

Cross-border cooperation for sustainable development and tourism, through valorization of rural cultural heritage and conservation of natural assets of areas with ancient olive groves

CROSS BORDER OLIVE

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Report on Good Agricultural Practices in Ancient Olive Orchards

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1. Introduction

Cross Border Oil project is funded by the Interreg Italy Albania Montenegro Programme under the Priority Area “Smart management of natural and cultural heritage for the exploitation of cross border sustainable tourism and territorial attractiveness”. Its main objective is to promote sustainable tourism development based on the natural asset of the landscape with Ancient Olive Orchards (AOOs). The project will contribute to promote sustainable tourism activities and to conserve and protect natural resources in areas with AOOs and to recover awareness of local populations on their own cultural heritage linked to traditional olive culture, by activating a process of setting local strategies of development.

Work Package 1 (WP1) deals with the identification and sharing of best practices for conservation of the landscape of ancient olive orchards and aims to identify and characterize the existing natural heritage of the involved countries in terms of landscape and biodiversity richness in AOOs. WP1 should fulfil three deliverables, notably i) mapping and age determination of olive trees and groves (A.T.1.1), ii) characterization of biodiversity of AOOs (A.T.1.2) and iii) Identification and sharing of best practices for conservation of the landscape of ancient olive orchards (A.T.1.3).

The activities under this contract were the identification and collection of good agricultural practices related to AOOs.

The identification of good agricultural practices will help to sensitize the local stakeholders on the ways they manage their olive orchards and if needed to present to them new methodologies for olive management. On the other hand will help to recover awareness of local populations on their own cultural heritage linked to traditional olive culture as part of the ancient agricultural tradition and of the social environment.

There are over 1.7 million ancient olive trees in Albania located in most of the territory where the climate favour their growth, with numerous olive groves and specimens. Most of the orchards are located in the areas around the cities of Tirana and Vlora, in the crowns of the cities and near the archaeological and cultural works inherited together with the culture of olive cultivation. Olive groves in Albania are planted mainly in hilly and mountainous terrains, using the most productive lands for other vital agricultural products, which shows the rational choices of these residents for the use of the territory to meet the needs and increase their well-being.

Over time, the olive tree has conquered different environments from a pedological, climatic and agronomic point of view, developing different realities of growth and together with it has determined according to these environments, diversity of managerial interventions to support cultivation and increase production. The reality created in the conditions of globalization and competition for olive oil and fruit, has put in difficulty the efficiency of the use of these olive groves, due to the added costs from the unfavourable terrain and the nature of crowns with a lot of wood and high, which reduce the use of mechanization.

Based on these considerations and in the activity of the Project, it is necessary to identify the most suitable and sustainable cultivation techniques for olive cultivation, in order to reduce production costs, while respecting the environment. Through the identification and application of good agricultural practices, the project aims to create an additional opportunity for growers of these AOOs, to increase revenue from the sale of their products by exploiting market interest in quality products, but also agritourism. Moreover, the transfer and promotion of these practices by the structure of the Ministry of Agriculture and Rural Development but also by

local NGOs, for all olive groves would help the sustainable development of olive growing in Albania. Their publication would be useful for their recognition by all stakeholders, including foreigners.

Good practices in olive groves, referring to the EU provisions and regulations identified and recommended by CIHEAM-IAMB for the Puglia region, are considered all methods of using natural resources, inputs and appropriate interventions for all stages of production and marketing, from land to the table.

Olive cultivation according to good agricultural practices respects the principles of fertility conservation using the most appropriate ways and equipment;

- erosion control by surface waters;
- application of fertilizer based on plant needs, natural condition in the soil and losses;
- reducing pesticide residues through the selection of quality phytosanitary protection methods, identifying the pathogen and the appropriate means to combat it;
- timely and proper pruning;
- oil collection and extraction;
- storage and marketing of oil in appropriate conditions.

In addition to them, appropriate management practices were identified to preserve the landscape and natural capital of AOOs.

2. Description for the three areas selected

The three areas selected with AOOs are located in almost the same cultivation belt and are representative of the centuries-old olive groves throughout the country. The selected areas are distinguished for the typical Mediterranean climate characterized by hot and dry summer and mild and humid winter. The hills do not exceed 500 meters above sea level, and being close to it, one can feel the migratory effect of the sea. The average annual temperature is 15-16 °C, absolute minimums range from -2 to -4 °C, in cold winters they range from -4 to -8° C and in rare cases up to -13° C. Annual precipitation is 800-1200 mm, about 75% of which falls in the autumn-winter period, with a tendency to reduce them in recent decades. Due to the terrain, most olives are in non-irrigated conditions and this is the main factor limiting production. In these olive groves rainfall is the only water reserve. Prolonged summer drought forces the right choice of cultivation system to retain some of the water stored in the soil during the rainy season.

ADMINISTRATIVE MAP OF ALBANIA

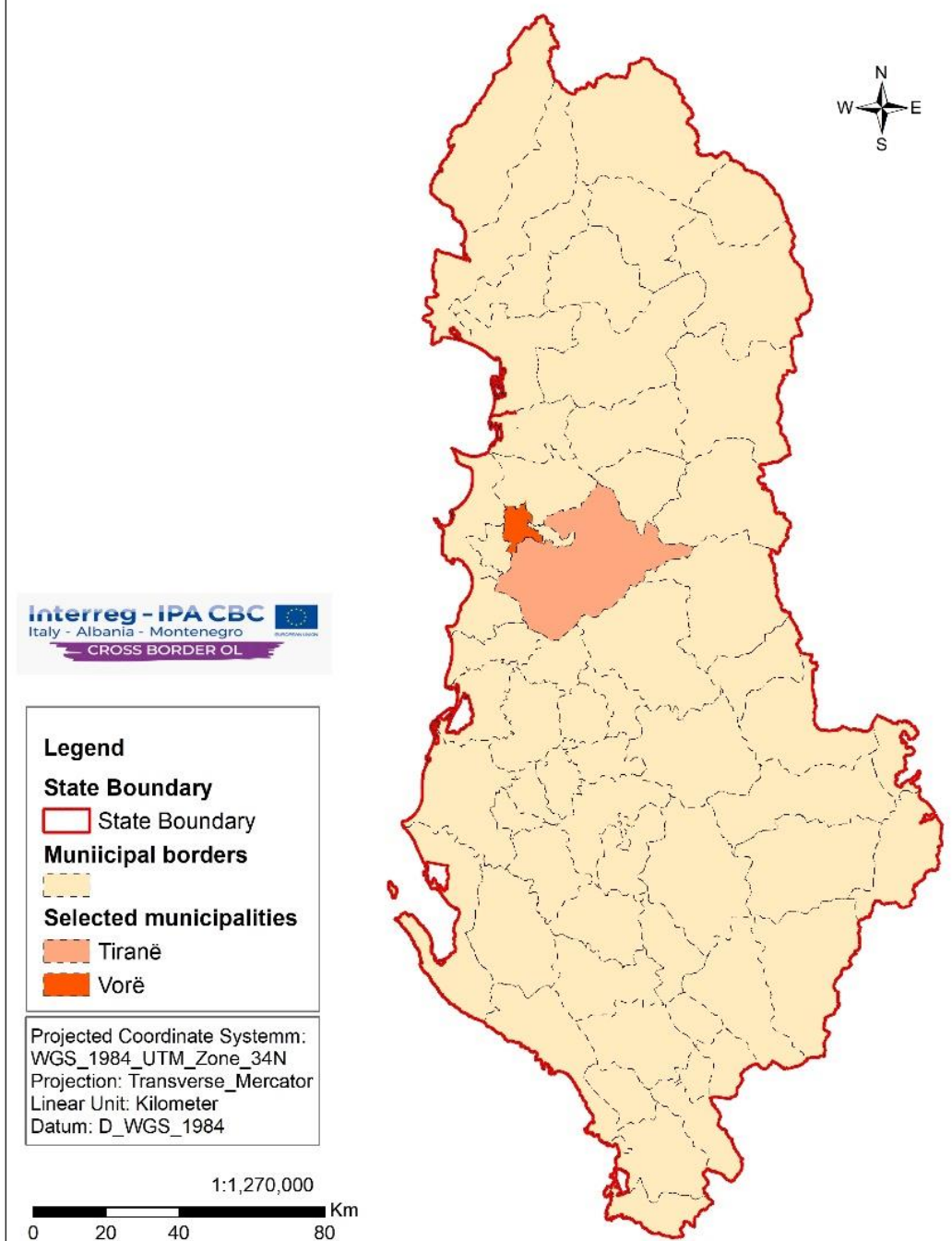


Figure 1: Map of Municipalities where the Administrative Unit are located

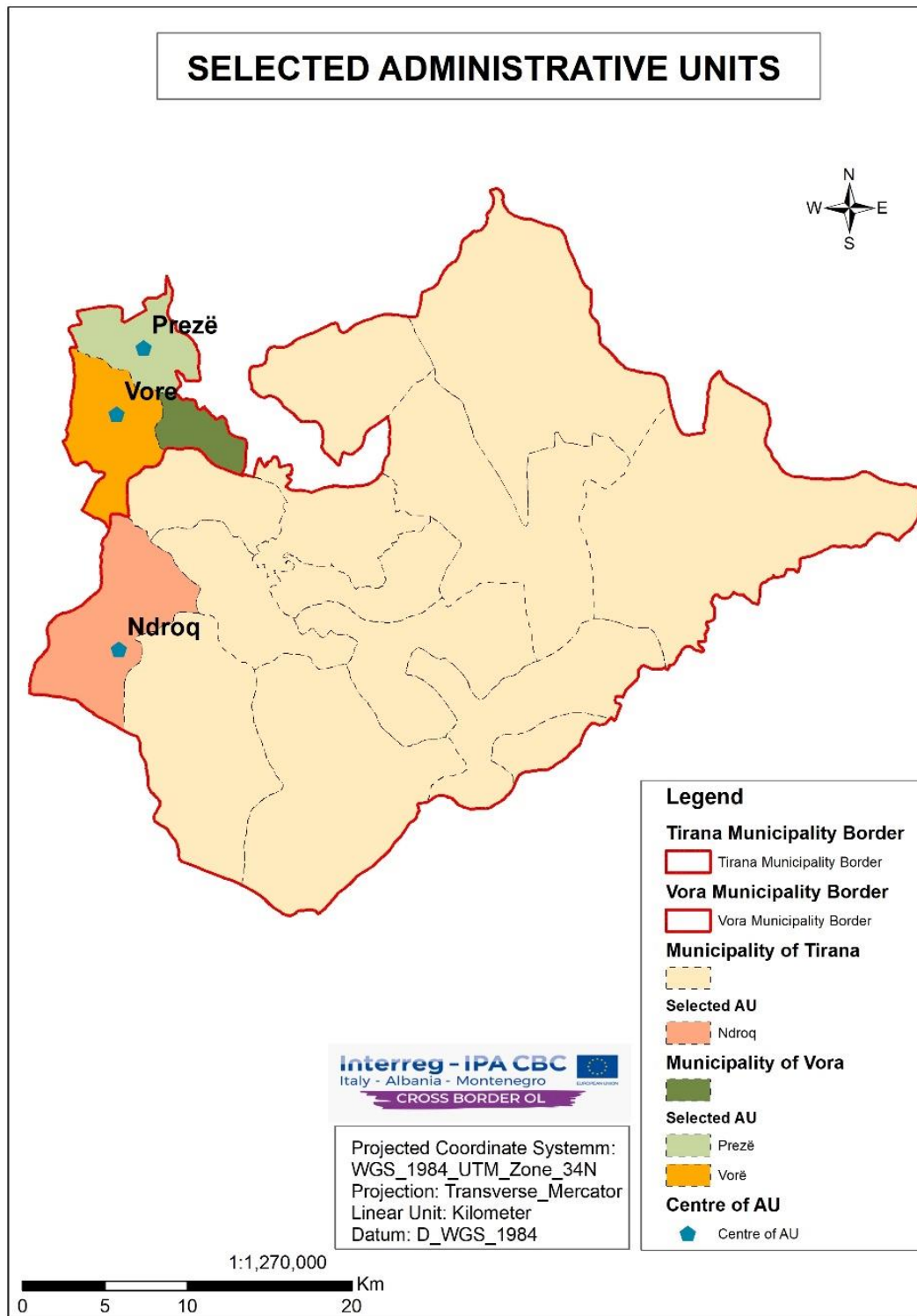


Figure 2: Map of selected Administrative Unit

2.1. Ndroq

Administrative unit of Ndroq area is located in the valley crossed by the river Erzen, in the middle of the highway that connects Tirana with Durrës. The people of this rural area are also good farmers known for their vineyards, fruits and vegetables. The inhabitants of this area have an inherited culture in the cultivation of olives; there are specimens of very old olives (up to 3000 years old) and a good tradition with olive oil production workshops. On the dominant hill of the

village Ndroq, rises the castle of Varosh (N: 41 ° 14 '50 "; E: 019 ° 38' 54"; height 387 m above sea level), which is one more reason that favours development of agro tourism in the area.

There are about 795 ha of olive groves in this area, of which about 682 ha are centuries-old olive groves, planted on the slopes of the hills in the villages of Ndroq, Grebllesh, Kërcukje, Sauqet, Shesh, Zhurie and Varosh. Most of the blocks planted at regular distances, on average with 88 trees / ha, on a sloping terrain, of which 191 ha on a slope of 15-20%, 543 ha on a slope of over 25% and 28 ha on lands located in terraces. The average production is 20 kv / ha.

Only Ndroqi as a village has a total of 166 ha of centuries-old olive groves. A large part of them suffers from the phenomenon of lack of proper services that have led to the deepening of periodic production and degradation of plants. Some of them, due to the lack of pruning, have created very high crowns, which make it difficult to harvest combined also with the rugged terrain. The lack of care for AOOs is also for the fact that many youngsters live in the city and are not an active part of the process of harvesting and maintenance for the olive groves.

The situation for the lack of maintenance of AOOs is also linked with the small size of the farms where in the 90's the olive blocks were distributed to the villagers, shredding the size of the farms. Their average size varies from 0.3-1.5 ha, with an average of 0.55ha, which unfortunately in centuries-old olive groves tends to decrease.

This situation does not reflect the culture of these inhabitants for olive cultivation. Interviews with old farmers, but also residents of this area have helped us a lot in identifying the good practices applied in olive groves in this area.

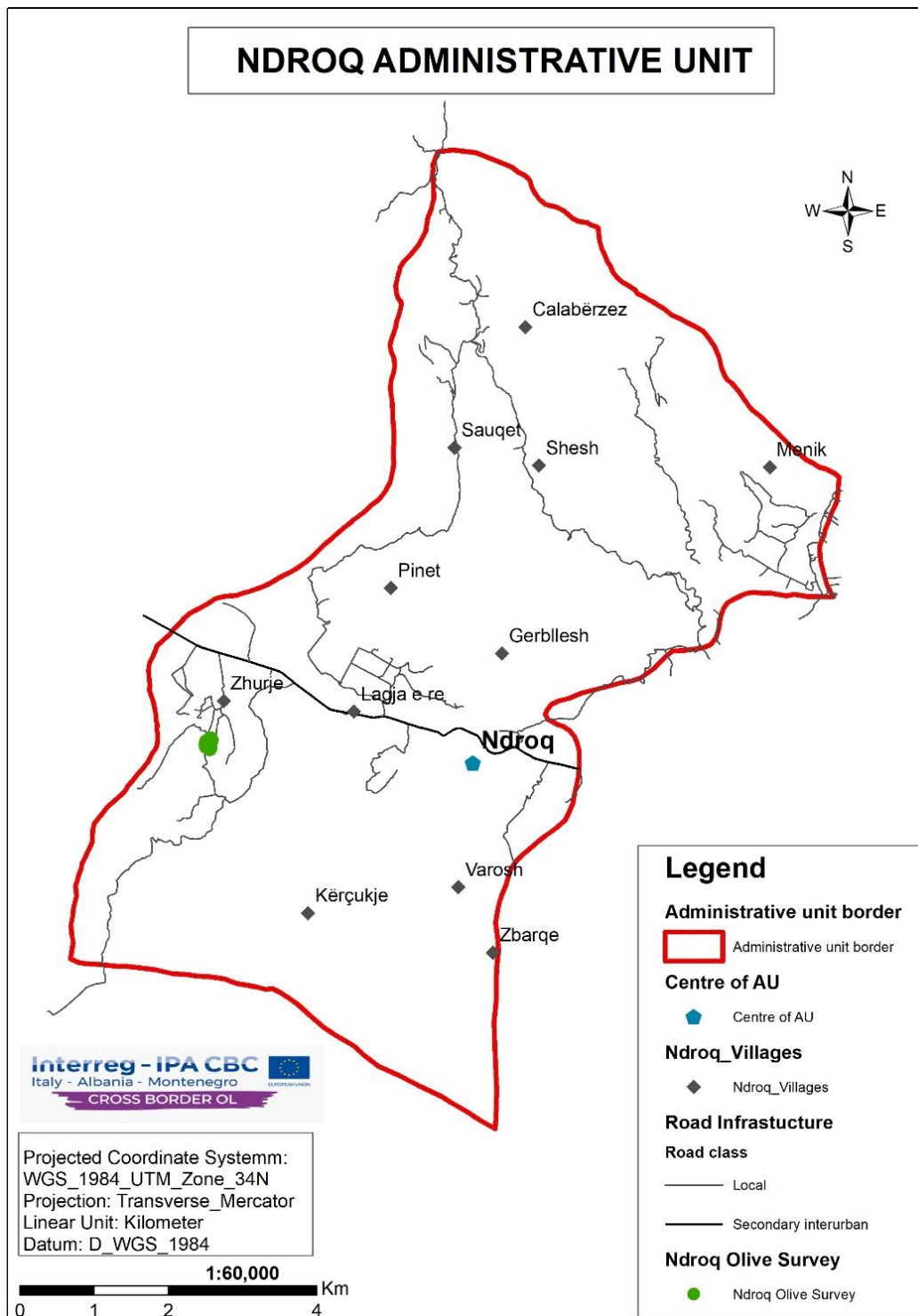


Figure 3: Map of the A.U and the location of the selected site in Ndroq

2.2. Marikaj

It is one of the villages administered by the Municipality of Vora, selected in Programme 100 Villages lunched from the central government for the development of agro-tourism. Marikaj is the village with the largest number of olives in the whole territory of Vora which encopresis the villages of Marqinet, Gërdec, Gjokaj, Kuc, Marikaj, Picar, Kodër Vorë. In the Marikaj area

grows the plant belt of Mediterranean shrubs and is known for cultivating fruit trees on hill slopes such as: olive, vineyards, peaches, apricots, apricots, plums, pomegranates and citrus.

The total area of olive groves in the area is 806 ha, of which 155 ha are centuries old olive groves (86 ha only in the village of Marikaj), positioned on terrains with a slope of over 15%, with an average yield of 22 q / ha and an average number of 80 olive trees. / ha. The size of the farm varies from 0.28-1.05 ha with an average of 0.6 ha. In this area the major part of the farmers have knowledge of the good practice of producing extra virgin olive oil. As in the other two AOO areas, the area's olive growers have benefited from many training and awareness-raising activities carried out by many projects in recent years, supported by local actors, led by the Subashi olive oil factory, which throughout the period has worked to increase the quality of the processed and marketed oil, known for its extra virgin oil.

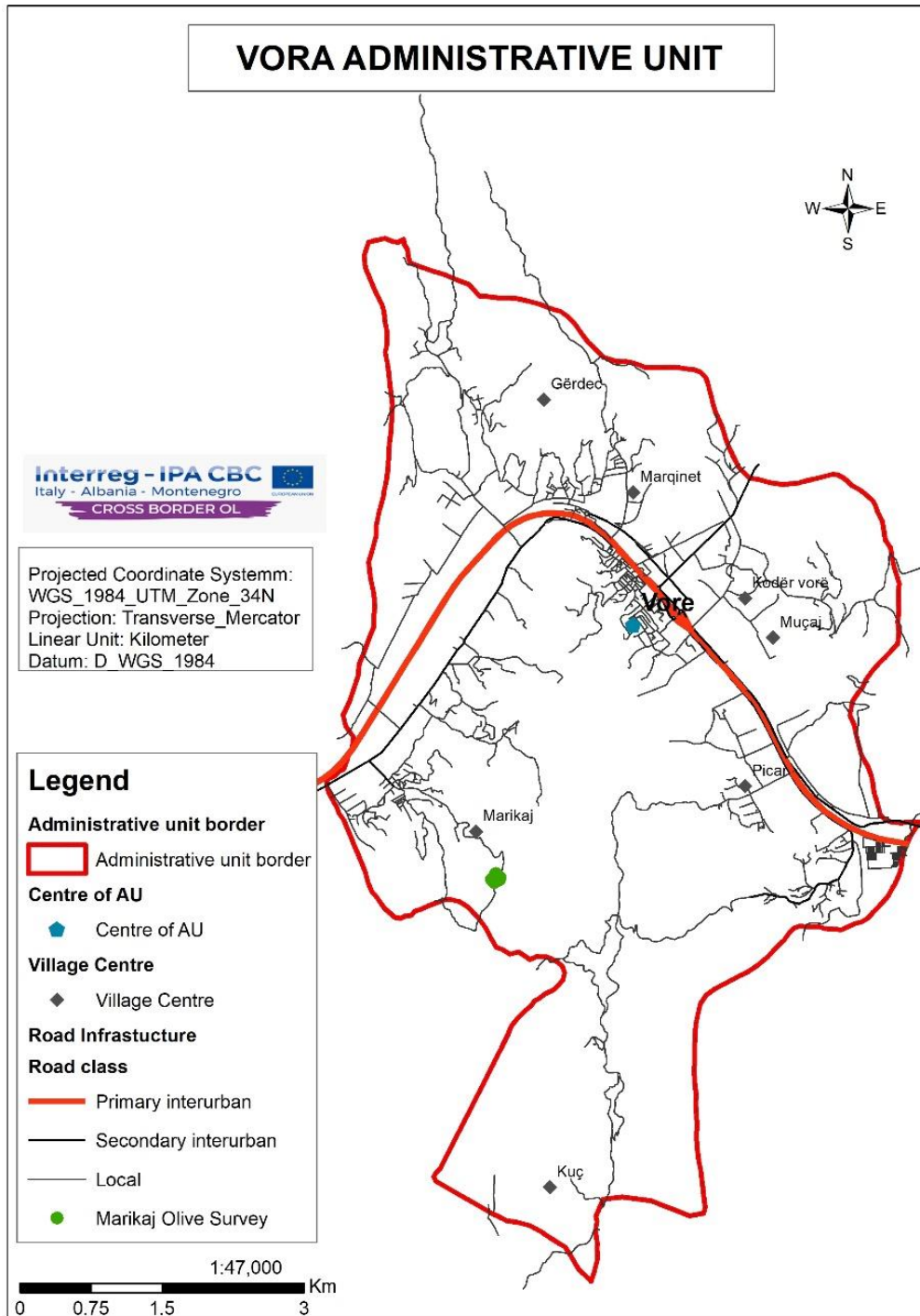


Figure 4: Map of the A.U and the location of the selected site in Vora/Marikaj

2.3. Preza

The Administrative Unit of Preza is located in the municipality of Vora. Preza is one of the most ancient villages of Tirana Region known as the city of Phoenix in which is located also the castle of Preza that many scholars believe that the castle was first built during the 3rd century AD. AU of Preza, with the villages of Prezë, Palaq, Fushë Prezë, Shargë, has 160 ha of olive groves, of which 66.7 ha are centuries old with millennial specimens.

The predominant landscape of the area is agro-agriculture with interweaving of fields, fruit plantations and olive groves. In the village of Preza, wherever you pass, the presence of

centuries-old olives stands out. There are about 8 ha with very ancient olive groves, from about 17 ha in total, mostly on steep terrain, somewhere even terraced. Olives have an average of 120 trees / ha, with a yield of about 30 q / ha. Preza has a well-built infrastructure and is visited by many tourists; the presence of AOO and the application of good practices in them are a benefit for agro-tourism.

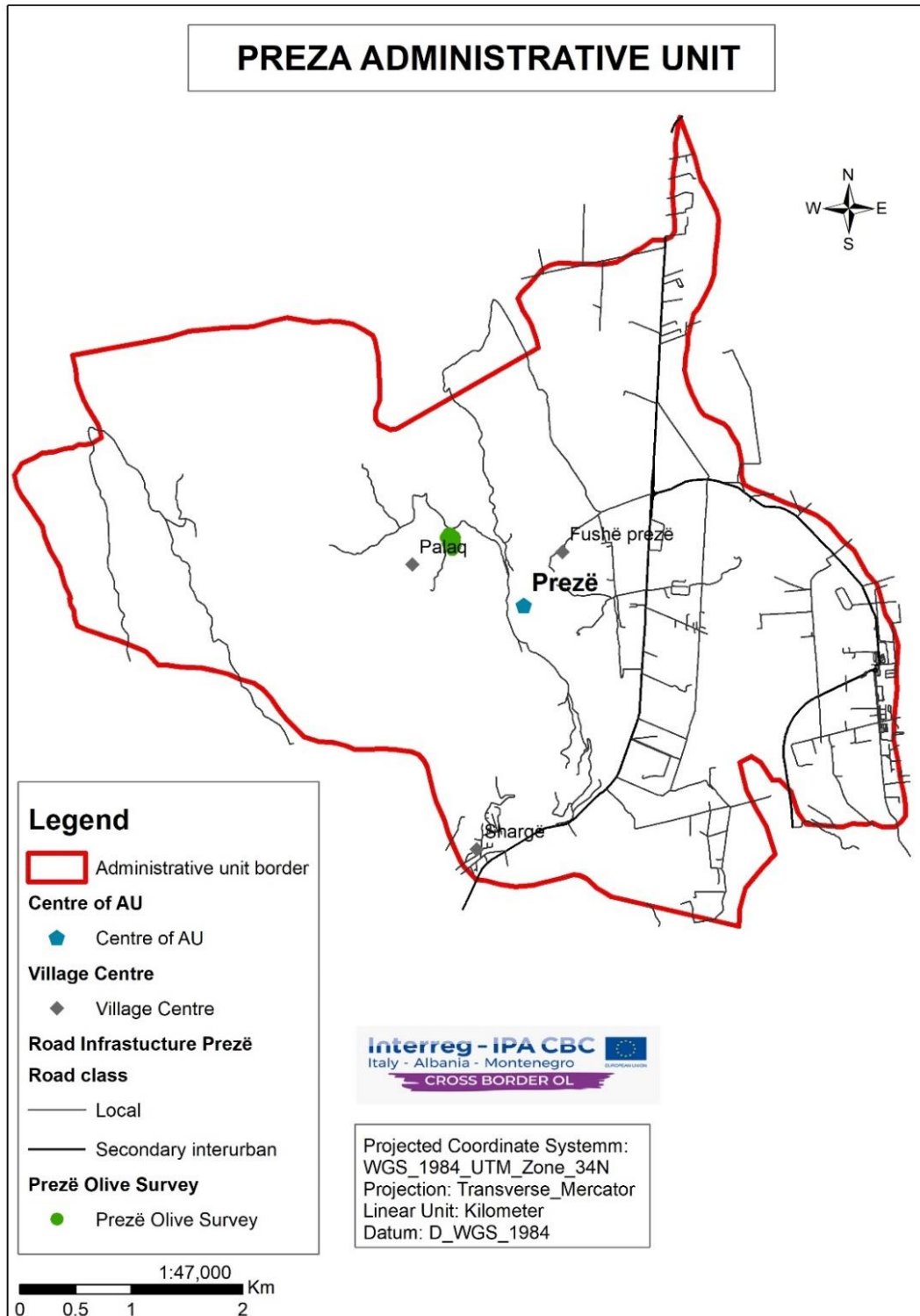


Figure 5: Map of the A.U and the location of the selected site in Preza

3. Good practices in olive groves

Although in their entirety they do not have essential differences from the practices applied in neighbouring countries, there are still special practices that differ even between the nearby cultivation areas. Farmers interviewed to identify good practices were not only the owners of the selected olive groves but also others close to them, according to the areas described above.

3.1. Mirror of cultivars

Centuries-old olive groves have a specific and very interesting significance as a genetic heritage. As for all cultivated plants and olive throughout history, humanity has preferred to cultivate improved varieties from time to time in order to meet its requirements and this has led to the reduction of biodiversity. Olive as one of the longest-lived fruit tree and for the nature of the addition has a more reduced number of cultivars, compared to other species. However, well-known cultivars in centuries-old olive blocks are known more as their population, as within it there are individuals with phenotypic and genetic changes, created during the thousands of processes that took place during the life of these cultivars.

In all three AOO areas, the main cultivar is the White Olive of Tirana. It is a cultivar that produces a high quality oil, making it a strong competitor even with foreign cultivars. From the characterization of the individuals of these olive groves, different indications were evidenced to raise the suspect that in these olive groves this cultivar is like a 'population'. The differences between the olives have to do with the characteristics of the trunk (cavities, spirals, alveoli, wider base than the trunk, etc.). This polymorphism may also be due to different environmental and agronomic conditions, however it is worthwhile for more in-depth studies.

From terrain visits and meetings with farmers it has resulted that the White Olive cultivar is found accompanied in all three areas by the Black Olive, Red Olive, Court and by Olivastra, in different reports in various parcels. In the Preza area there is another cultivar, Kushan, which is located everywhere in the old olive groves. These cultivars help each other with the pollination and this is one of the best practices we find in all three sites selected from the project. In olive groves aged 40-70 years, there are also cultivars imported from other areas as in the case of Marikaj, where there is big surface with the cultivar of Kalinjot and less with Kokërr Madh of Berati. Kushan cultivar is only part of Preza olive groves and is rarely found outside this area. In post-1990 plantings, there is a proliferation of foreign cultivars, mainly Frantoio, Leccino, Koroneiki and Arbequina.

Recommendations

We would recommend that autochthonous cultivars to be selected for new plantings. These autochthonous cultivars are those who over the centuries have passed all the tests and adapted to the climatic conditions of these areas. The diversity of cultivars located in these AOOs, gives the opportunity to choose cultivars according to the farmer interest and final product as there are many of them that are valuable and effective (production + quality) in many territories.

Investing in indigenous cultivars does not mean that testing of new cultivars with known values seemingly unsuitable for a specific area, should be stopped, because result of a crop is always determined by the combination of genetic, environmental and cultural factors.

3.2. Land management

Land management aims to improve land conditions for better plant development, favouring control of infections, improving the efficiency of fertilizers and nutrients by minimizing loss from rinsing, reducing water evaporation, inhibiting erosion, facilitating water permeability from rainfall or irrigation.

3.2.1. Surface terrain systems

The distribution of olive groves on lands with different slopes, where predominate those with over 20% slope has led to a significant change in their management, both land and crown interventions. In all the three AOO areas, there is a terrain system which works to simplify services and protect the land from erosion. Most of them have built-in eyebrows for each olive tree and a smaller part have arranged them with terraces. The construction of terraces is mainly in the form of escarpments, but there is no lack of eyebrows and terraces built with stone walls in the area of Preza. The use of stone located in the territory of the olive orchards for the creation of terraces is a good practice and we find it in almost all centuries-old olive orchards in the country, which not only cleans the soil from stones but also has very positive effects on balancing hydrological factors, thermal and microclimate of the land environment. These terraces not only serve for a better administration of land and olive groves, but also they create a very beautiful landscape with olive terraces which are in complete harmony with the hilly terrain of the areas.

The spaces between the stones also serve as a refuge for many organisms in the animal world that are useful in the fight against olive pests and that help maintain the biodiversity and natural balance of the agro ecosystem.

Abandonment of the maintenance of these walls in some cases, is a negative phenomenon, as it disrupts the balances established by the root system, impedes soil management but above all increases the phenomenon of erosion which in these hilly areas can cause serious damages.

Erosion is the main issue for all three AOOs, and for all management practices slope is what determines how it is performed. Construction of hydro-technical works (sewerage network, drainage and irrigation system, protective dams, etc.) are inevitable in these olive orchards. They control the water regime in olive groves in order to curb erosion and landslides on clay soils and to effectively use rainfall water.



Figure 6: Image of an anti-erosion canal in the olive orchard

The drainage system serves to control the movement of water, mainly in those olive orchards that have an erosive character with the aim to reduce the creation of water flows and to balance the speed of water flows. The distances between anti-erosive channels vary from 15-20 m to 30-40m, depending on the slope and terrain configuration, with small distances in high slopes and with large distances in low slopes. Their length also depends on the terrain. These canals flow into canals of larger dimensions or slopes and usually their length determines the size of the orchard block.



Figure 7: Erosion around the trunk of the tree caused by the malfunction of the anti-erosion channels

For all three AOO zones, the anti-erosive channels terminate at the edges of the slopes. Instead of slowing down the flow of water through canals or pits, residents in the absence of these works have taken care to grow plants on these plots, mostly shrubs. Their presence is positive for the preservation of biodiversity and the natural balance of parasites and their predators and for this reason it has been highlighted as a good practice.



Figure 8: Terrace wall damaged in Prezë

Recommendations

We would recommend keeping the drainage system in working order. These systems should be checked and cleaned periodically, mainly before the start of the rainy season in autumn. This system serves to prevent the formation of water flows through the eyebrows and terraces. Special attention should also be paid to the maintenance of the stone walls that form the terraces which affect the preservation not only of the balances created for the stability of the terrace but also for the preservation of the landscape offered by these olive groves.

In the area of Preza where many ancient olive trees are located inside the yards of the houses, we would recommend to keep them and increase the care by intervening with non-damaging methods and not to lay concrete alleys near their trunk as this can cause damage of their roots system and can lead to the drying of the tree.

3.2.2. Land maintenance system

The climatic conditions and the slope of the terrain condition the manner of management. Climatic conditions do not favour keeping the grass system (meadow) during the summer period, while the high slope increases soil erosion in the ugar maintenance system, so a compromise between these two systems must be found.



Figure 9: Maintenance of worked terraces / eyebrows

The solution that the olive growers have done in these areas is to cultivate the land only in the eyebrow area or the terrace square under the olive crown, while for the rest the land is kept in the grass system using spontaneous vegetation. We have identified only one case in Ndroq, of planting leguminous plants in the fall after harvest and reversing it in April for green manure. Even in this case, the bath was planted in the terraced olive grove area.

The grass is not kept all year round but only for the winter period. In the Ndroq olive orchard the grass was chopped with a motorized grass scythe in early June. In Marikaj the grass mowed in the spring is used as animal feed, while in the olive orchard of Preza, with the harvested grass the farmers cover part of the cultivated land. These practices are also applied on other farms but in the surrounding areas there are also olive orchards that owners do not take care of them and the presence of vegetation increases the risk of fires during the dry and hot months damaging the whole area.



Figure 10: Mulching the soil with the harvested grass in Prezë

High temperatures and lack of rainfall for a long period are factors that greatly reduce water reserves on land. Soil tillage is the most common agronomic practice that among other effects, reduces water evaporation by disrupting the earth's capillary network. The work on the terrace / eyebrow is applied in all the three AOO areas and in the non-abandoned olive orchards. Planning and coordination of these works with all the other cultivation interventions, especially fertilization, irrigation and plant treatment, is a good practice with a positive impact on reducing maintenance costs. Over 50% of farmers cultivate the land at the same period to fertilize at least once a year.

Due to the terrain, the possibility of using mechanics for the realization of these works is reduced and this affects the increase of the cost of performing these works. Most of the work is done with a waist on a limited area, and pruning as appropriate to eliminate grass and cover with manure. In these olive orchards the most common mechanized works is milling which is done with motorized milling cutters. Their use requires the soil to have an optimal level of humidity because dry soil makes it very difficult to use of this motorized tools.

On the other hand, the work done when the soil has high humidity can worsen the soil-air structure and regime deep work on the soil structure can damage the root system of the olives and is not advisable. Keeping the soil surface friable accelerates the decomposition of organic matter and in case no organic fertilizers are used the soil is depleted of beneficial microorganisms which can lower the soil fertility.

Herbs that have sprouted in the cultivated area can be eliminated by pruning or can be chopped into mowers. Among the measures for the elimination of weeds out, in addition to work or mowing, in special cases in the practice of olive growers in these areas, is the use of herbicides

(based on glyphosate), mainly for drying of blackberries and vegetation that is not controlled by mowing.

Since the milling machine works rotationally, we would recommend using it as little as possible in orchards, as it affects the breakdown of the soil structure (especially in clay soils). Frequent use of the milling machine creates a brittle layer on the surface which facilitates the path of smallest particles of soil to precipitate at the bottom of this layer, creating in this way a compressed layer below it with deteriorating porosity and low water and air permeability. These phenomena negatively affect the functioning of the root system and the balance of water reserves for this reason working over 3-4 times a year especially with milling machines, is not a good practice. Comparing the work done in the olive orchard through the milling machine and not cultivating the land, the second option is considered the best practice for the olive grove.

3.3. Olive fertilization

Fertilization and pruning are the two practices with the greatest impact on the productivity of these olive groves. The olive tree uses mineral elements to realize the synthesis of the necessary assimilates for its vegetative organs and for production. It is therefore necessary for it to have a constant supply of these elements, as some of them leave the soil together with the production. The idea that the olive tree has modest requirements for the nutrient comes because it lives long and has a highly developed root system in space. Olive fertilization is one of the vital and most important agronomic techniques to keep the plant healthy and to guarantee abundant production and quality olive oil which is very necessary to ensure a stable market to sell the product.

In all three selected olive orchards, the practice of fertilization is seen as an opportunity to increase production and use of organic fertilizers is highly valued in AOO areas. All of the cattle manure and plant debris is dumped in front of the olive groves.

In the AOO of Preza olive fertilization was done using 30-50kg / organic fertilizer once every two years, NPK-shaped chemical fertilizers 4-5 kg / plant and urea 2-3 kg / plant each year.

In the AOO of Ndroq, the owner of the orchard had hired an agronomist who had a pharmacy for agricultural inputs for the calculation of the amount of chemical fertilizers to use on his orchard and this solution is to be welcomed because the cooperation between farmers and specialist from the agronomy field should be increased in order to have better management of these AOOs. From the information we received, the method used for fertilizer doses was based on the amount of nutrients that the plant needs and their expected yield taking into account the calculated coefficients provided by the literature.

At the AOO of Marikaj within the same olive grove there are many owners who have had a limited number of olive trees and we have noticed that the practice of fertilization is different from each of them. Two farmers which have migrated in this area from the northern area and bought some olives used up to 200-300 kg fertilizer per olives with a distance of 10-12 m, while the care with other services was good.

Others use their cattle manure for olive groves, adding 2-3 kg of nitrogen fertilizer in the form of urea. There were also those who did not serve the olives leaving them without fertilizing and pruning in the last 2-5 years and this is the case of the beginning of the abandonment of the

olive groves. The proximity to other well-maintained olives somewhat reduces the deterioration of their condition but the risk of fires endangers all of these olives.

From the discussions conducted with olive growers in these areas it was noticed that the use of organic fertilizers in 58% of cases predominates over chemical fertilizers, although their quantities are not sufficient. We have identified only one case in Ndroq which have planted leguminous plants in autumn after harvesting for green manure.



Figure 11: Crops planted in olive groves for green manure.

The use of organic fertilizers is a good practice as it contains the most essential elements in good relations between them and with the requirements of the olive tree but at the same time affects the increase of water capacity, cation exchange and encourages the acquisition of microelements by the olive.

A good practice of organic fertilization made by olive growers who also have small cattle (sheep) in Ndroq, but applied previously in the two other areas AOO, for fertilizing olive groves is fertilization with earrings. In the old olive growing tradition, small cattle are placed in the olive groves. Their urine is rich in nitrogen and in this way they use their attitude to enrich the soil. This method of fertilization creates a good coexistence between cattle and olives but the fertilization period should not be too wet, while this method it is not always convenient, especially in low crowns trees and young plants.

In addition to organic fertilizers in the olive groves of these areas, chemical fertilizers are also used, benefiting from the developed chemical fertilizer industry as well as for the rest of agriculture. The use of mineral fertilizers with the most necessary elements for plants has been the revolution made in agriculture to increase yields, for the fact that was impossible to cope with the need for organic fertilizers. They contain elements and nutrients that are almost ready

to be assimilated by the root system of the trees. In their composition they have the necessary elements for the plant they can be with the content of special elements but also complex in different content of the elements and the active substance. Their condition in the market of agricultural inputs is presented with a variety of contents, forms (granular, crystalline, liquid, etc.) varying from the manufacturing companies.

What can make a good or a bad practice is linked to the dosages of using the fertilizer and the time of fertilization, organic fertilizer doses should also include organic fertilizers as well. We have identified cases of unauthorized distribution and disposal of fertilizers and this is not a good practice.

In general, the doses of fertilizer used are determined empirically without making soil analyses which leads in making mistakes in the dosage given to the plant. In the practice of three AOO areas most of the farmers uses 20-50kg organic fertilizer per tree almost every year, a smaller part of them fertilize century-old olives with 200-300 kg per tree once every 2-4 years depending on their possibility and the others which are more careful add chemical fertilizers mainly in the form of superphosphate and nitrogen fertilizers, in the form of urea or nitrate.

The amount to be added depends on the physical properties of the soil (structure, texture, depth), chemical properties (pH, mineral and organic components), temperature, hydric state, microbiological activity and above all, the functional state of the plant.

The method used in the AOOs of Ndroq do not take into account the real condition of the nutrients in plants and their content in the soil. This can lead to unbalanced fertilization, the farmer can throw higher quantities than the tree needs which affects the cost increase and environmental pollution.

The required quantities of elements to meet the nutritional needs of olives, which must be added with fertilizers, can be determined based on soil analysis, leaf analysis and the amount of deposits on the olive body parts and those that are removed with production.

Although fertilization practices in the three AOO areas are environmentally friendly and this is positive, the general condition of the olive groves indicates that the method of fertilization needs to be improved. First, fertilizer doses should be determined depending on the development cycle, the condition of the plant, the growing power of the cultivar, the direction of production to be carried out, land management practices (ugar, meadow), irrigation and pruning.

In relation to the developmental cycle, absorption varies according to plant age. Young olive trees require a lot of nitrogen, while grown ones have special requirements for phosphorus, which is needed for the formation of reproductive organs. Ancient olives need to be fed with more nitrogen to increase vegetation.

Weak or degraded olive trees require mostly nitrogen, while very strong plants or those affected by parasitic infections benefit more from phosphorus or potassium.

Second, the timing and manner of fertilizer disposal is just as important as the proper dose. This should take into consideration, the stage at which the plant needs the most and has the highest intensity of absorption.

In relation to the annual cycle, the absorption of elements undergoes changes according to the season and phase in the following way:

- for nitrogen the highest intensity is from full bloom to hardening of the nucleus
- for phosphorus absorption is at modest levels, does not occur in specific periods
- for potassium intensive absorption begins in vegetative reactivation and becomes high in the stage of fruit growth and ripening.

If with the method of fertilization we manage to provide the plant with the necessary elements in a timely manner than the effect of this action will be greater. But the availability of these elements in the soil is related to the presence of water, and this is one of the most important aspects that an olive grower should keep in mind to guarantee a good olive grove nutrition. If the olive grove is in a lack of irrigation, fertilizer should be applied to the soil at a more suitable time but taking care that this does not affect the loss of nutrients.

To make fertilization corrections especially for elements that exhibit symptoms of deficiency in plants we would recommend foliar fertilization as an effective fertilization option. Market situation enables numerous alternatives for the use of these fertilizers also associated with other ant parasitic treatments.

3.4. Irrigation

Irrigation it is of great interest not only in new orchards but also for the orchards in production especially in areas with dry climates. All the three selected olive orchards do not use irrigation even in extreme conditions as an available water source is almost impossible. In these areas is needed an irrigation system which will allow farmers to access water in order to make possible the irrigation of their orchard. In the absence of water, the growth of the plant is balanced, it reduces the growth and the formation of buds as well as their differentiation, there is fruit drop by reducing the productive potential of the plant.

But other olive groves in these areas that have invested and with new plantings apply irrigation in their orchard. The use of a localized irrigation system programmed according to the requirements of the plant by eliminating wasteful irrigation, especially in the case, where accompanied with the fertilization guarantees a quantitative and qualitative production of the orchard.

Recommendations

We would recommend building irrigation systems where it is possible to provide water, as a practice that increases production capacity and keeps olive groves in good health. The fact that residents have low surface area does not prevent them from collaborating with their neighbours to build common irrigation systems. The use of high water rates in ancient olive groves is not advisable due to the fact that ancient olive groves have an outdated root system with wood mass, an excessive increase in water would encourage its degradation and consequently damage to the functional roots.

3.5. Pruning of olive groves

Olive pruning is one of the most important services done to olive groves. Technical interventions in olive groves are mainly aimed at preserving plants, maintaining efficient

vegetation and their productivity. The fact that the olive grove reacts faster after the pruning than to other services done to the plant gives the impression that it is the key service to achieve a sustainable production. Pruning interventions are related to the age of the plant and its strength, young olive trees should be pruned less than older plants.

In the AOOs of Ndroq, olive grove there had high crowns and was pruned every 2 - 5 years, in Preza the AOO was pruned every one or two years, while in Marikaj most of the trees in the selected AOO, have not been pruned for the last 2-5 years. In this AOO, two new owners prune their olives every year, but they do not have the necessary knowledge to do this practice properly. The major part of farmers report that they prune their olives at least once every two years, but the condition of the plants indicates that most of them do not have the proper knowledge. In general, referring to meetings, the most common pruning operations are removing camouflage and nipples each year, cutting branches that have survived very high at harvest time and thinning branches. Pruning along with harvesting is not a good practice, even if pruning is applied once every two years, it is best to do it the year when the production is expected and when the olive has entered the winter solstice.

Another bad practice that has been found is the drastic cutting of the main branches, in order to reduce the crown, interventions that greatly weaken the plant, and in some cases prove fatal to the centuries-old olive trees.

This overall appearance has not stopped us from finding well-pruned olive groves, and this in all three AOO areas. In general, in these cases, the natural habitat of olive growth is preserved by thinning the crown.

Technical interventions through pruning in these olive groves should mainly aim at the preservation of plants, efficient maintenance of vegetation and their productivity. Their great age has made them have a large amount of wood, which requires energy to live, and this is detrimental to production, moreover a large part of the wood is at risk of not being able to support the weight of large, due to tissue degradation, damaging the plant and endangering human life. Having many non-living woods in the centre of the trunk, these olive groves are at risk of being attacked by degrading fungi and therefore pruning interventions should consider this factor. The tendency to lower the crowns by cutting the main branches drastically, in addition to destroying the relationship established between the crown and the root system, further exposes the remaining wood to these degrading factors.

Recommendations

We would recommend that the owners of these olive groves hire experts to prune these olive groves. Ancient olive groves stand between their landscape value and economic purpose. The pruning process should go in the direction of satisfying them both elements.

Excessive pruning should not destroy the natural shape of ancient olive groves. Loss of their natural form is associated not only with the deterioration of their appearance but also economic loss. It should be noted, that these olives, due to high crowns, have a high cost for their management related to pruning, phytosanitary protection and harvesting

There are many options and discussions for pruning the ancient olive groves, but what predominates is related to the degree of pruning. In these olives groves, severe and immediate pruning is harmful knowing that each cut branch corresponds to a root that dies if not fed.

Heavily pruned olive groves on the other hand lose their monumental appearance and are no longer safe. Damage to the vegetative mass damages the roots and increases the risk of uprooting.

The choice of the owner of the orchard to keep the height even 6 m in the conditions that the branches are healthy, not rotten and that create strong and productive crowns. The disadvantage of these pruning is that they have higher cost of harvesting and reduce the possibility of mechanized harvesting.

Applying pruning to the function of using mechanical harvesting machines should be the goal, after creating the lowest crowns in these olive groves.

3.6. Phytosanitary protection against diseases and olive pests

Some pests and diseases affect Olive culture, albeit with a lower prevalence compared to most fruit crops. In Albania, as in other parts of the Mediterranean area the main pests are olive (Bactrocera oleae), olive moth (Prays oleae), turtle (Saissetia oleae) and twigworm (Zeuzera pyrina).

Among the diseases the eye of the peacock (Spilocaea oleaginea), cercosporioza (Mycocentrospora cladosporioides.) and withering from Verticillium sp. are the most common fungal diseases that cause loss of production if no treatment is given to them. A bacterial disease known as olive cancer (Pseudomonas syringae pv. Savastanol) has been spread by pruning with infected means during the months with rain.

In the selected AOO areas, because of the fact that pruning is not done properly have lead to an increase of infection. Chemical treatments are performed very little, mainly for fly and this has been done for several years by the programs of the Ministry of Agriculture. The method used is that of massive capture significantly reducing the dynamics of the population of this pest through Ekotrapi. They are made from bags size 15-20 cm, filled with ammonium carbonate as equipped with a capsule, which contains the female pheromone similar to the female pheromone. This entire bag is immersed in the solution named Deltametrin, a drug that has neuroparalyzing properties when in contact with olive fly.

A special practice evidenced in Ndroq AOO after the question of whether or not to graze olive groves by animals, has been the grazing of turkeys in the olive orchards. Their presence in olive groves directly affects the fighting of olive fly and other insects. By feeding with fallen olives, they eliminate the insect that occurs in the fruit without excluding those that are in the soil, significantly reducing the fly population for infections of new generations.

Due to the terrain and the height of the crowns, the treatments for the protection of the olive from diseases are not applied and this is not a good practice. The damage caused by the peacock's eye is high in certain years, which affects not only the production of these olive groves, but also their health.

Recommendations

We would recommend that these olive groves invest more in phytosanitary olive protection. Improving the quality of olive pruning would help the health of the trees. Chemical treatments should be performed after diagnosis and when infections or damage has reached the economic threshold. For olive fly, we advise fighting the adult insect, especially its first generations, and

only in severe infections to intervene with larvicide insecticides. Using traps prepared by various flies that attract flies would be a good practice for catching them in masse. To combat the peacock's eye, we would recommend chemical treatments at least twice a year, in the spring, in the spring, and in the fall with copper-based preparations.

3.7. Harvesting

The most important aspects related to harvesting are the time or moment of harvesting, the way of harvesting, and the period after harvest until processing which regardless of the qualities of the cultivar, have a very important impact on the quality of the oil. The practice of harvesting when the olive had reached its maximum maturity is the old practice applied to these olive groves, which enters into bad practices. The improvement of technology and the introduction of new modern factories have radically changed the concept of the time for harvesting, but also all the aspects related to it for the production of high-quality oil. The fruit-ripening phase has already been defined as the most optimal period for olive harvesting and this applies to AOO.

In the practice of many farms, shaking with long wooden or plastic sticks has been used when the colour of the olive grain has begun to fade. This is a bad practice as it damages the fruit by spoiling the quality of the oil, damaging the shoots and causing wounds that promote disease infections (especially *Bacterium savastanoi*), but negatively affecting next year's production.

The introduction of harvesting equipment and machinery in recent years has not only increased the yield but also the quality of harvesting. The shaking machines are spreading very fast in the olive growing areas of AOO. The good practice that is applied is also the use of harvesting nets, which has also influenced the elimination of the mixing of harvested olives with those dropped on the ground, which adversely affect the quality of the oil.

Recommendations

We would recommend that the owners of these AOOs look at the possibility of purchasing harvesting tools to eliminate stick harvesting, in addition we propose to continually use the nets and would recommend the elimination of bags and the use of plastic crates for collecting and transporting olives. Another point is the period from harvest to processing, to produce extra virgin olive oil this period should not last more than 24-36 hours. Olive storage after harvesting should not cause changes and fruit spoilage.

3.8. Extraction and storage of oil

Generally, all interviewed olive growers accept the role of factories to extract quality oil. In all three areas, AOO has had oil extraction plants. In Preza there are many traces of old mills near the castle, while in Ndroq there is an old factory preserved in an exhibition form that consists of a special tourist attraction.

As in the whole country, in selected AOO areas there are some modern factories that guarantee very good oil extraction, extracting extra virgin olive oil.

For olive oil, the way it is stored is just as important as for other food products. A significant proportion of farmers store the oil in plastic containers and indoor conditions without paying attention to ambient temperature. The ambient temperature should be uniform and not exceed 15 ° C, so as not to favour oxidation and the environment should be clean with floors and walls that allow washing and with little light.

4. Cultural heritage and rural development

Ndroq

The village of Ndroq is located in the valley crossed by Erzeni river, in the middle of the highway that connects Tirana the capital of Albania with Durrës where the biggest port of the country is located. The old village Ndroqi is located further south and on the dominant hill rises the castle of Varosh (N: 41 ° 14 '50 "; E: 019 ° 38' 54"; height 387 m above sea level), to the southeast of which today is a neighbourhood with few inhabitants, once there were they were also Ndroq's largest neighbourhood.





Figure 12: Images from Varrosh castle in Ndroq



Figure 13: View from Varrosh castle in Ndroq

The presence of the castle is a more reason that favours the development of agritourism in the area. It is thought that Ndroqi as a settlement has existed since the Roman period, however is mentioned for the first time as a village of Andronicus with 23 houses in the Turkish register of the Sandzak of Albania, compiled in the years 1431-1432.

Traces show that this settlement (387 m high) was equipped with surrounding walls during the barbaric invasions of the century. IV- VI. The walls are wide and built of medium-sized stones connected with mortar and lime mixed with fine brick powder according to the technique characteristic for the late antique period, a fact that is also supported by fragments of pottery found on the surface of the castle. It was thought that the castle suffered severe damage at this time, but was later rebuilt during the 13th and 14th centuries, serving as the seat of Albanian feudal lords, against local rivals and foreign invaders. Its function is closely related to the geographical position it occupies in the Erzeni valley by controlling the road that connects the coast with the interior territory.

After Skanderbeg's death, the Ottoman invaders attached importance to the castle of Ndroq, as through it they could observe Durrës, which was under the rule of Venice. After the fall of Durrës in 1501, Ndroqi lost its importance, but regained it during the feudal anarchy that swept our country during the eighteenth century, again serving as the seat of the local feudal lords.

The area is known for olive groves, fruit and vegetable cultivation. All the surrounding hills are planted with olive trees, most of them ancient. Along with the olive groves the oil extraction technique has been developed, with technology factories according to the periods and technological development. Near the olive oil factory 'TRE MIQTË', in the coordinates N: 41 ° 15 '46.5"; E: 019 ° 40 '00.7"; height 45 m above sea level, parts of an old olive factory are very well preserved.



Figure 14: Image from an old mill within TRE MIQTË olive oil factory

The hills of the village of Shesh need to be mentioned for the viticulture, where two well-known grape varieties “Black Square” and “White Square” are cultivated, from which two well-known Albanian wines are named.

Processing of fruits and vegetables is another tradition of the area where it is worth mentioning their drying and preparation of products with dried fruits such as fig bread (prepared with dried figs), etc.

The Municipality of Tirana is the initiator of the organization of "Bio-Fest Ndroq". This activity was conceived as a fair of agricultural and livestock products of the area with the aim of returning to the tradition of promoting agro tourism in this area very rich in organic products making Ndroqi a hospitable space for dozens of citizens from Tirana and surrounding areas. It is also worth mentioning the presence of foreign visitors who are attracted not only by the beauties of nature but also by the agricultural and livestock products of the area.

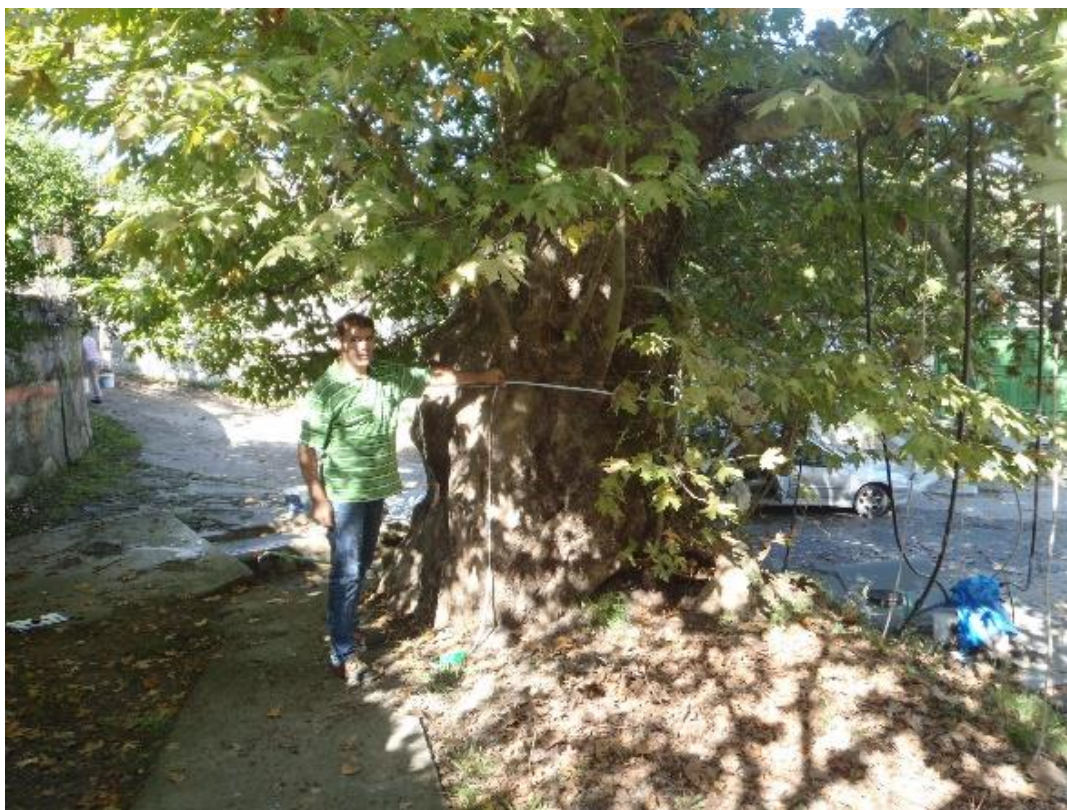


Figure 15: Ndroq's old maple

It is located in the centre of the village near a water source in the coordinates N- 41 ° 15'48 "; E- 019 ° 39'33 "at an altitude of 52 m above sea level. As early as the 1920s, the bazaar day was organized around it for the entire province of Ndroq, so it is also known as Rrapi i Pazarit.

This maple is 400 years old, with a perimeter at the base of 7 m and 5 m at a height of 1 m from the ground, while it is about 17 m high. He has been struck several times by lightning, which has damaged his crown, burning and tearing large branches.

"Ashik's Tomb" is another retreat of the area, which tells the tragic story of two lovers from Ndroqi, who were buried in this place, as they preferred to die rather than be separated from each other.



Figure 16: Image from Ashik's Tomb

This grave is located on the right side of the Tirana-Durrës highway, not far from Ndroq, under the shadow of an ancient **maple** tree known as the Old Ashik **Maple** that is drying up, in the coordinates N- 41 ° 16'21.6 "; E- 019 ° 37'25.5 "at an altitude of 46 m above sea level.

Sadly, years later, the tomb was destroyed and lost, but in folk memory lives its legend,

Marikaj

It is one of the villages administered by the Municipality of Vora, with a very favourable geographical position and a considerable area of olive groves. For its history and assets, Marikaj is been selected in the 100 priority villages for agritourism development promoted from the central government. The village is located in the middle of the Tirana-Durrës road, only 20 kilometres away from Tirana, 17 kilometres from Durrës, with a distance of 9 kilometres from the airport.



Figure 17: Image of an artificial lake in Marikaj

It is a village with a high economic activity, with some local restaurants known for traditional cooking, but also very attractive places for agritourism.

One of them, Agritourism Kuçi, known for its bio products and for the beautiful nature created with the artificial lake, has become an attraction for many groups of tourists and visitors.

Marikaj is known for cultivating fruit trees on the slopes of the hills where the olive groves give a beautiful landscape. In addition to olives, vineyards, peaches, apricots, plums, pomegranates and citrus fruits are cultivated.

A major contribution to the development of the olive growing sector in this area in recent years has given the Subashi oil factory, which throughout the period has worked to increase the quality of processed and traded oil, known for its extra virgin oil. With their passion, its owners have been promoters of many activities developed with residents to promote the best technologies for olive cultivation, helping them to increase oil production and quality. The owners of this factory are carrying out activities to promote olive orchards of this area, they also own one of the oldest olive groves in the area in which they are building a new structure to serve as agritourism.



Figure 18: Images of products from Subashi olive oil factory



Figure 19: Images from Subashi olive oil factory and an old mill

Preza

Preza is one of the oldest and most attractive villages in the Tirana Region, which is located in the northwest of Tirana. It is known as the Phoenix city due to its demolition and reconstruction over the centuries.

Many scholars think that the castle of Preza was built for the first time during the 3rd century AD. From the time of its construction until the end of the 19th century, due to the wars that took place in this region, it has been demolished and rebuilt several times. The castle rises on the highest part of the hilly range of Preza 277 meters above sea level, with the coordinates N-41 ° 25'53.5 "; E- 019 ° 40'22.3 ". This castle has the shape of an irregular pentagon with round towers at its four extremities and with a rectangular tower around the middle of the wall that extends in a West-East direction. The castle is 80 meters long and 50 meters wide (Papajani, L., 1974: 167). Numerous facts prove that the castle of Preza served mainly as a control tower for the road of economic and military importance that connected Durrës, Kruja and Shkodra. From the walls of Preza you can see the castle of Petrela or that of Lezha. Legend has it that in the wars waged in Skanderbeg's time against the Ottomans, forts and armies around them communicated with large torches with fires to inform each other.





Figure 20: Images of Preza castle

Until the late 1920s, Preza served as the administrative centre of the 15 surrounding villages.

Another old object is the water well, known as the Castle well located at coordinates N- 41 ° 25'50.3 "; E- 019 ° 40'21.9 ".



Figure 21: Image of the old Castle well in Preza

Ancient olive trees surround the whole area and residents say that olive trees have been planted there since Skanderbeg's time. This rumour also explains why Preza is known for its olive oil and the famous stone mills, from which the inhabitants processed olives. Near the castle in the facilities of Bar Restaurant Kalaja e Prezës, famous for traditional cooking, there are some of the stone mills that pressed olives during the extraction of oil in these mills and other tools with museum values.

The village is also known for its handmade fabric works, a traditional mechanism for making pieces on looms. Preza is one of the most attractive destinations for day tourism in the Tirana area. Like Marikaj, Preza has become part of a program launched by the central government in 100 villages that will have a priority focus on developing agritourism and promoting the culture and traditions of these areas. The case of Cantina Enol Guesthouse is a model of agritourism, which is frequented by the increased influx of local and foreign visitors who enjoy the traditional food of the area but also the landscape of the area, which is surrounded by olive groves.





Figure 22: Images of parts from an old olive mill at the Castle of Preza restaurant

4.1. Tourist development potential

All three selected countries are in a very favourable position for the development of cultural and culinary tourism.

All three of these sites are very close to Tirana, which is also the capital of the country and has the highest number of inhabitants in the country; also, Tirana is the main centre of the economic development where a part of the largest industry enterprises of the country and all the main central institutions are located. On the other hand, Durrës is the second most populous city after the capital and the city with the largest port in the country and a very developed tourism due to its large coastline and beautiful sandy beaches.

The highway that connects these two development poles is concentrated about 90% of the productive enterprises of the façade country, which make this region with a very high potential for economic development.

Local and foreign tourists who visit mainly during the summer but also in winter these big cities can easily access these three sites. These places with the right promotion can become very interesting destinations for tourists who are interested in cultural sites and culinary tourism. They are easily accessible through the urban and interurban transport network as they are only 20-25 minutes away from the centres of these two cities. Simplicity of access makes these places convenient to access even within a day, allowing tourists to then proceed to other destinations.

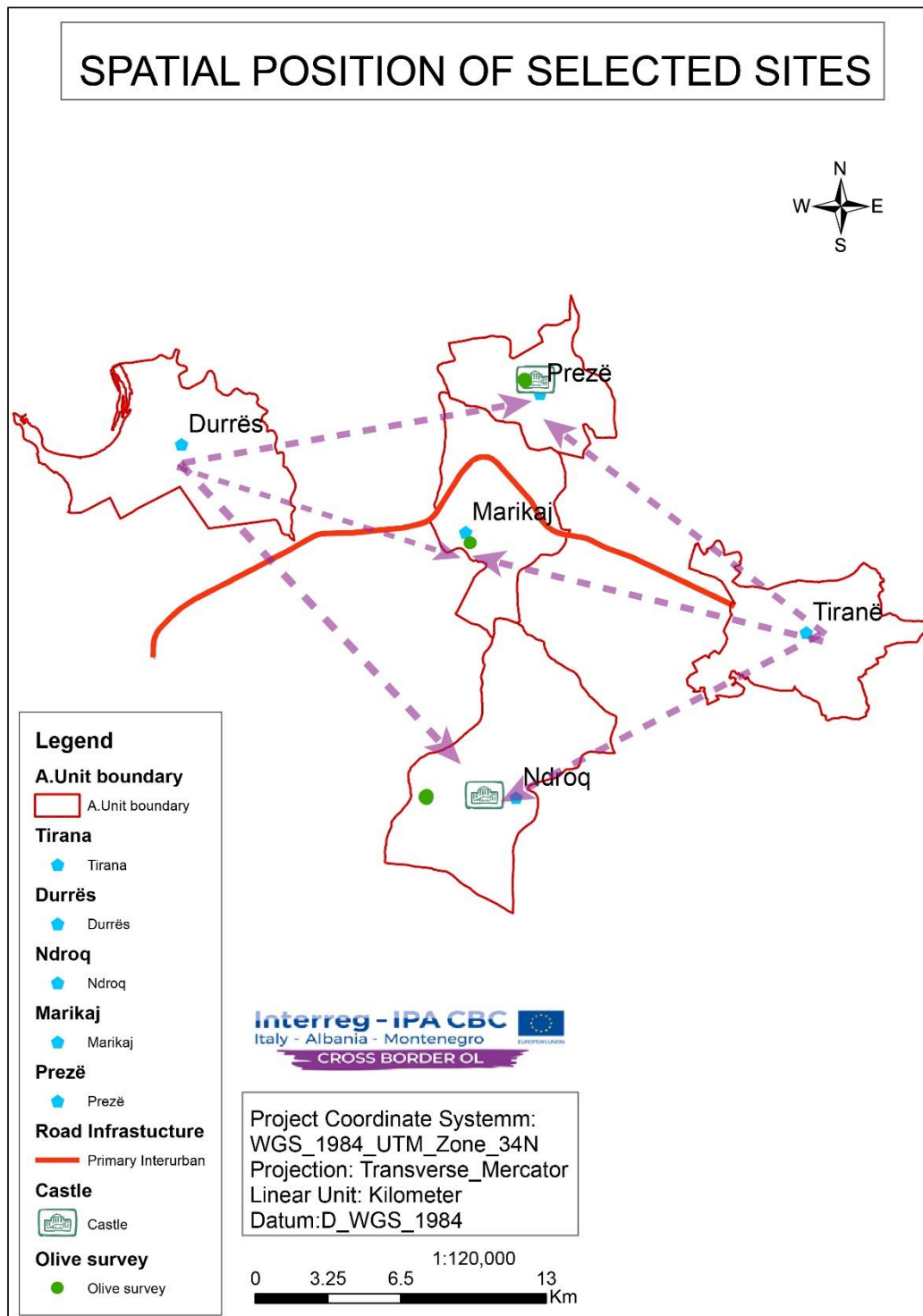


Figure 23: Map of the potential development of the selected sites

The map above shows the positioning of the three selected areas in relation to the centres of the two cities, which shows their proximity to these centres. On the other hand, the potential of the tourist movement towards these destinations is shown through the arrows.

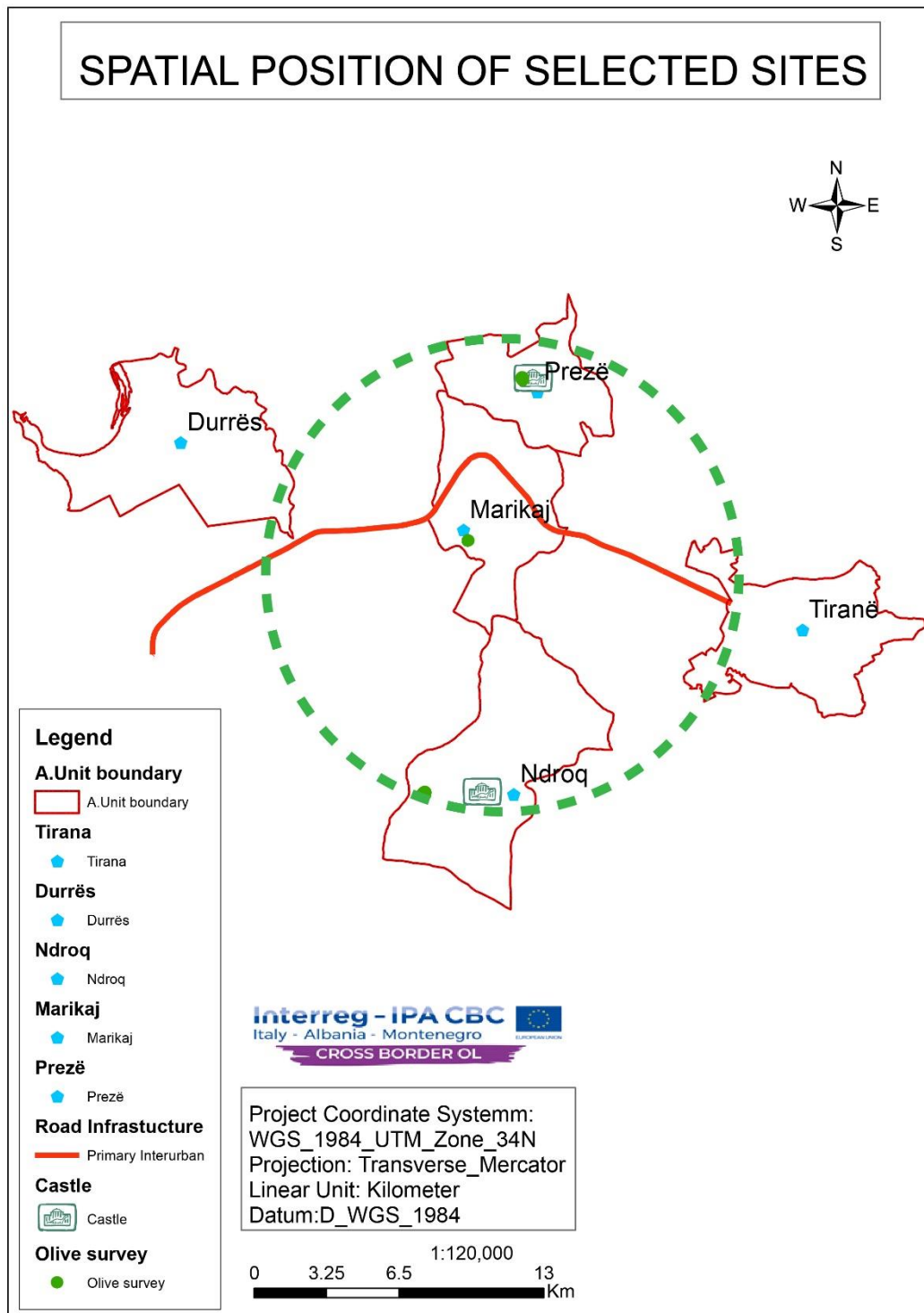


Figure 24: Map of the potential circular development of the selected sites

The map above shows the potential of a circular development that would enable a better synergy between urban and rural areas which would help to further promote rural landscapes and somewhat reduce the development pressure which years the latter is mainly concentrated in urban areas.

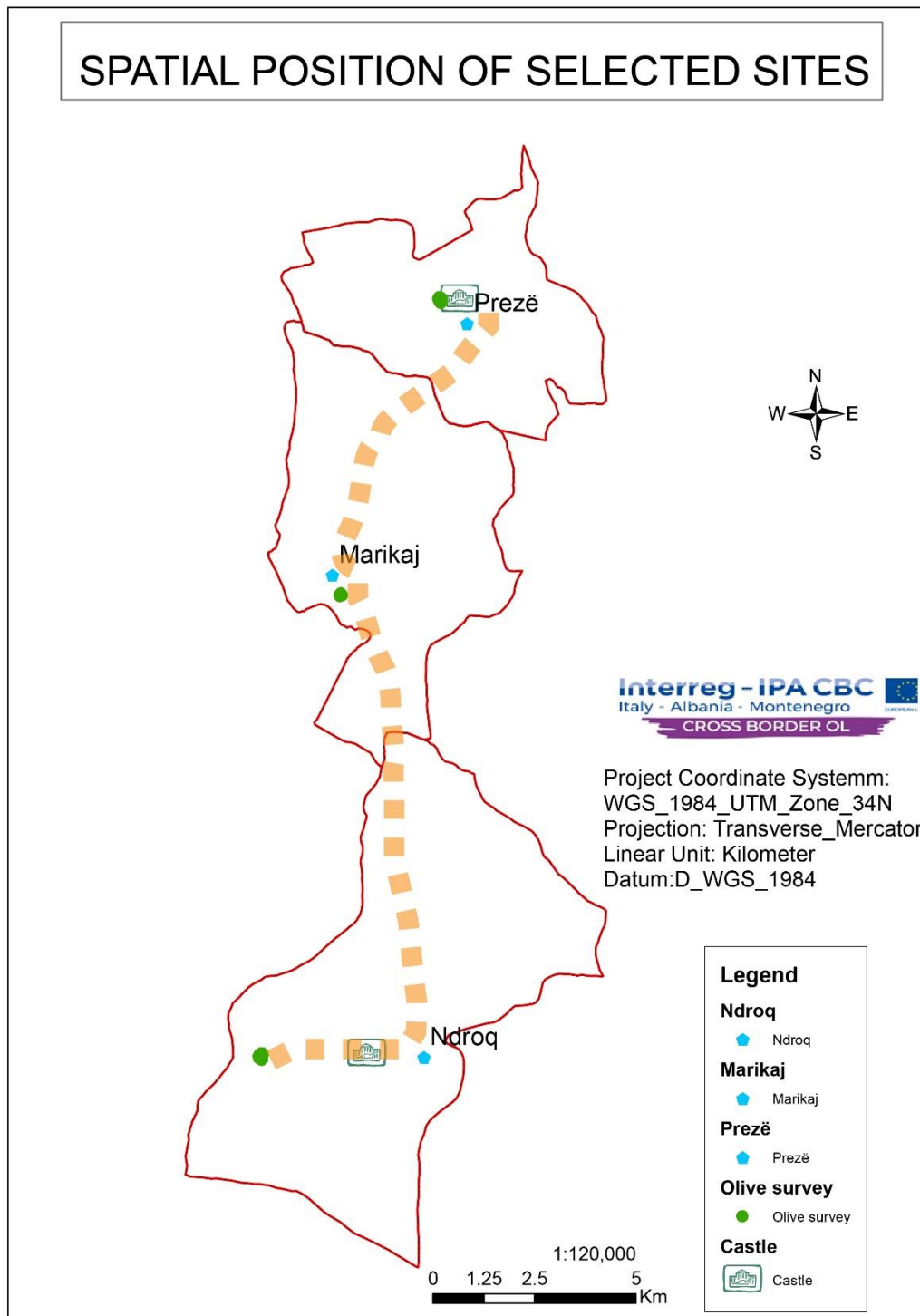


Figure 25: Map of the potential linear development of the selected sites

The map above illustrates the potential for a linear development between these three areas. If these areas interact with each other in a sustainable and unified way, they have a high potential for economic, social and environmental development, as it would allow them to exchange labour and good practices in maintaining ancient olive orchards and groves. With strong cooperation with each other, these areas would be a good option to promote culinary tourism, allowing tourists to experience closely the whole process of cultivation, harvesting and processing of olives until the final product, which is mainly olive oil and why not decorative and aesthetic objects.

5. Conclusions

Proof of olive processing dates back to the 6th century AD. Presence of olive exemplars aged 1500 to 2500 years in many areas of Tirana, Kruja, Durrësi, Berati, Mallakstra, Vlora, etc. with a multitude of cultivars and populations, mostly found close to medieval castles and ruins of millenary civilizations, demonstrate how ancient is the cultivation of olives in Albania. There are rare exemplars of adapted olive populations existing in all of these areas, having high economic, environmental, social and breeding value. In many ancient olive orchards (AOOs), cultivated following traditional environment-friendly practices, play an important ecological role, surrounded by a dense net of dry-stone walls where wild shrubs still survive. Such semi-natural habitats create structural conditions allowing the diversification of plant and animal species, some of them AOOs are resistant to climate change and can help local populations adapt to it.

The selected AOOs belong more or less to the same era and use the same cultural care. They are found in the same cultivation belt and are truly representative of centenary olive groves in the country. The areas have a typical Mediterranean climate characterized by hot summer and a mild and wet winter. Hills are 500 m above sea level and being close to the sea benefit from its buffering effect. The three areas represent some of the oldest sites of olive growing in Albania in Tirana region, which demonstrates the ancient olive culture in these areas, including agronomical techniques. Olive growers have inherited many good agricultural practices.

Olive growers in these AOOs have cultivated populations of the local cultivars by associating cultivars, which are compatible in terms of cross-pollination. They have included even inferior cultivars in terms of production and quality but with the purpose to improve the production of the main cultivar. We find this old inherited knowledge in our three AOOs. The main cultivar ‘Ulliri i Bardhë’ (white olive) is found associated with Olivaster, cv. ‘Ulliri i Zi’ (black olive), cv. ‘Ulliri i Kuq’ (red olive) and in Preza AOO with cv. ‘Kushan’. The Red Olivastër of Tirana is found almost in all ancient olive orchards of Tirana and Durrës.

Ancient olive orchards are adapted and show a high resilience to unfavourable climatic conditions. The variation in climatic and soil conditions has caused many cultivars introduced in different times to do not perform as expected. Even the displacement of autochthonous cultivars outside their typical cultivation areal has not always resulted in good performance.

In the selected AOOs, a partial cover crop is applied where spontaneous vegetation covers the entire orchard except for under the tree canopy. Taproots eases the deep penetration of water especially in the case of heavy rains. In our AOOs, cover crops are mechanically mowed when become competitive for water with the tree considering that these olive orchards are not irrigated. Mowed grass is left on the field as a mulch adding matter that is more organic but also conserving scarce water reserves in the soil. Since irrigation is not feasible, this permanent cover crop (repeatedly mown to reduce competition for water to the minimum) is the right solution to preserve the organic matter content in the soil. AOOs with low vegetation under the olive canopies reduce the force of raindrops and erosion while flowing in the surface.

Of particular interest is the cultivation of olives in the so-called “eyebrows” (half-moon). This technique consists in building “eyebrows” with stones or earth mounds on the lower side of the slope to create small terraces. This “eyebrows” retain many nutrients leached downhill as well as leaves and other plant material decayed. Other cultural practices were applied to the “eyebrows” like fertilization with manure and later, green manure with leguminous crops. The latter is frequently applied and it is an important measure to avoid alternate bearing. Another best practice is the construction of terraces from dry stones (without using mortar). This inherited technique, not only uses the stones found in the area to create the terraces and removing them where they can be an obstacle, but it has a series of positive factors for balancing soil hydrological, thermal and microclimatic factors, including an impressive view in terms of landscape.

In cases of high intensity of erosion and in more degraded sites, olive growers have used other measures to establish protective belts using circumstantial objects. More commonly, belts created with woody material from olive pruning waste or other plants in the form of fences, including stones if are found around.

Another best practice of great relevance in establishing and successfully managing AOOs is drainage of superficial and underground waters. The typical methods applied by olive growers in AOOs consist in drainage of waters through drainage canals and construction of a drainage network in waterlogged prone areas.

AOOs are managed as low-input agricultural system. We have achieved a success if we manage to control the fruit fly before depositing its eggs in fruits. To prevent this we may effectively use poisoned proteins punks (1 kg Buminal + 300 gr Rogor/ 100 liters of water) or Succes 24 CB (1 litre solution in 30 litres of water). These solutions are applied in one square meter from the sunrise side. Treatments are repeated after 21 days (or immediately after the rains); a total of 3 – 4 sprays during the season. The preventive control is important from the ecological and toxicological viewpoint because it uses a very low quantity of pesticides. Since several years, the olive fruit fly mass capture method is being widely used to significantly reduce the dynamic of this pest. A particular experience found in our AOO is the reduction of the olive fruit fly by the pasturing of turkeys in olive orchards.

The strategy to control olive peacock spot requires a good knowledge on the level of infection and its development. This enables also to identify also latent stages of the disease through diagnosis and early identification. The diagnostic technique for young leaves consists in dipping a sample of 100 leaves taken from 4 trees/ha, 10 leaves/tree in sodium hydroxide 5% (NaOH), for 2 – 3 minutes in room temperature. For mature leaves, a warm water bath at 50 – 60°C will show eventually the infection like dark spots on the crest of the infected leaf.

No chemical weeding is applied in AOOs. In the selected AOOs, instead of soil tillage, weeds are mowed at a height, which slows down the sprouting of vegetation, which will take place when the climatic conditions of the crop are more favourable. Mowing is done at a height of 5 – 6 cm from the ground as to create a mulching layer, which reduces the water losses, by direct evaporation from the soil.

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