specific wild (native) plants e.g. with mixed seeds.

**Why / Significance:** The enrichment of natural elements in areas within crops offers many advantages for biodiversity and soil. Introducing more structural elements within the field, e.g. stone elements, shrubs, trees, annuals, zones without herbicide application, enriches biodiversity, helping to attract a range of other fauna species, and gradually leads to a more stable agro-ecosystem. As with uncultivated field boundaries, these areas also contribute to keeping pest populations low, due to the increase in the beneficial insects that feed on them. Similarly, the help preserve populations of pollinating insects and high aesthetic insects such as Lepidoptera (butterflies). In addition, the stones in the fields become a habitat for various reptiles, while contributing significantly to protecting the soil from erosion and protecting soil moisture from intense evaporation.

**Implementation guidelines and indicators:** Optional Criterion (O). Five (5) points are awarded for its implementation. The application of the criterion will be checked by comparing with the previous situation (which must be recorded in the Terra Lemnia geodatabase) and can be documented by taking photos.

**Environmental / landscape benefits** include increasing native species and invertebrates, birds that hunt in the field, and reptiles that take refuge in rocky outcrops and rocks.
E. Maintenance of traditional pens (mandras) and other traditional farming structures

E.1. Maintain traditional mandras and other stone constructions

**What it is:** The traditional mandras of Lemnos are complex farming structures of significant historical, cultural and environmental value. The mandras typically include a sheep barn (‘hayati’), an attached dry-stone fenced open area (‘somandro’), storage areas, the farmer’s hut which is used as workplace and occasionally as living space. They are made of stone, with dry-stone used for fencing constructions. Most traditional mandras have been abandoned or have been significantly altered and are gradually being replaced by modern structures that have negative impact on the island’s landscape.

**Why / Importance:** Mandras are important elements of the island’s landscape and cultural heritage, also presenting value for biodiversity. Many species of reptiles and invertebrates inhabit these traditional stone constructions, while falcon (Falco naumanni), an important hawk species, nests in such structures. In addition, there are some species of chasmophytes that depend on them.

**Implementation guidelines and indicators:** Mandatory Criterion (M). Each farm must maintain the stone structures that exist at its borders, regardless of whether they are used directly or not for agricultural production. The farm must keep detailed record of all such constructions in the Terra Lemnia Geodatabase. The recording will be done by the responsible agronomist in collaboration with the farmers using the geodatabase. The application of the criterion will be checked by comparing with the previous situation and can be documented by taking photos.

**Environmental / landscape benefits** include increasing invertebrates, birds, and reptiles who find refuge in these structures, and preserving the structure and diversity of the landscape.

E.2. Restore traditional mandras and/or construct new, traditional-styled, ecological farming structures

**What it is:** This criterion is about full or partial restoration of a traditional mandra as a functional part of the farm, and it can be combined with the possibility to construct a new, traditional-style, animal shed using ecologic materials, based on the model study of local association Anemoessa, Terra Lemnia project partner.

**Why / Significance:** The traditional mandras of Lemnos, an emblematic element of the island’s landscape, are being replaced in recent decades by modern greenhouse-type facilities. These facilities degrade the landscape of the island, and have poor environmental performance in comparison to traditional structures (e.g. they are non-recyclable, they cannot function as habitat for other animals, etc.). Hence, there is dire need for restoration of old traditional mandras, and for construction of modern, ecological, facilities which will be compatible with the character of traditional mandras while addressing the needs of modern livestock farming, in terms of herd sizes and welfare rules. A model study has been implemented by Anemoessa and a demonstration facility is planned to be developed aiming to allow the development of standard design specifications.

**Implementation guidelines and indicators:** Optional Criterion (O). Five (5) points are awarded for full or partial restoration of a traditional mandra and its re-use (as supporting facility, small dairy and / or
agro-tourism facility); ten (10) points are awarded if a new, traditional-styled farm, is also constructed, based on the model specifications of the Terra Lemnia project.

**Environmental / landscape benefits** include increasing invertebrates, birds, and reptiles who find refuge in these structures, and preserving the structure and diversity of the landscape.

E.3. Maintain or construct small water ponds for rainwater storage

**What it is:** These are small ponds, usually constructed on clay soil, used to collect and store water for watering animals. In very permeable soils (e.g. sandy soils), clay or cement mortar is applied. Their size usually does not exceed 10m².

**Why / Significance:** In addition to their obvious value for watering animals (domestic and wild) they play an important role as habitat for a number of fauna species, mainly invertebrates, but also amphibians such as frog larvae (tadpoles), etc. In addition, they host aquatic plant species thereby increasing the number of plant species in the wider area. Lastly, they are feeding grounds for many more invertebrates and birds.

**Implementation guidelines and indicators:** Optional Criterion (O). Five (5) points are awarded for maintenance or creation of at least one pond per *mandra*. The use of cement mortar to coat the bottom should be avoided. Instead clay and pebbles should be used.

**Environmental / landscape benefits** include increase of invertebrates, birds, amphibians, reptiles and aquatic plants for which this type of construction is a habitat.