GIS IN THE CONTEXT OF PUBLIC INFORMATION FOR MEDICINAL AND AROMATIC PLANTS OF THE MUNICIPALITY OF DIBRA

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Abstract: The population living in the mountainous areas is dependent on the use of biodiversity, especially the forest ecosystems where the medicinal and aromatic plants have a major role. The growth of the world's interest for the natural and cultivated plants is açompanied with the study and creation of digital database açessible to all, which provide basic information concerning the botanical descriptions and values of medicinal and aromatic plants. Albania is one of the countries in Balkan with a great potential of medicinal and aromatic plants (over 310 species), where around 15% of population living in mountainous areas is dependent on the activity of collection and cultivation of medicinal and aromatic plants. In the last decade, the growth of the international market demand about the Albanian medicinal and aromatic plants has led to the growth of the interest of this population for collection and even cultivation.

As a result of lack of information on the methods of collection, harvest calendar, etc., numerous species are damaged or endangered to be extinct. On the other hand, the number of farmers that deal with cultivation of medicinal and aromatic plants has increased, but the lack of information about the climate and soil conditions required for the plant cultivation has led to the failure of these efforts resulting with considerable economic losses. For this reason the public information about the area of medicinal and aromatic plants, calendar of harvest, harvesting techniques, climate and soil conditions for cultivation of specific plants, market prices, etc., is a necessity.

The geoinformation of the medicinal and aromatic plants created with the help of GIS is a digital database where an inventory card of each plant includes the photo and the information about the botanical description, geographical extension, harvest time, technical harvest criteria, values and uses, etc. GIS offers also the possibility of analyzing and cartographic visualization through interpolation of geological, climate and topographic data, etc., to determine the optimal conditions for the cultivation of medicinal and aromatic plants. The municipality of Dibra was taken as case studie, whose population living in rural areas is involved in farming activity of the sage, besides colleting plants in the wild. Geoinformation of the wild and cultivated medicinal and aromatic plants of this municipalitie is created and a website is being created, where the public and other actors involved with collecting, planting or management of medicinal and aromatic plants will be informed.

Keywords: medicinal and aromatic plants, GIS, geoinformation, cultivation, management

INTRODUCTION

Mountainous areas account for about 24% of the land area and in it live about 12% of world population.[86] Natural resources of these areas provide good material not only for people that living in these areas, but also the rest of the population living in urban areas and are dependent economically from these natural resources. Biodiversity is one of the natural assets which is intensively exploited by the population and today is one of the key global issues. In the context of biodiversity, medicinal and aromatic plants occupy an important place, which have been historically used by the population for the treatment of various diseases. The Interes of the population on these plants was high, which made the researchers to undertake studies on the potential. Literature is mainly found in the form of printed publications, so that the population often faced difficulty on securing these researches. Development of science and technology after the second half of the Twentieth Century made possible for a part of this literature to be thrown in electronic form (in the form of digital database) and this way it was served to a broader audience[87]. Expansion of awareness of the importance of medicinal plants and their use in the medical field led to the growth of interest in the international market on the activities of MAP. This was followed by the potential damage causing some of them to disappear or be listed in the Red Book as plants with the special status of endangering.

Albania, for the geographical location and favorable physical and geographical features (geological diversity of forms of relief, diverse climate, rich hydrographical network, types of soils and diverse nature edaphic) is ranked among the first European assets to its flora and the general surface it possesses. In Albania are increased about 47%

[86] International Centre for Integrated Mountain Development, (2012), Mountain Biodiversity Conservation and Management, Kathmandu, Nepal, pg.1

[87] K. K. S. Bhat, (1997), Medicinal plant information databases, Medicinal plants for forest conservation and health care, FAO, Rome, pg.60

of Balkan plant species and 30% of Europe's plant species. Albania's Flora includes around 3250 different plant species that belong to 165 families and 910 genders. About 1.1% or 28 becoming sub species and 150 are endemic. Over 310 species are medicinal and aromatic plants and about 10% of the flora of the country is occupied by the rare species, endangered species and relict species. [88] Medicinal and aromatic plants which are grown in Albania are significantly potential and 90% of them are grown in a natural state. They constitute in an important potential for the country economy generating significant economic income. To the processing medicinal and aromatic plants' industry in Albania it was paid a special attention during the period of yeas 1945-1990, which is reflected in the figures of the economic benefits generated by their exports. Nowadays the industry of medicinal and aromatic plants is being transformed into one of the main industries agro agricultural occupying over 50% of Albania's agricultural exports[89]. The mayor part of the population living in rural mountain areas of Albania is engaged in the collection of medicinal and aromatic plants. Foreign market for medicinal and aromatic plants is increasing its interest from one hand, and as well as the low level of economic income of people living in rural areas has led this increased interest in collecting, gathering and cultivation of MAP. Debar Municipality is one of Albania's municipalities with the highest number of people living in rural mountain areas, where a large part of them are being engaged in activities of MAP. The failure to inform the population on the criteria and harvesting techniques, the supplies and equipment to be used, harvest calendar, etc., has led to over sortation and to a very potential damage to MAP, where some of them, as it was mentioned above, are included in the Red Book as endangered plants. Existing literature on this potential is relatively poor, which is found in the form of printed publications and accessibility of the population of these areas is relatively limited. Creation of geo information of BMA, with a lot of information and details for each plant, has brought to an innovation in Albania and will soon be accessible to all stakeholders and public interested in the high potential of cultivation of MAP.

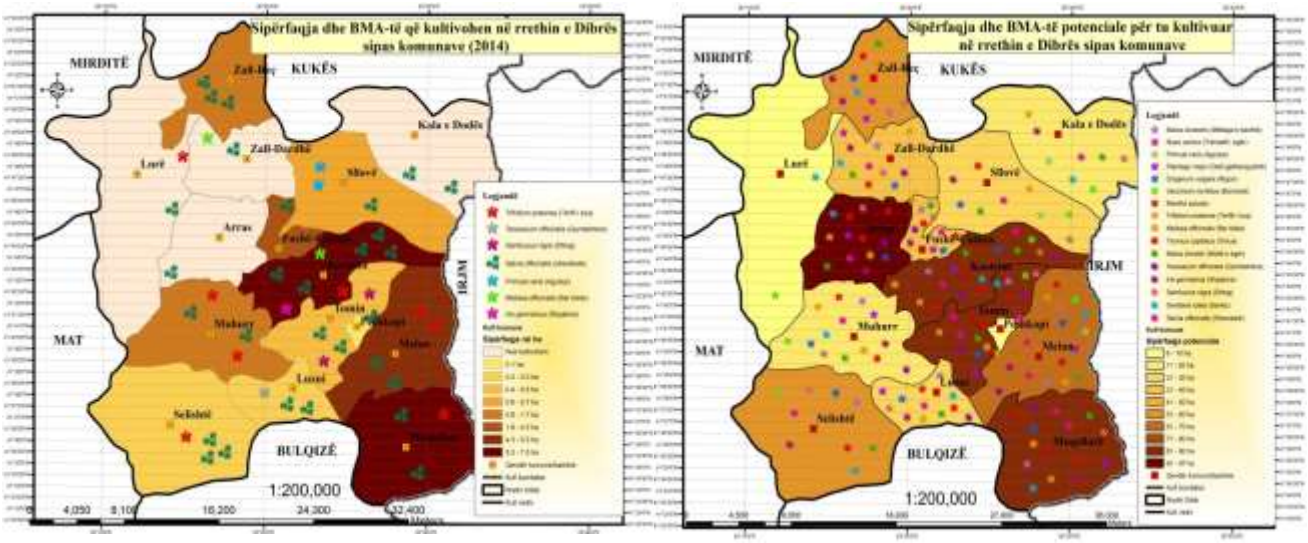
MEDICINAL AND AROMATIC PLANTS IN THE MUNICIPALITY OF DEBAR

Debar Municipality lies in the northeastern part of Albania and has a population of about 93,287 inhabitants, of which 78 000 people live in rural mountainous areas. Their main economic activity is agriculture, which occupies an important issue and activity and the gathering / collecting of the MAP in wild/ wildly. Debar Municipality geographical position offers good favorable-soil conditions into the cultivation of medicinal and aromatic plants. In the mountainous areas of this municipality (Debar) we find growing over 100 plants with medicinal and aromatic values, where about 98% of them is already in the wild. Some of wild MAP are: Lavandula vera, Narcissus poeticus, Papaver rhoeas, Primula veris, Thymus vulgaris, Gentiana lutea, Orchis maria, Arctostaphylos uva-ursi, Vaçinium myrtillus, Betula pendula, Prunus spinosa, Tussilago farfara, Crataegus oxycantha, Matriacaria chamomilla, Rosa canina, Urtica dioica, Saturea montana, Taraxacum officinalis, Sambucus nigra, Malva silvestris, Trifolium pratense, Primula veris, Salvia officinalis, Colchicum automnale, Bellis perennis, Capsella bursa pastoris, Aremisia obsinthium, Malus silvetris, Ononis spinosa, Juniperus communis, etc[90]. While the plants are cultivated are fewer in number (about 2% of them) and the cultivation of their stated interest comes always growing. Currently the Municipality of Debar 28.5 hectares of land are cultivated on medicinal and aromatic plants, where the largest surface area is planted sage, while the forecast for a period of 10-15 years to reach 710 ha and to increase the types of species cultivated[91].

[88] Vangjeli J, Ruci B, Mullaj A. Libri i Kuq, 1997, pg.5
[89] Ministria e Bujqësisë, Ushqimit dhe Mbrojtes së Konsumatorit, 2012
[90] Gjoni Z., *Vjelja dhe grumbullimi i bimëve mjekësore të Dibrës*, Tiranë 2008.
[91] SNV, Dibër, 2013

Figure 1 - Map of the distribution of MAP currently grown and the potentially map to be cultivated in Debar Municipality

Source: Z. Gjoni, D. Horeshka, Collection center of MAP in Debar, 2014



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One of the major issues facing nowadays the potential of MAP in Debar Municipality is the damage of the plants we are discussing over, where the main factor is human. With the increasing market demand for MAP is parallel increased the population pressure over this potential. On the one hand there is the natural potential to grow in the wild, which is facing the over exploitation while on the other hand we see the increased interest of the population to put on the cultivated areas with plants with higher requirements in the general market. Both these forms of benefit have brought destruction and degradation of the zone of some habitats (until their extinction), which common denominator is the lack of information of the population.

Most of the population engaged in the collection of MAP activity in the wild, belongs to that order of people with low incomes. They are unable to be served by the economic literature of the MAP, because, in most cases it is inaccessible by them. Some NGOs have taken initiatives to organize training workshops and other various trainings on this potential. Even so the participation has been limited in number and most of them have not benefited from these activities. On the other hand there are farmers who have taken initiatives investing in the cultivation of MAP (the case of sage), but the misinformation to be notified for the climatic and soil conditions the plant requires have failed, bringing them considerable financial damage. It is the necessary to offer more information to the population. The creation of MAP's geo information (which contains digital database with the relevant information about medicinal and aromatic plants as well as visualize their mapping) offers people accessibility on MAP in a shorter time and with lower economical cost compared this, to other methods of information.

THE GEO INFORMATION OF MEDICINAL AND AROMATIC PLANTS IN DEBAR MUNICIPALITY

The MAP Geoinformation is created through the use of GIS technology (Soft ArcGIS10) and aims to create a digital database and the cartographic visualization of medicinal and aromatic plants and turning it into a digital accessible product concerned into the potential and industry of MAP. This database enables the storage and updating of spatial, biological and medical MAP data. The database contains detailed information for each plant as the name in English and Latin, Botanic description, geographical distribution, climatic conditions of growth, parts of the body with can be used, the calendar of harvest, usage, current status and economic value. The following table we give a model how to create a database for some of the plants growing in Debar.

Table 1 – Database of Medicinal and Aromatic Plants

Shape*	Id	Latine name	Popular name	Family	Botanic description	Geographic area	Climatic and pedologic conditions	Parts used	The harvest period	The use	Status of endangerd	Economic value
Point	1	Gentiana Lutea	Sanza	Gentianaceae	Two years plants,30-130cm t	800-2000 m hight over sea level	Mediterranean mountain foothills climate, gr	Roots	June-July	The medicine, food industry an	Endangered	High economic value (20-30 €/kg)
Point	2	Origanum vulgare	Rigon i Bardhe	Lamiaceae	Herbaceous plants 30-80 cm	Everywhere until 800-900m eve	Warm clime and sandy limestone soil	All plant without roots	June-August	Medicine and food industry	Endangered	High economic value (3500 €/ha)
Point	3	Crataegus oxycanth	Murriz	Rosaceae	The wood 2-3 m hight with s	It grows everywhere until 160	Grows in sunny slopes, bands quarry dried	Flowers, leaf and dry	August	The medicine	-	High economic value
Point	4	Foeniculum vulgare	Finoku	Umbrellifere	The hight until 250 cm, wilde	Coastal area until 600 m hight	Plants with heat demand, poor ground limes	her seeds	June-August	The medicine, food industry an	-	High economic value (16-20 kv/ha) value t
Point	5	Lavandula vera	Lavanda	Lamiaceae	he bush 50-120 cm hight,narr	From coastal area until 1800 m	Flerly dry land,Mediterranean mountain foot	Flowers	June-July	Medicine and cosmetic	-	High economic value (1500-2000 €/ha)
Point	6	Matricaria chamomile	Kamomil	Compositae	Herbaceous plants 10-60cm	Everywhere until 2000 m over s	all climatic type and limestone soil	Flowers and leavs	June-September	Medicine	-	High economic value (2000-2500 €/ha)
Point	7	Malva silvestris	Mellaja	Malvaceae	Herbaceous plants 30-40cm,	Everywhere until 1300 m over s	all climatic and soil types	Flowers and leavs	May-June	Medicine	-	High economic value (1500-2000 €/ha)
Point	8	Juniperus communis	Dëllinja e zezë	Cupressacea	The bush 1-3 m hight,leaves t	until 600 m over sea level	Averange moisture and fresh ground	Her fruits	October-December	The medicine	Endangered	High economic value
Point	9	Laurus nobilis	Dafina	Luaraceae	The wooda 10-15m hight,barc	During the costal area until 600	Mediterranean climate, fresh ground	The leaves	March-November	The medicine and food industr	Endangered	High economic value

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For the creation of GI is required a collaboration between managers in the field (researchers, botanists, agronomists, local population, etc.) and experts who are able to use GIS technology so to create digital information and a connection between their respective maps. The main components needed to create interactive maps containing MAP information are: determining the geographical coordinates, determination of physical and geographical elements of the area (relief, pedology, and hydrography) and the types of plant species found in the area.These layers overlap each other to show which area has more or less species or which area has particular species (endemic or economic importance, etc.). Once the mapping is done, it is necessary to send on connections with tables containing the relevant information for each plant thus creating the MAP and GI. This information is associated with an interactive map and we only may click on the area and the species we are interested in and the information will be shown to us.
In the figure No. 2 is given the illustration about the sage, and so on for all the species to be grown across Municipality of Debar. This geo information serves as a guide for MAP users and it is all concerned for MAP growing in Albania. It is easy to use, accessible and updating at any time.

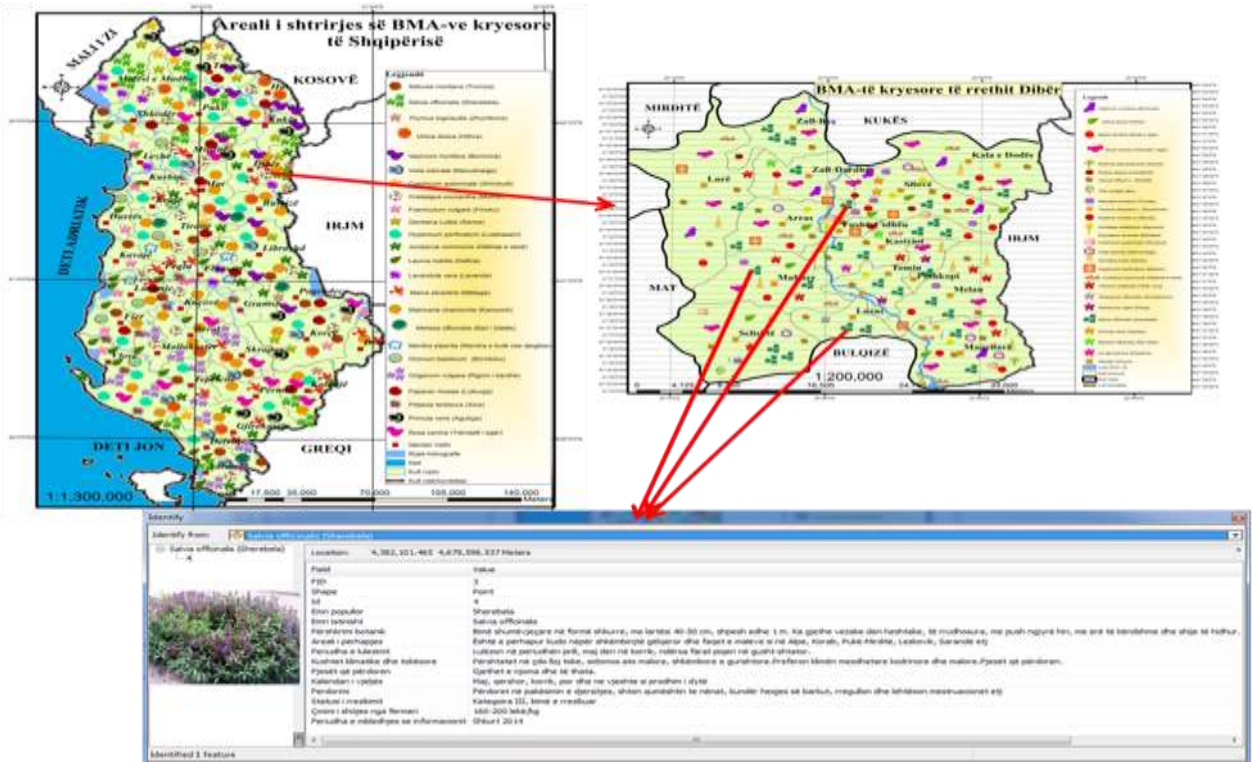

Figure 2 – Illustration of MAPs geoinformation (case sage)
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The importance of GI consists of: Providing information on BMA and the elements related to them before they visit the area; it helps users to easily identify the plant they are/ may be interested in; it helps managers and researchers to define and easily identify the most endangered species or experimental determination of potential of their cultivation. GI provides detailed information for each plant about the vegetative period, the time of collection, its use, and so on. GI provides information on their economic values, market demand as well as possible areas for their possible cultivation; it assists in the management of their own and concrete intervention measures in case of damage to their sustainable use of MAP.

GIS TO INFORM THE POPULATION ON THE CULTIVATION OF MAP

Besides the creation of geo information the MAP, GIS technology offers us the opportunity to determine the suitable areas for the cultivation of MAP. This is achieved by analyzing data and geological interpolation, climatic and soil of the area concerned, where the farmer is concerned about / is interested in the cultivation of MAP.

This interpretation provides an opportunity to inform farmers to make their investment in areas with optimal conditions into the growing of the plant, which would have brought productivity and a possible reduction of the risk of investment failure. To illustrate the importance of the application of GIS technology into the cultivation of MAP is taken as pilot area the administrative unit Maqellarë, part of the municipality of Debar, and as we mentioned above, the species of sage.

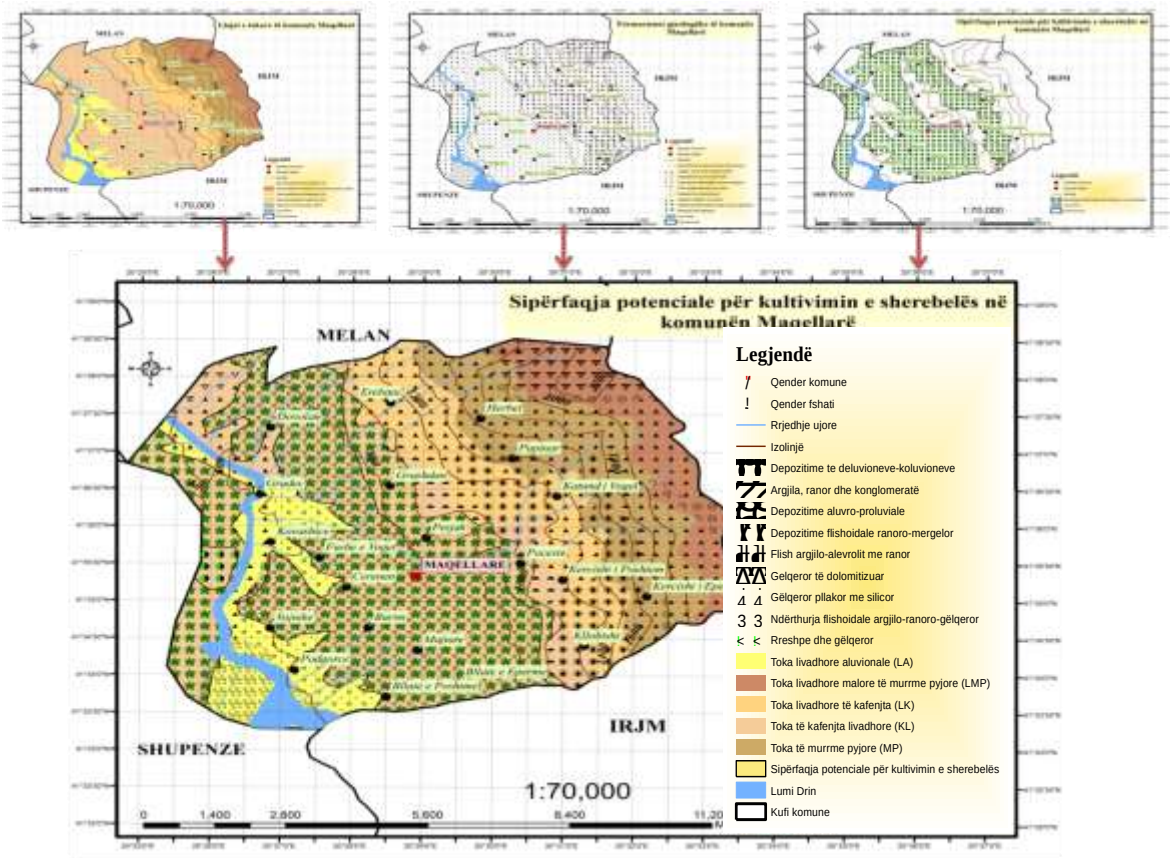
In this analysis there are included climate elements administrative unit Maqellarë (minimum and maximum temperatures, precipitation, frost, humidity, types of soils, geological formations, etc.) and climatic soil conditions requiring from sage. After analysis and interpolation of ArcGIS data there are defined the most suitable breeding sage fields and areas.

Table 2 - Conditions climatic-soil of commune of Maqellarë in the view of cultivation of sage

The climatic conditions for sage to be upgrown[92]	**Climatic condition of Maqellare[93]**	**Geo conditions for sage to be ungrown[94]**	**Geo conditions Maqellare[95]**
The Temperature -for the insemination 8 ºC - for the germination 12 ºC -for the breeding 24>30 ºC - minimal 10 ºC -maximal 32 ºC The humidity approximately high	Temperature -yearly average 11.3°C -winter 3.1°C -spring 10.4°C -summer 20.9°C -fall 13.9°C -Minimal 1.2°C (December, -January) -Maximal 22.3°C (July-August) precipitations 240-982 mm precipitations /yearly Frost 10 days/yearly	-the depth asked ~ 0.5 -good drainage -the soil structure oozy equilibrate (6) (skeletal, pebbly, faintly airily soil) -pH 6.5 – 8.5 (should be avoided the high acidity) -active lime <10% -salt not salty: <2mS/cm -high organic substance -rich in phosphorus -poor in potassium -the soil position –exposed to the sun and protected from the wind	Deep soils Rich in humus unpenetrable (pebbly airily pH 6.8-7 rich in potassium, phosphoros and nitrogen

[92] Shema R., Pllumi M., Sherebela e kultivuar, Shkodër, 2011, pg. 10-11
[93] Stacioni metereologjik i Maqellarës, 2014
[94] Shema R., Pllumi M., Sherebela e kultivuar, Shkodër, 2011, pg. 10-11
[95] Gjoka F., Brahushi F., Tokat (natyra, cilësitë, shpërndarja dhe përdorimet e tyre), Tiranë 2007, pg.148-163

Figure 3 – Areal potential to cultivation sage in Maqellara administrative Unit (Debar)



CONCLUSION

Increasing the interest of the population living in rural areas of the municipality of Debar, the inclusion of collection activity and collection of medicinal and aromatic plants has led to damage and overexploitation of this potential. Ignorance of harvesting techniques, supplies and equipment used, the harvest calendar or climatic and soil conditions the plant requires for its growth are some of the reasons the massive habitat destruction and the failure of efforts MAP farmers for their cultivation. Ways of informing the population on the potential have mostly been fund in printed literature and in organization of trainings and workshops, where the mayor part of the population who has been directly involved in the activity of MAP have failed to be part of them. For this reason it is necessary to inform the public to be more inclusive and accessible to all. Geo information is crucial to help people obtain this kind of information very easily on the digital way, in a short time and with very low cost compared with other methods. It, also assists and farmers who want to cultivate MAP, informing them for climatic and soil conditions the plant requires for its growth in optimal conditions without losing their biological values. Besides the population dealing directly with this activity, the use of GIS technology through analyzes and assists and efforts and management of MAP stakeholders in monitoring and intervening with concrete measures for a good management and sustainable development of the MAP.

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