Ecological Vineyards Governance Activities for Landscape's Strategies

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Multi-criteria Analysis - methodological document

Responsible Partner

Provincia Autonoma di Trento

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Paesaggio viticolo della Val di Cembra – Foto di Agenda 21 srl

1 PU = Public document; PP = Partnership document

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Project Summary

ECOVINEGOALS promotes sustainability and resilience in the winemaking industry by encouraging the transition of intensive viticulture towards agroecological management systems that protect natural habitats and landscapes, while reducing chemical and fossil fuel inputs and harmful emissions. The project aims to enhance stakeholders' skills in participatory local governance, to strengthen transnational cooperation and provide specific transnational instruments to promote, support and manage the agroecological transition.

Expected results

- Sharing between partners in the ADRION countries of fundamental concepts and practices necessary for the transition from intensive viticulture management systems, towards agroecological management methods.
- Improvement of the participatory local governance skills of decision makers and all other viticulture stakeholders, both public and private, to jointly develop and define strategies and plans aiming to protect natural habitats and rural landscapes.
- Transnational communication, cooperation, and exchange between regional authorities and civil society organizations concerning common objectives to protect vulnerable environments, to promote ecosystem services, to prevent or mitigate climate change, and to avoid social conflicts in land use.
- An increase in the number and quality of tools and strategies available to support the planning and management of the agroecological transition of viticulture systems in the region.

Partnership:

PP1- LP	**LAG EASTERN VENICE, VEGAL (IT)**
PP2	Autonomous Province of Trento, PAT (IT)
PP3	Chamber of Agriculture and Forestry of SIovenia, KGZS-Zavod GO (SI)
PP4	Research Centre of the SIovenian Academy of Sciences and Arts, ZRC SAZU (SI)
PP5	Agency for rural development of Istria Ltd. Pazin, AZRRI (HR)
PP6	Association for the promotion of employment, vocational training and education, INFORMO (HR)
PP7	Business Development Center Kragujevac, BDCKG (RS)
PP8	Foundation Business Start-up Center Bar, BSC BAR (ME)
PP9	Municipality of Bar, BAR (ME)
PP10	Mediterranean Agronomic Institute of Chania, CIHEAM MAICh (EL)

Associated Partners (APs):

General Union CISL Cultivators Venice (IT)
Bio district of production and biological community of central-eastern Venice - BIO VENICE (IT)
IAL - Innovation Learning Work S.r.l. - Social enterprise (IT)
AIAB-Italian Organic Agriculture Association (IT)
Agroecologiki SP (EL)
Municipality of Topola (RS)
Šumadija winemakers association (RS)
Ministry of Agriculture and Rural Development (HR)
Agroecology Europe (BL)

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Introduction

This document do not aim to represent a conceptual study on the effective theoretical possibilities to validate or compare different agroecological systems through multi-criteria analysis, not even building a sort of ideal model of agroecological farm nor of drawing the lines of demarcation between more or less “pure” systems.

This contribution, on the contrary, proposes a more immediately operational horizon - not less demanding - which should allow to present a rigorous working method on a formal and easy to understand level on the operational side. A tool that can be used with a certain precision allowing to carry out a research-action, a multi-criteria investigation, in the different Pilot Areas of "Ecovinegoals", and by that to better understand their level and “distance”, in relation to the rich agroecological practice in the project context.

To do so, some agro-environmental, economic, social and landscape cultural heritage indicators will be introduced in the following pages. Indicators that will be identified not only on the basis of a presumed possibility to describe a particular aspect, but rather on the possibility of being effectively populated through data that are available or easily produced.

In this sense, the multi-criteria analysis will be based on a questionnaire that will be proposed to the different local stakeholders selected in the project pilot areas. This will allow the collection of effectively comparable data on the agroecological, productive, economic and landscape-cultural aspects of the pilot-farms.

1. The assumptions of the multi-criteria analysis and the Main Agroecological Structure (MAS)

The hypotheses underpinning the different methodologies of multi-criteria analysis is laying on the assumption that the object of the study (in our case the agroecological practice) can be divided into different analytical factors, single elements, or analysis criteria, which fully describe it. Moreover, that these different analysis criteria can be described and evaluated separately[2].

The steps through which multi-criteria analysis traditionally develops can be summarized schematically in the following 5 ones:

1. the definition of the evaluation matrix and the consequent choice of indicators;
2. the "standardization" of the evaluation matrix;
3. the attribution of “weights” to each indicator;
4. the calculation of the orders (multiplication between "standardized” matrix and weight vector) and consequent definition of the impact matrix from which is possible to extrapolate the order of the preferences;
5. Sensitivity analysis (optional).

In this sense, it is proposed to focus the analysis of the agroecosystems of the different pilot areas of Ecovinegoals project, through the introduction of the concept of Main Agroecological Structure (MAS). The concept of MAS, resumed from the researches of Leòn Sicard[3], has some elements (qualificable, quantifiable, measurable and comparable) that facilitate the adoption of a simplified system of multi-criteria analysis.

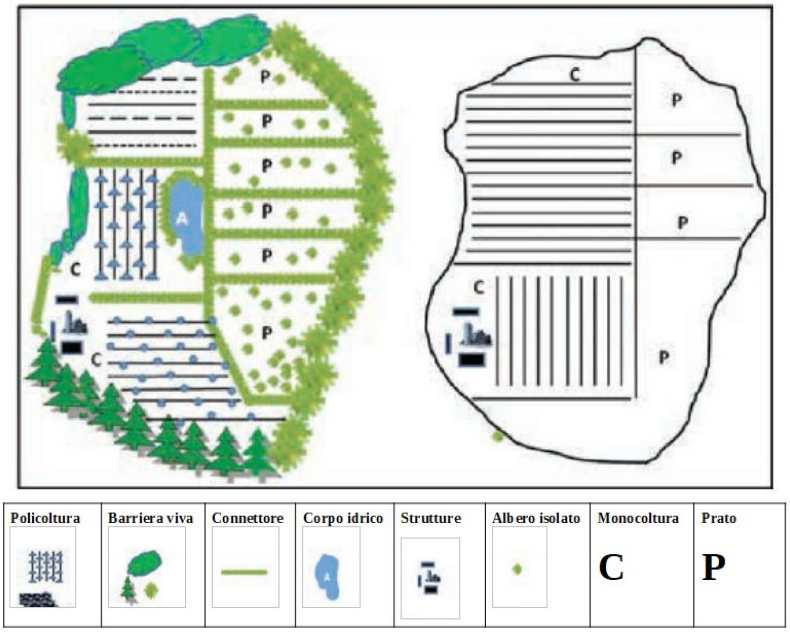
So the MAS can be defined as the "the internal configuration or spatial arrangement of the farm and the connectivity between its different sectors, patches and corridors of vegetation or productive systems and the exchange with the external environment". Taking in consideration the internal configuration of the farm, in particular, the observation focuses on the degree of openness and on the exchange relationships (between the different living species and between the different cultural contaminations) that the same farm maintains with the

2 In the case of the evaluation of agroecological practices, this is a strong hypothesis, a starting point that probably may not always be shared by professionals.

3 Leon Sicard is full professor at the Institute of Environmental Studies of the National University of Colombia

environment in which is included. The more the farm presents an articulated arrangement of its spaces, able to alternate different crops, preserve the presence of trees and hedges, keep functional small ditches and water bodies, the more will be able to offer vital connection systems, both internally and externally, with the surrounding environment.

Comparison between two farms with (left) and without (right) Main Agroecological Structure (Leon-Sicard, 2014)



The chance to describe qualitatively and quantitatively these characteristics lays on the identification of certain indicators that can be populated as they are based on data that can be easily detected in the field, through observations and interviews. These indicators, combined each other, will be used in order to create an index (a pure number) useful for introducing and explaining comparative analysis as well as for guiding a process of transition from conventional agriculture models, towards virtuous models referable to practices. organic farming, up to subsequent modifications and reorganizations of production systems and spaces as achieved by agroecological practices.

The MAS, and the relative index that will be described below, represents the parameter, actually one of the possible parameters, able to evaluate the degree of agroecological transition both of a single farm and, with a wider perspective, of a larger area dedicated to the primary sector.[4]

2. The evaluation matrix

The first essential prerequisite to describe, parameterize and standardize any agroecological transitions in progress, in order to "build" the aforementioned MAS index, is given by the definition of the evaluation matrix.

In this sense, the MAS index presents 10 indicators as shown in the following table: 5 indicators describing the structure and connection of the farm and its capability to exchange "energy"; and 5 examining aspects related to farm management.

4 Even though in a schematic way the agricultural transition refers, in "Ecovinegoals" project context, to the farm's transition from conventional agriculture (where the crops could generally be intensive, marked by the use of synthetic chemical products fertilizer and pesticides) to biological practice (where the natural fertility of the soil is encouraged, favoring it with limited interventions, excluding the use of synthetic products or the presence of genetically modified organisms), up to agroecological reorganization. Moving on from the farm analysis to that of a "vast area", the agroecological reorganization is evident in a renewed (and direct) relationship between producers and consumers, up to the explicit support of local agricultural policies.

*T***able** *1. The indicators necessary for the construction of the MAS index*

	Indicator	Acronym	Description
1	Connection with the main ecological landscape structure	CMELS	Assesses the distance of the farm in relation to the nearby fragments of natural vegetation, mainly forest covers and bodies of water.
2	Extension of external connectors	EEC	Evaluates the percentage of the linear extension of live fences located in the perimeter of the farms.
3	Extension of internal connectors	EIC	Evaluates the percentage of the linear extension of the rows of vegetation but internally.
4	Diversification of external connectors	DEC	Evaluates the diversity of live fences or hedges located in the perimeter of the major agroecosystem.
5	Diversification of internal connectors	DIC	Evaluates the diversification of internal living fences.
6	Use and Soil Conservation	USC	Evaluates the distribution percentage of different covers within the farm and the conservation of the soil (evidences of erosion).
7	Management of Weeds	MW	Evaluates the management practices and systems of weeds control.
8	Other management Practices	OP	Evaluates the types of production systems (ecological, conventional or in transition) of each farm.
9	Perception – Awareness	PA	Evaluates the degree of conceptual clarity and awareness of producers regarding agrobiodiversity.
10	Level of Capacity of Action	CA	Evaluates the capacities and possibilities of farmers to establish, maintain or improve their MAS

Further on this document, we will come back to each of the 10 indicators listed above for an immediate operational definition. In this sense, it is worth recalling what has already been mentioned from the first lines of this document: the aim is to propose an easy-to-use evaluation system, not avoiding the complexity of the issue; its immediate usability has been privileged over the rigor, albeit necessary, of academic reflection.

Therefore the evaluation matrix will be based on the proposition of the 10 analysis criteria introduced in the table above (the columns) through which the data relating to the various farms involved in the project will be collected and identified (the rows).

The following table presents the evaluation matrix that to be populated following the observation, analysis and/or proposition of a questionnaire to each farm that has to be evaluated in its agroecological transition process.

Table 2. **Evaluation Matrix for the calculation of MAS index**

	CMELS	EEC	EIC	DEC	DIC	USC	MW	OP	PA	CA
Farm 1										
Farm 2										
Farm 3										
Farm ..										

Leon-Sicard, 2018

The 10 indicators suggested in the context of the evaluation of the MAS will be reviewed below, proposing a simplified and immediately usable data collection system in the context of Ecovinegoals.

3. The ten indicators

With reference to the specific issues that will be identified for the population of the table above, it is necessary to consider that the analysis should deal with farms of different sizes and, sometimes, parceled out over several holding's units that are not necessarily contiguous to each other. In the case of these "fragmented" farms into two or more parts, specific attention must be given to the collection of information, which will be specified case by case, as described in the following paragraphs, for each indicator.[5]

In any case, some of the necessary information useful to populate the evaluation matrix may already be available because it has been frequently collected and cataloged by the public administrations or already evaluated by previous surveys and/or studies/publications (back office activities). On the other hand, other information will have to be collected by a specific research conducted directly in the field through the comparison with farm owners and the distribution of a questionnaire.

Connection with the Main Ecological Landscape Structure (CMELS)

This is the first crucial indicator that evaluates the "structural exchange" possibilities of the farm in relation to its integration with the surrounding environment. The information for population of this indicator is obtained both by detecting the distances from the center of the farm to the neighboring natural systems (or portions, or fragments of the same systems) and by detecting the distances between the same systems identified outside the farm: mainly forest coverings and water bodies. In general, the collection of the necessary information can be determined in two ways:

a. using any type of remote sensing image (such as aerial photographs, satellite or drone images) if it is possible to overlay the official property register layer that indicates the boundaries of the individual properties. [back office activity]
b. making a comparison with the managers/owner of each farm through the proposition of some specific questions included in a questionnaire.

In the simplified system proposed, the information collected refers to the simple detection of two distinct information: the distance of portions of natural elements external to the farm from the center of the farm and the distance between any fragment of natural elements present in the area surrounding the farm. The score will be assigned as indicated in the table below:

Table 3. Connection with the Main Ecological Landscape Structure (CMELS): Attribution of values

Description	Connectivity degree	Value
Distance of natural elements external to the farm such as a forest, a	High (0-150 m)	5

5 The terms "agroecosystem" and "farm" are continually interchanged, in the rest of the text, and used as synonyms. This is a simplification which, in our case, has no contraindication.

pond or waterhole, a perennial stream or an abandoned meadows (or portions of these) from the center of the farm. Related to the exchange of organisms between forests and crops. The greater the distance, the less chance there is for biotic interrelationships or for hosting a high degree of biological connectivity.	Medium High (150-300 m)	4
	Medium (300–450 m)	3
	Medium Low (450–600 m)	2
	Low (above 600 m)	1
Distance between at least two fragments of natural elements external to the company such as, for example, a fragment of forest, a pond or waterhole, a perennial stream or an abandoned meadow (or portions of these). Related to the exchange of organisms between forests and crops. The greater the distance, the less chance there is for biotic interrelationships or for hosting a high degree of biological connectivity.	High (0-150 m)	5
	Medium High (150-300 m)	4
	Medium (300–450 m)	3
	Medium Low (450–600 m)	2
	Low (above 600 m)	1

The total value of farm's connectivity will result from the algebraic sum of the two scores assigned, based on the indications described in Table 3. The total value will be reported, for each farm, in the first column of the "evaluation matrix". The interpretation of the total value, the degree of company connectivity with the main ecological structures can be summarized in the following table:

Table 4. Connection with the Main Ecological Landscape Structure (CMELS)

Connectivity degree	Value
High (0-150 m)	9/10
Medium High (150-300 m)	7/8
Medium (300–450 m)	5/6
Medium Low (450–600 m)	3/4
Low (above 600 m)	1/2

Box 1. CMELS: guidelines for an interview, the questions to be included in the questionnaire

Pay attention: these distances must be read as perception, it must be verified if the farmer has an approximate idea of measurement, or if he believes that they are close / distant / able or not to influence the relations between the farm and the landscape:

- Taking in consideration the natural elements external to the farm, how far is the center of your farm from the closest external natural area? How far is the forest, if any? Or a pond or a waterhole, if any? Is there a perennial stream or abandoned meadow beyond the farm boundaries? Are there any rural or wooded hedge/fence systems outside your farm? How far are they from the center of the farm?
- Always looking outside the farm perimeter, are the fragments, even if residual, of natural areas isolated? Are they connected with other fragments of forest? With a pond, a pool of water? A perennial stream or an abandoned meadow? Rural or wooden hedges/fences? If you have several components, how much distance have they between each other, if any?
- In case the farm is fragmented, the analysis will be slightly more complex in two or more parts. The information is collected considering "only" the largest portion of the farm, in the case that this exceeds 66% (or 2/3) of the overall extension. Otherwise, it is necessary to consider the average value of an analysis conducted separately for each farm portion until reaching at least 50% (half) of the total extension.

Extension of External Connectors (EEC)

The second indicator takes into consideration the percentage of linear extension of the living fences or hedges, present along the perimeter of the farm. In this case, as for the next three indicators presented below, the "*structural exchange*" possibilities of the farm are evaluated in relation to its integration with the surrounding environment. The necessary information for the population can be obtained by measuring the actual extension of the farm perimeter - marked by the presence of hedges, fences and/or rows of trees (or even streams) - and comparing it to the length of the entire perimeter.

Once the information has been collected, the score will be assigned as indicated in the table below.

Table 5. Extension of external connectors (EEC): **Attribution of values**

Description	Perimeter continuity percentage	Value
Percentage of the perimeter of the agroecosystem consisting of living fences (both autochthon and exotic species). The greater the percentage of living perimeter that surrounds the farm, the greater the chances of biotic interrelationships between the same farm and the external context in which it is located.	Continuous "living" perimeter – between 75% and 100%	10
	Mainly continuous "living" perimeter – between 50% and 75%	8
	Discontinuous "living" perimeter – between 25% and 50%	6
	Very discontinuous "living" perimeter – between12% and 25%	4
	Very poor "living" perimeter – less than 12%	2
	No “living” perimeter (only spotted presences)	0

The corresponding value must be reported, for each farm, in the second column of the "evaluation matrix".

Box 2. EEC: guidelines for an interview, the questions to be included in the questionnaire

- Farms are usually bordered by nets, fences, walls, roads, tracks, hedges, waterways, etc. Looking at hedges or other "living" elements, how much of the perimeter is covered by these elements? What is the rest of the perimeter made by? For better understanding, take note of the complete description of the farm perimeter.
- In case the farm is fragmented, the analysis will be slightly more complex in two or more parts. The information is collected considering "only" the largest portion of the farm, in the case that this exceeds 66% (or 2/3) of the overall extension. Otherwise, it is necessary to consider the average value of an analysis conducted separately for each farm portion until reaching at least 50% (half) of the total extension.

Extension of Internal Connectors (EIC)

If the previous paragraph is focused on the hedges or on those "living" elements that border the farm from the context in which it is inserted, this third section intend to look at the "living" fragments present within the farm itself. Internal partitions of the agroecosystem, produced by past practices, for organizational and management reasons or due to the different crop destinations. The analysis is focused on the presence and extent of the linear extension of water courses or natural ditches, of ecological corridors, hedges or rows of vegetation placed inside the agroecosystem. The necessary information for the aim (the observation applies to both internal connectors and external connectors) can be acquired through a direct comparison with the owners/managers of the companies (interviews or questionnaires) as well as from the analysis of remote sensing images.

Once the available data have been reordered, the scores will be loaded on the “evaluation matrix” as indicated in the following table.

Table 6. Extension of **int***ernal connectors (EIC):* **Attribution of values**

Descrizione	Percentuale di continuità perimetrale	Valore
Presence of internal partitions of	Widespread presence of "living" dividers over 75%	10

the agroecosystem consisting of waterways, natural ditches, rows, hedges. The greater the presence of "living" dividers between the different parts of the farm, the greater the chances of biotic inter-relations within the agroecosys-tem.	Quite widespread presence between 50% and 75%	8
	Presence widespread only on some parts between 25% and 50%	6
	Not very widespread presence between 25% and 50%	4
	Marginal presence, only on some parts between 5% and 10%	2
	Absence of "living" dividers (only spotted presences)	0

The corresponding value will be reported, for each farm, in the third column of the "evaluation matrix".

Box 3. EIC: guidelines for an interview, the questions to be included in the questionnaire

- Farms may or may not have different types of internal living connections (hedges, rows of trees, ditches), these connections could also act as partitions between different crops. Are there natural elements, hedges, ecological corridors or waterways? Is it a widespread presence? How much does the part of the cultivated area cover? Are the natural elements used to divide the different parts? How is one crop distinguished from another? Or one variety and another? Or two different plots of land?
- In case the farm is fragmented - into two or more parts - the analysis will be articulated as already said previously. The information is collected considering "only" the largest portion of the farm, in the case that this exceeds 66% (or 2/3) of the overall extension. Otherwise, it is necessary to consider the average value of an analysis conducted separately for each farm portion until reaching at least 50% (half) of the total extension.

Diversification of External Connectors (DEC)

This parameter evaluates the diversity of fences or living hedges located in the farm's perimeter. This analysis is closely linked to what is described above (paragraph 3.2) and includes the investigation of the types of herbaceous, shrubby or arboreal vegetation that make up the living enclosures.

The necessary information for the population of this fourth indicator can be collected by observing the rows of trees and hedges around the perimeter of the farm, noting the name of the different species.

Once the information has been collected, the score will be assigned as indicated in the table below.

Table 7. Diversification of External Connectors (DEC): **Attribution of values**

Description	Number of plant species	Value
Number of plant tree species (both native and exotic) that combine to form the living enclosures of the farm. The greater the number of tree species, layers of vegetation and rows of vegetation that contribute to forming the green infrastructures, the greater are the connection functions.	Presence of over 4 different tree species, of several layers of vegetation, of at least two rows of vegetation	10
	Presence of 2 or 3 different tree species, at least two layers of vegetation, and 1-2 rows of vegetation	5
	Mainly a single species, single layer, single row	1

The corresponding value must be reported, for each farm, in the fourth column of the "evaluation matrix".

Box 4. DEC: guidelines for an interview, the questions to be included in the questionnaire

- Taking in consideration the external “borders” of the farms, in particular at the “living” elements already described above, which and how many tree plant species combine to form the external hedges? Are they multi-layered? Are there multiple rows? How do they articulate between tree and shrub components? When gathering the information, do not consider the casual or sporadic presence, but note the species that actually contribute to "forming the hedges" or "live enclosures".
- In case the farm is fragmented - into two or more parts - the analysis will be articulated as already said previously. The information is collected considering "only" the largest portion of the farm, in the case that this exceeds 66% (or 2/3) of the overall extension. Otherwise, it is necessary to consider the average value of an analysis conducted separately for each farm portion until reaching at least 50% (half) of the total extension.

Diversification of internal connectors (DIC)

This fifth, and last, indicator describes the structure, the connection of the farm and its ability to exchange "energy", takes into consideration the diversity of fences or living hedges located within the farm or dividing the different plots or different crop units, or because they are maintained to strengthen the resilience and diversity of the farm itself. This analysis is closely linked to what is already indicated in paragraph 3.3 and includes the detection of the types of herbaceous, shrubby or arboreal vegetation that form these living hedges or living rows, ecological corridors.

The necessary information for the population of this indicator is obtained backing to the data collected by observing the "living" dividers within the farm and by looking at the notes that refer to the names and descriptions of the various plant species present.

The score will be assigned as indicated in the table below.

Table 8. Diversification of internal connectors (DIC): **Attribution of values**

Description	Number of plant species	Value
Number of plant tree species (both native and exotic) that combine to form the living enclosures of the farm. The greater the number of tree species, layers of vegetation and rows of vegetation that contribute to forming the green infrastructures, the greater are the connection functions.	Presence of over 4 different tree species, of several layers of vegetation, of at least two rows of vegetation	10
	Presence of 2 or 3 different tree species, at least two layers of vegetation, and 1-2 rows of vegetation	5
	Mainly a single species, single layer, single row	1

The corresponding value must be reported, for each farm, in the fifth column of the "evaluation matrix".

Box 5. DIC: guidelines for an interview, the questions to be included in the questionnaire

- Focusing on the internal "connectors" of the companies in particular to the "living" elements already described above, which and how many tree and shrub plant species contribute to forming these internal hedges/rows? When collecting the information, do not consider the casual or sporadic presence, but note the species that actually contribute to "forming the hedges" or "living enclosures" and above all the presence of complex multi-layered structures, more rows, more species.
- In case the farm is fragmented - into two or more parts - the analysis will be articulated as already said previously. The information is collected considering "only" the largest portion of the farm, in the case that this exceeds 66% (or 2/3) of the overall extension. Otherwise, it is necessary to consider the average value of an analysis conducted separately for each farm portion until reaching at least 50% (half) of the total extension.

Use and Soil Conservation (USC)

After reviewing the first 5 parameters - aimed at classifying the various farms structures in terms of their structural capacity to "exchange energy" both internally and in relation to the external environment - with the next 5 the aspects directly related to management issues of the farm.

Specifically, this first indicator concerns the use and conservation of the soil and evaluates the percentage of distribution of the different land covers associated with the productive activities of the farm and erosion phenomena. For the collection of information, where possible, for an initial screening and cataloging of companies, we rely on the data made available by Corine Land Cover cartography to be integrated with a company visit or questionnaire to collect data on the situation of soil erosion, in order to understand the different classes between the two extremes: absent at more than 50% of the surface.

*Table 9. Use and Soil Conservation **(USC)**:* **Attribution of values**

Description	Cropping plans and practices	Value
Diversity of crops and agro-sylvo-pastoral systems which contribute to limiting the loss of biodiversity, quality, soil fertility and limiting soil erosion phenomena. The greater the crop diversity, the lower is the phenomena of soil impoverishment and erosion.	Between 75% and 100% of polycultures and sylvo-pastoral activities, tree coverings, no evidence of erosion	10
	Polyculture, sylvo-pastoral activities and tree cover between 50% and 75% of the farm, erosion phenomena of less than one third of the company	8
	Polyculture, sylvo-pastoral activities and tree cover between 25 and 50% of the farm, erosive phenomena in about one third of the company	6
	Polyculture, sylvo-pastoral activities and tree cover up to 25% of the company, erosive phenomena over a third of the company	4
	Monoculture, breeding and arboriculture, at least 40% of the surface with evidence of erosion	2
	Monoculture or farming, heavy evidence of erosion	0

The corresponding value must be reported, for each farm, in the sixth column of the "evaluation matrix".

Box 6. USC: Lguidelines for an interview, the questions to be included in the questionnaire

- The direct confrontation with the owners/managers of the farms should be aimed, where possible, to confirm the information collected on Corine Land Cover and above all to collect data, at least the perception of the farmer, on erosion.
- Then proceed through a series of questions aimed at verifying and understanding the cultural changes (if there had been any) in recent years in order to be able to conclude with a description of the current situation in relation to both the present crop(s) and to any complementary grassing and breeding practices.

Management of Weeds (MW)

A second issue, that directly concerns farm management, is the one taken into consideration by this seventh indicator, which refers to the different ways of managing weeds. The management of weeds in an agricultural land is traditionally exercised with the aid of agronomic practices, mechanical processing, interventions with physical, chemical, biological means or through the combined action of those mentioned.

Once the issue has been described and examined for each farm, the score will be assigned as indicated in the table below.

Table 10. **Management of Weeds** *(MW):* **Attribution of values**

Description	Managing practice	Value
Weed management methods. The greater the degree of biological diversity present on the farm, the greater the degree of transition towards an agroecological balance model.	Intentional presence of random streaks or areas of weed species throughout the farm	10
	Intentional presence of stripes or random areas of weed species in some parts of the company	6
	Mechanical management only	2
	Chemical and mechanical management	1
	Only chemical weeding	0

The corresponding value will be reported, for each company, in the seventh column of the "evaluation matrix".

Box 7. MW: guidelines for an interview, the questions to be included in the questionnaire

- Consdering at the management of weeds: what interventions are carried out in the farm? Mechanical processing? Interventions with chemical products? Through the combined action of these? Finally, are there strips of land, patches, rows or surfaces specifically dedicated to intentionally confined random weeds in the farm?

Other management Practices (OP)

While not wanting to confuse agroecology with organic farming, it is clear that the different settings of primary production systems play an important role in the agroecological transition process. For this reason the eighth indicator refers to production/management practices used in the farm with particular reference to "organic" and the consequent presence/absence of synthetic products.

Once the issue has been described and examined for each company, the score will be assigned as indicated in the table below.

Table 11. Other management Practices (OP): **Attribution of values**

Description	Agricultural practice	Value
Cultivation and breeding methods that aim to enhance and preserve the biological production systems, without the use of synthetic and chemicals. The greater the degree of "maturation" of organic practices present in the company, the greater the degree of agroecological transition.	Certified organic/biological farming	10
	Non Certified organic/biological farming (*de facto*)	8
	Farm in organic/biological transition	6
	Integrated agricultural practices	4
	Conventional farm	0

The corresponding value will be reported, for each farm, in the eighth column of the "evaluation matrix".

Box 8. **OP***: guidelines for an interview, the questions to be included in the questionnaire*

- Looking at agricultural practices, the questions to be investigated are the following: is the company sticked to a conventional management model or has it already decided for some integrated practices? Or is it on the way to biological transition? Is it able to prove, or better still to certify, its being an "organic farm"?

Perception – Awareness (PA)

Evaluating the degree of conceptual knowledge and awareness of farmers in relation to the use and management of agrobiodiversity is not immediate or easy to do. The population of this ninth indicator, in fact, presents some margins of arbitrariness even greater than what may have happened for some others previously. However, this is a decisive aspect in terms of the actual possibility of a successful agroecological transition. For

this reason, the information will be recorded trying to maximum polarize the information and answers that will be collected from the operators.

Once the situation has been examined for each farm, the score will be assigned as indicated in the table below.

Table 12. Perception – Awareness (PA): **Attribution of values**

Description	Awareness and consequent practice of farmers	Valore
Attention paid in the farm to environmental factors and the role assigned to the importance of biodiversity. The greater the degree of "awareness", the more immediate will be the openness towards the agroecological transition.	Awareness of both the value of the environment as well as the role of biological connections ensured by living hedges and fences.	10
	Awareness of the value of the environment but not of the role of ecological connections ensured by living hedges and fences.	5
	Little importance is given to the environment and the role of biological connections ensured by living hedges and fences.	0

The corresponding value must be reported, for each company, in the ninth column of the "evaluation matrix".

Box 9. PA: guidelines for an interview, the questions to be included in the questionnaire

- Investigating the values and practices present in the farm, the issues to be noted must refer not so much, or not only, to one or more statements of principle (which also have their importance), but also to any interests evidenced by participation in groups and moments of training, growth and exchange between operators on issues related to environmental protection and biodiversity protection.
- Is the company aware of the importance of environmental protection? Has this awareness grown in recent years? If so, how? Through participation and meetings and training moments? Through a different management of the different environmental components (water and soil) in the company? If so, how? Or are these important issues on which, however, only words are spent that do not have any impact on the concrete management of farms?
- What assessment is made, in the farm, on the role of the protection of biodiversity? Do you think this is an important issue that has practical implications for business management? If so, which ones? Or a question (albeit an important one) to be reserved only for universities and scholars? In particular, is there awareness of the role of ecological corridors? Are there or have there been concrete attention, both within and outside the perimeter of the farm agroecosystem, to favor them? If so, which ones? Have hedges and "living" dividers increased or decreased in recent years? Why?

Level of Capacity of Action (CA)

This last parameter completes some of the information that has already been introduced with reference to the previous indicator (Perception and Awareness [CA]). This tenth indicator, in fact, evaluates the capacities and actual possibilities of farmers to establish, maintain or improve their Main Agroecological Structure (MAS). In addition to the ideal beliefs and commitment of each, in fact, this parameter aim to evaluate the abilities and actual possibilities of farmers to establish, maintain or improve the MAS of their production units.

Also for the evaluation of this indicator (as for the other 4 "social" parameters introduced above and directly connected to the farm management) it is crucial to be able to compare and collect data and information through surveys or direct interviews. Finally, also for this latter indicator, the information collected will have to be cataloged trying to distinguish as much as possible the positions expressed by the owners or by individual farm managers.

Once the situation has been examined for each farm, the score will be assigned as indicated in the table below.

*Table 13. Level of Capacity of Action (CA): Att***ribution of values**

Description	Farmer action capability	Valore
Availability of financial, economic and family tools, social structures and technological means to establish a complete and functional MAS for the needs of the farm. The greater the real possibilities, the greater the actual chances of growth and improvement of agroecology.	High possibility of establishing, maintaining or improving your own MAS.	10
	Medium possibility of establishing, maintaining or improving your own MAS.	5
	Low possibility of establishing, maintaining or improving your own MAS.. Presence of some objective external barrier to the	0

	capacity for action.	

The corresponding value must be reported, for each company, in the tenth and last column of the "evaluation matrix".

Box 10. CA: guidelines for an interview, the questions to be included in the questionnaire

- Questioning the values on which one intends to orient one's actions may appear more difficult than questioning the wills and the actual willingness to act. For this reason, the conclusion of the interview must be conducted with extreme care.
- Is there material availability in the farm to proceed with the strengthening of ecological corridors? In the maintenance and enhancement of boundary hedges or divisions of the various crop plots? In favoring the presence of areas of weeds? Is there a willingness to diversify the management of the farm, to make investments by increasing the number of crops and accentuating the polycultural character of the production? Is there a provision to move, albeit gradually, to a transition towards the practice of organic farming? If so, how and when?
- Or, on the contrary, are there constraints (due to the actual lack of economic and financial resources) that block any corporate transformation? Blocks (family, generational, cultural) that hinder any transition in the direction of agroecology. Which? Can rent, loan, property management be the limitations? Does the role of associations to facilitate the sale of the product encourage or discourage the management of MAS?

4. Standardization and weighting

Once the data population of the "evaluation matrix" has been completed, the next step of the multi-criteria analysis is standardizing (or normalizing) the collected data. In our case, however, due to how the 10 evaluation parameters have been presented, the "standardization phase" of the collected data is not needed. The information collected for each indicator, in fact, was immediately classified through the attribution of a score distributed on a scale ranging from 0 to 10. This is for each of the 10 parameters. So there is no data to normalize/ standardize.

The same applies to the attribution of weights. Leon Sicard's starting hypothesis, to which this methodological document refers, is a very “strong” hypothesis: each of the 10 indicators has the same relevance in terms of defining the degree of agroecological transition process in the different farms. Obviously, the European context in which Ecovinegoals project is implemented, presents many aspects of otherness compared to the Latin American context, in which the MAS methodology was conceived. For this reason, in re-proposing the MAS, as an interesting benchmark for the deepening the agroecological issues also in Europe, the 10 indicators have been suitably integrated and adapted to the needs of our continental context.

In this document, however, the original scheme has been maintained: therefore each of the 10 evaluation criteria of the Main Agroecological Structure (MAS) of the farms evaluated maintain the same importance. This means, concretely, that, for example, a high percentage of "living hedges" surrounding the perimeter of the farm “weighs" as much as producing according to the protocols of organic farming. Or a farm dedicated to monoculture is from agroecological practices as a farm that manages weeds only with chemical herbicides.

It is, as mentioned, a “strong” hypothesis. Which probably needs to be refined, but which works well enough at least in order to obtain an ordinal scale on which to compare different farms, of the same geographical context, relative to their degree of agroecological transition.

It could be of great interest to reconsider the issue directly with the world of farmers. Consultation with stakeholders, in this sense, could prove to be interesting in order to assign different "weights" to the various evaluation criteria. It must be considered, however, that it is also necessary that the rigor of an original approach is not subjected to the "sensation" of the "local feeling".[6]

In any case, for the reasons given, and therefore not having to assign the different weights to the different parameters and indicators collected in the evaluation matrix, it will be possible to proceed immediately to the calculation of the orders and arrive at the conclusion of our multi-criteria analysis.

6 The question re-proposes the theme of the confrontation between widespread knowledge and expert knowledge and the identity of places. However, this is a question that is beyond the realm of further study in this context.

5. The calculation of the MAS

Adding all 10 values obtained on each row of the "evaluation matrix" it is possible to calculate the MAS for each farm.

In other words, the final calculation of the MAS is obtained by adding the resulting value of each of the aforementioned indicators, according to the following formulation:

MAS = CMELS + EEC + EIC + DEC + DIC + USC + WM + OP + PC + CA

The scale of interpretation of the MAS is indicated in the following table.

Table 14. **Scale of MAS interpretation**

MAS development	Value
High developed	80 – 100
Moderately developed	60 – 79
Slightly developed	40 – 59
Weakly developed, with cultural potential	20 – 39
Weakly developed, without cultural potential	10 – 19
No agroecological structure	1 – 9

6. Conclusions

At the end of these useful methodological indications in order to have a tool - at the same time agile and solid - to be able to carry out a multi-criteria analysis on the degree of agroecological maturation of the different companies (and therefore of the different local contexts), it is worthwhile to underline again that more than for the absolute (cardinal) assignment of the score referred to the different companies, the total value assigned to the MAS is useful for drawing up an ordinal classification of the same companies and a solid indication of their degree of transition towards agroecology. From the analysis of its Main Agroecological Structure, each farm will be able to easily identify which actions to invest in and which management issues to pay attention to.

A further observation refers to the possibility of being able to aggregate (or not) the analyzes relating to individual farms, to be able to combine them — perform more complex calculations, indicate averages, choose summary indicators — in order to cumulatively assign a single overall assessment on the degree of agroecological transition of an entire territory considered as a whole. This is an interesting perspective which, however, in terms of method, presents not a few elements of uncertainty. Interest is usually shown by those who have to support the local public decision-maker intent on promoting the sustainable development of agricultural activity. However, there are many margins of uncertainty and, in particular, destined to increase the more the different areas to be compared differ in terms of surface area, geographical situation, and degree of integration of the local agricultural market. This without wanting to add further and more specific (albeit necessary) considerations on the degree of profitability, economy and efficiency of the various agricultural sectors being analyzed. From this point of view, therefore, it does not seem appropriate to propose aggregate scoring systems that make it possible to classify different SAPs of territory or large area. This at least until the scientific community is able to offer a specific tool.

Finally, a final consideration about the opportunity to include the evaluation of other issues, in addition to those necessary for the determination of the 10 criteria on which we have proposed the analysis of the MAS. It is a choice that is not only obviously possible but, in some cases, also opportune. With only two clarifications: the first, that it is advisable to clearly divide the questions proposed for the calculation of the MAS (the 10 criteria that we have illustrated above) from the additional ones aimed at collecting other information; the second, that it is necessary to verify whether said additional information is not already available from previous questionnaires administered as part of the Ecovinegoals project, or in any case easily available by consulting the various public activities or trade associations (censuses or agricultural monitoring) or, more in general, other recent research.

In particular, the two issues that we want to investigate in addition to the evaluation of the MAS are two:

- the perception of the territorial context and its agroecological vocation by the winegrower;
- the perception of the degree of environmental impact of agricultural activity and its management.

With the first question it is proposed to complete the development assessment of the MAS with an assessment of the perception of the socioeconomic dimension, in particular on the level of production (quality, quantity and income) and of the relationship with the relational and community fabric of the Pilot Area.

The objective of the second is to assess the level of awareness on any environmental impact external to the company.

Both issues are useful for assessing whether the wider territorial context outside the company is favorable to the agroecological transition. The ranking allows you to compare farms from different geographical and socioeconomic contexts. These indices will complete the evaluation for the specific purposes of the Ecovinegoals project, while, as mentioned, keeping them separate from the MAS matrix.