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4th meeting report

Businesses of medicinal and aromatic plants' wild harvesting

State of the art & needs on training

9-10th May 2013

Kilis 7 Aralik University

Kilis (Turkey)

Written by:

E. Moré¹, A.M.Barata², V.Lopes², F.Rocha², J.Radusiene³, B. Karpaviciene³,
H.Cetinkaya⁴, N.Sekeroglu⁴, Muhittin Kulak⁴.

¹Forest Sciences Center of Catalonia, Medicinal and Aromatic Plants Group, Ctra. Sant Llorenç de Morunys, km.2. – 25280 Solsona (Spain). E-mail: eva.more@ctfc.es

²Instituto Nacional de Recursos Biológicos, Banco Português de Germoplasma Vegetal, Quinta de S. José, S. Pedro de Merelim, 4700-859 Braga (Portugal)

³Nature Research Center, Institute of Botany, Laboratory of Economic Botany, Žaliųjų Ežerų g. 49, LT-08406 Vilnius (Lithuania).

⁴Kilis 7 Aralik University, Faculty of Arts and Sciences, Department of Biology, Mehmet Sanlı Mah. Doğan Güreş Paşa Bul. No:134, Kilis (Turkey).



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Objective

During the 4th meeting of Grundtvig Plant Wild Project that was held in Kilis (Turkey), the partners presented the state of art of the businesses related to medicinal and aromatic plants (MAPs) wild harvesting and discussed about the training needs of the stakeholders involved in the value chain.

Methodology

Before the meeting the partners prepared a survey considering the 10 most important MAPs species (in terms of volume) wild collected in each partner's country for a commercial use.

Next information was unfolded:

- Resource description and distribution.
 - o Type of vegetation.
 - o Biogeographical region.
 - o Altitude range (lower and higher altitude where the plant can be found in the nature).
 - o Map of regional distribution.
- Production and use estimation.
 - o Collected part of the botanical resource.
 - o Production estimation (abundance and productivity).
 - o Use estimation (number of hectares and tons collected and associated economic value).
 - o Evolution of production.
 - o Land property of harvesting areas.
 - o Regions providing collected plants.
- Value chain.
 - o Raw material obtained according to collected part.
 - o Production process.
 - o Stakeholders involved.
 - o Enterprises dealing with MAPs wild harvesting.
 - o Prices.
 - o Main market.
 - o Elaborated products and services

At the end, a SWOT analysis on MAPs wild harvesting businesses in each country was elaborated.



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Each partner suggested the training needs that the main stakeholders involved in the MAPs wild harvesting's value chain (collectors and buyers) have, and indicated how this training should be in order to reach these stakeholders.

And finally, a participative discussion was implemented in order to do a SWOT analyses and key recommendation on training needs from business point of view.

Results

SPAIN

There were considered these 10 species from the wild as the most commercialized:

1. *Artostaphylos uva-ursi* (L.) Spreng. (cast. Gayuba cat. Boixerola)
2. *Gentiana lutea* L. (cast. Genciana cat. Gençana)
3. *Crataegus monogyna* L. (cast. Espino blanco cat. Arç blanc)
4. *Rosmarinus officinalis* L. (cast. Romero cat. Romaní)
5. *Thymbra capitata* (L.) Cav. (cast. Orégano español, tomillo carrasqueño cat. Frígola)
6. *Lavandula latifolia* Medik. (cast. Espliego, alhucema cat. Espígol, barballó)
7. *Thymus zygis* Loefl. ex L. (cast. Tomillo blanco)
8. *Cistus ladanifer* L. (cast. Jara pringosa)
9. *Satureja fruticosa* (L.) Briq. (cast. Poleo blanco cat. Poniol)
10. *Thymus mastichina* L. (cast. Mejorana)

Resource description and distribution

The types of vegetation where these species can be found are:

Types of vegetation	Species
<i>Juniperion nanae</i>	<i>Arctostaphylos uva-ursi</i> (L.) Spreng.
<i>Vaccinio-Piceetalia</i>	<i>Gentiana lutea</i> L.
<i>Prunetalia spinosae</i>	<i>Crataegus monogyna</i> L.
<i>Rosmarino-Ericion</i>	<i>Rosmarinus officinalis</i> L., <i>Thymbra capitata</i> (L.) Cav.
<i>Rosmarinetalia</i>	<i>Lavandula latifolia</i> Medik., <i>Thymus zygis</i> Loefl. ex L.
<i>Lavanduletalia stoechadis</i>	<i>Cistus ladanifer</i> L.
<i>Asplenion petrarchae</i>	<i>Satureja fruticosa</i> (L.) Briq.
<i>Quercetum rotundifoliae</i>	<i>Thymus mastichina</i> L.



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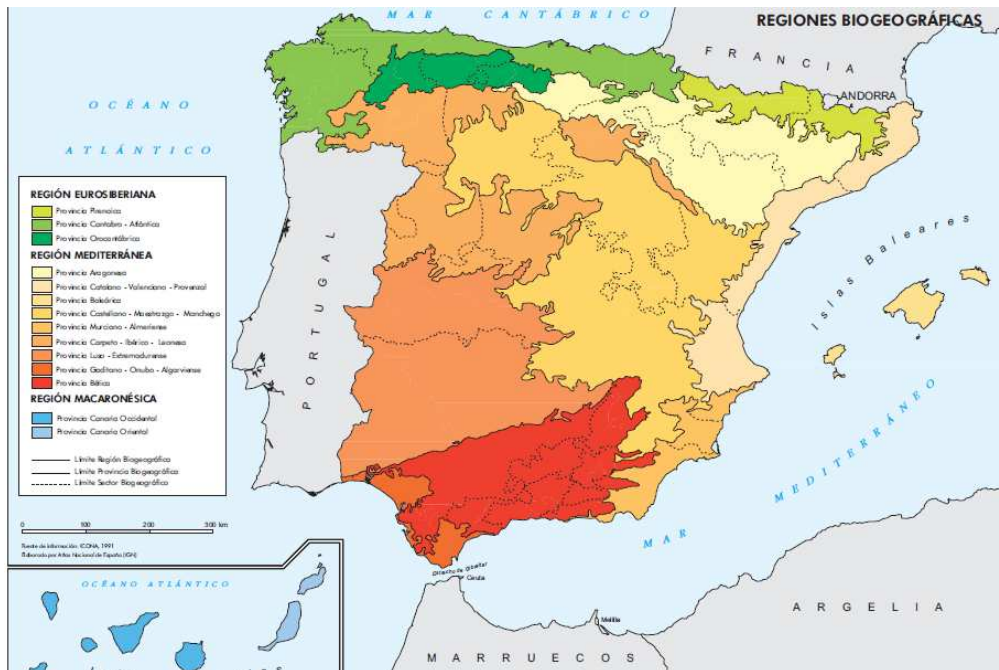
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Related to biogeographical regions Spain territory has three main ones: Eurosiberian, Mediterranean and Macaronesian (Canary Islands). Therefore there are some specific bioregions with Boreal and Alpine characteristics included in Eurosiberian region.



SOURCE: Instituto Geográfico Nacional

Two species belong to the Alpine bioregion: *Gentiana lutea* to Boreal-Alpine region (from 900 to 2.100 m of altitude) and *Arctostaphylos uva-ursi* to Boreal-supalpine, Submediterranean, Northern Mediterranean ones (from 600 to 2.500 m of altitude).

Crataegus monogyna is located both in the Late-Eurosiberian bioregion either in the Mediterranean one, from 0 to 1.800 m of altitude.

The rest of the species belongs to the Mediterranean bioregion. *Rosmarinus officinalis* is spread in all the Peninsula (from 0 to 1.400 m), *Lavandula latifolia* in the Northern Mediterranean (from 0 to 1.700 m); *Thymbra capitata* in the Southern Mediterranean (from 0 to 200 m), and rest the species are located in the Western Mediterranean: *Thymus zygis* (from 0 to 500 m), *Cistus ladanifer* (from 0 to 1.000 m), *Satureja fruticosa* (from 0 to 1.500 m), *Thymus mastichina* (from 0 to 1800 m).



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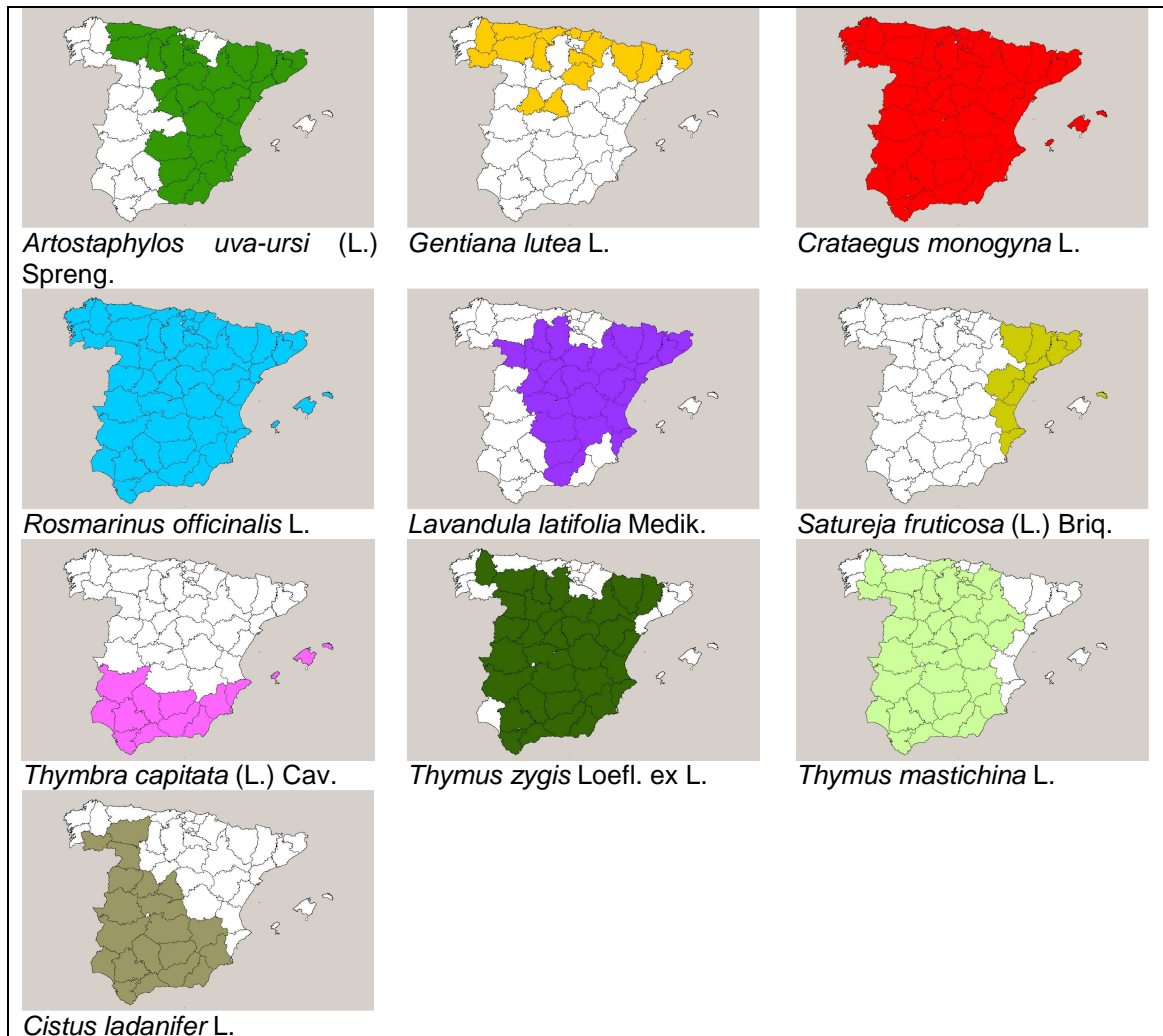


Figure 1. Regional distribution of wild harvested MAPs in Spain

Production and use estimation

In Spain there are few surveys for monitoring the abundance of MAPs, and only for specific species and in concrete places (e.g. in 2009 there were estimated a potential production of 0,07 kg/ha of flower of *Arnica montana* in surroundings of Aigüestortes Natural Park²). So, the potential productivity in Spain can only be estimated by taking into account the number of botanical registrations:



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Table 1. Number of botanical registrations of species identification in Spain

Species	Nº of registrations
<i>Thymus mastichina</i> L.	2.244
<i>Crataegus monogyna</i> L.	2.092
<i>Thymus zygis</i> Loef. ex L.	1.972
<i>Rosmarinus officinalis</i> L.	1.811
<i>Lavandula latifolia</i> Medik.	983
<i>Cistus ladanifer</i> L.	943
<i>Arctostaphylos uva-ursi</i> (L.) Spreng.	616
<i>Thymbra capitata</i> (L.) Cav.	338
<i>Gentiana lutea</i> L.	286
<i>Satureja fruticosa</i> (L.) Briq.	142

SOURCE: www.anthos.es

The commercial collected parts are:

Leaves	<i>Arctostaphylos uva-ursi</i> (L.) Spreng.
Roots	<i>Gentiana lutea</i> L.
Flowers	<i>Crataegus monogyna</i> L., <i>Thymbra capitata</i> (L.) Cav., <i>Lavandula latifolia</i> Medik.
Plant in flower	<i>Rosmarinus officinalis</i> L., <i>Thymus zygis</i> Loef. ex L., <i>Satureja fruticosa</i> (L.) Briq., <i>Thymus mastichina</i> L.
Plant after flowering	<i>Cistus ladanifer</i> L.

In relation to use estimation, there is not specific information on each of these species. Just some specific studies give information in some regions: 2,6 t/year of *Arctostaphylos uva-ursi* in (Catalonia)³; 8 t/year of *Gentiana lutea* in Catalonia and 620 ha of collected surface in León (Castilla y León)⁴. Other studies in Andalusia^{5,6} state wild harvesting of: *Thymus zygis* L. subs. *gracilis*, *Th. mastichina* L. (25 t/year) and *Thymbra capitata* (40 t/year) for essential oil obtention; *Th. vulgaris*, *Th. orospedanus* H., *Thymus baeticus* Boiss., *Thymus hyemalis* Lange for dry leaves. *Cistus ladanifer* L., orange flower (*Citrus* spp.) and *Eucaliptus* spp. in Huelva and Sevilla. *Thymbra capitata* and *Mentha pulegium* L. in Cádiz, Málaga and Córdoba. *Salvia lavandulifolia* V., *Rosmarinus officinalis* L. and *Lavandula latifolia* Med. in Granada, Jaén and Almería.

Nevertheless, there is some statistical data on general MAPs production from forests.

According to Forestry Statistics⁶, main NWFP productions are: mushrooms and other plants. Most of surfaces are for mushrooms and truffles collection. MAPs are only the 0,04% of NWFP value. Most of MAPs are aromatic ones (e.g. *Thymus* spp., *Thymbra* spp., *Lavandula* spp., *Cistus* spp., *Rosmarinus* spp.), mainly harvested in Andalusia region (81% of the production). Land property is mainly private (73% of forest area) overall in Andalusia, while only 27% is public.



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Table 2. Economic importance of MAPS as non-wood forest product in Spain

Use estimation	Associated surface (ha)	total production (t)	Economic value (€)
Total aromatic and medicinal plants	457.246 (1)	3.528 (1)	64.506 (2)
Total non-wood forest products (plants and mushrooms)	3.310.471 (1)	9.411.395 (1)	143.672.984 (2)

SOURCE: (1) Anuario de Estadística Forestal (2010) (2) Anuario de Estadística Forestal (2008)

Table 3. Medicinal and Aromatic Plants production from forests in Spain

REGION Province	Total MAPs 2009		Total MAPs 2010		2010 Forest and wild harvesting certified organic Surface (ha)
	Production (t)	Surface (ha)	Production (t)	Surface (ha)	
ANDALUCIA	3.797	505.187	2.867	454.445	181.349
Almería	332	38.682	319	38.952	
Cádiz	249	28.739	239	29.234	
Córdoba	552	63.681	529	64.778	
Granada	1.036	168.104	958	110.465	
Huelva	668	76.070	341	75.909	
Jaén	417	67.217	227	67.227	
Málaga	192	22.268	91	26.578	
Sevilla	350	40.426	164	41.122	
ARAGON	115				547
Zaragoza	115				
C.VALENCIANA		229	229		6.213
Valencia		229	229		
CASTILLA Y LEÓN		428	215		1.166
Léon		428	115		
Soria			100		
CASTILLA LA MANCHA	104	2801	104	2.801	5.222
Albacete	104	2801	104	2.801	
R.MURCIA	33		43		341
I.BALEARS					3.966
I.CANARIAS					429
CATALUNYA					16.528
MADRID					159
NAVARRA					1.391
LA RIOJA					135
Total MAPs	4.243	508.553	3.528	457.246	217.446

SOURCE: Anuario de Estadística Forestal (2009, 2010)



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It is difficult to compare years when statistical data is unreliable, but since 2006 it has been noted an increase in the MAPs harvesting, despite 2009 was the year with highest production and has decreased more than 700 t in 2010 according to theses surveys.

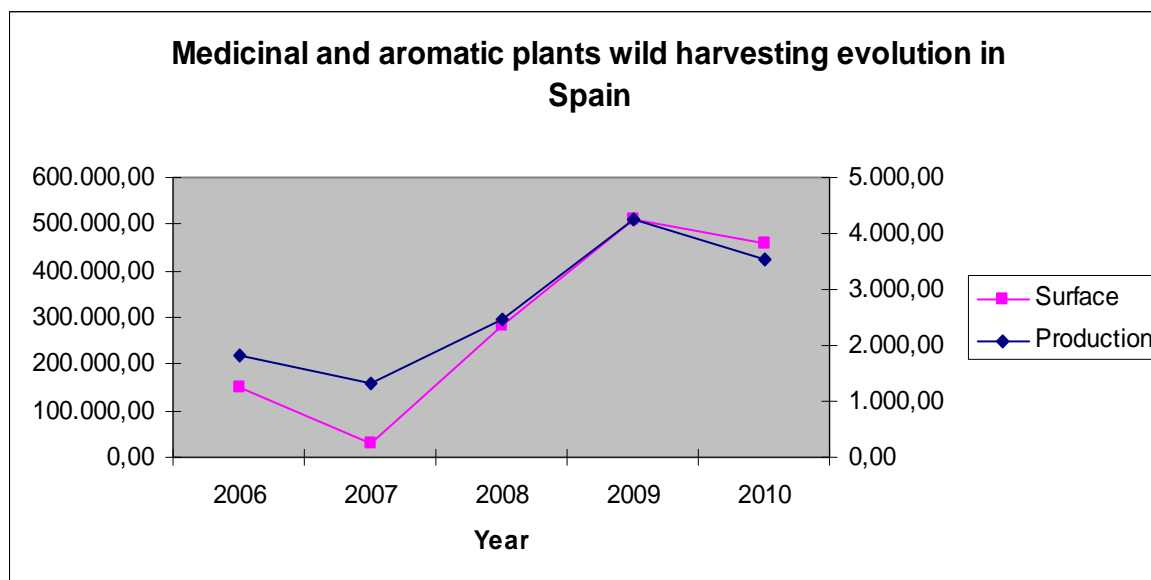


Figure 2. Medicinal and aromatic plants wild harvesting evolution in Spain

Value chain

Related to uses, *Arctostaphylos uva-ursi*, *Crataegus monogyna*, and *Gentiana lutea* are mainly addressed to the medicinal market. *Gentiana lutea* with *Thymbra capitata* are also used in the food market, for elaborating liquors. Regarding the food market, *Satureja fruticosa* and *Rosmarinus officinalis* are used for herbal teas, while this last one is also used as a condiment for cooking. From rosemary there is obtained also essential oil and antioxidants, with a varied use in the industry. But the most important market for wild harvested plants in Spain in the perfumery one, which is provided of essential oils and essences from several species: *Rosmarinus officinalis*, *Thymbra capitata*, *Thymus zygis*, *Thymus mastichina*, *Lavandula latifolia*, and *Cistus ladanifer*.



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Table 4. Main products obtained from the wild harvested MAPs in Spain

Species	Collected part	Raw material	Market	Elaborated products
<i>Arctostaphylos uva-ursi</i> (L.) Spreng.	1	2, 4	1	1
<i>Crataegus monogyna</i> L.	3 (flower top), 4	2, 4	1	1
	4	3	1	4
<i>Gentiana lutea</i> L.	2	2	1, 2	1, 5
<i>Satureja fruticosa</i> (L.) Briq.	5	2	1, 2	2
<i>Rosmarinus officinalis</i> L.	1	1	3	8
	1	2	1, 2	1, 2, 3
	5 (flowering)	4	2, 3	7
	5 (flowering)	5	1, 2, 3, 4	1, 6, 8, 9, 10
<i>Thymbra capitata</i> (L.) Cav.	3	2	2	5
	3	5	4	9
<i>Lavandula latifolia</i> Medik	3 (spike)	5	4	9
<i>Thymus zygis</i> Loef.ex L.	5 (flowering)	5	4	9
<i>Thymus mastichina</i> L.	5 (flowering)	5	4	9
<i>Cistus ladanifer</i> L.	5 (after flowering)	5, 6	4	9

Collected part: 1.leaves 2.roots 3.flower 4.fruit 5.plant

Raw material: 1.fresh herb 2.dry herb 3.juice 4.extract 5.essential oil 6.essences

Market: 1.medicinal 2.food 3.cosmetic 4.perfumes 5.other

Elaborated products: 1.phytomedicines 2.herbal teas 3.condiments 4.food supplements
5.liquors 6.flavours 7.antioxidants 8.cosmetics 9.perfumery
10.aromatherapy

FRESH HERBS AND FRUIT JUICES

From the wild, only *Rosmarinus officinalis* is harvested as fresh raw material for elaborating cosmetic products, and fruits of *Crataegus monogyna* for obtaining fresh juice addressed to food supplements. The product process through the value chain is the following:

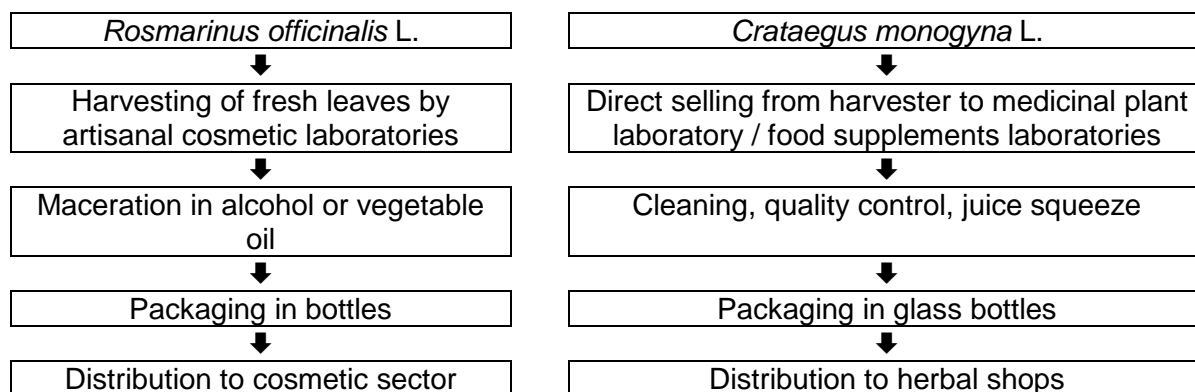


Figure 3. Value chain of fresh herb raw material obtained from wild species in Spain.



DRY HERBS

From dry herbs can be obtained phytomedicines addressed to medicinal market and food products, like us herbal teas, condiments and liquors. The wild plants that dry herbs are obtained as raw material are: *Arctostaphylos uva-ursi*, *Crataegus monogyna*, *Gentiana lutea*, *Rosmarinus officinalis*, *Satureja fruticosa* and *Thymbra capitata*.

The product process through the value chain is the following:

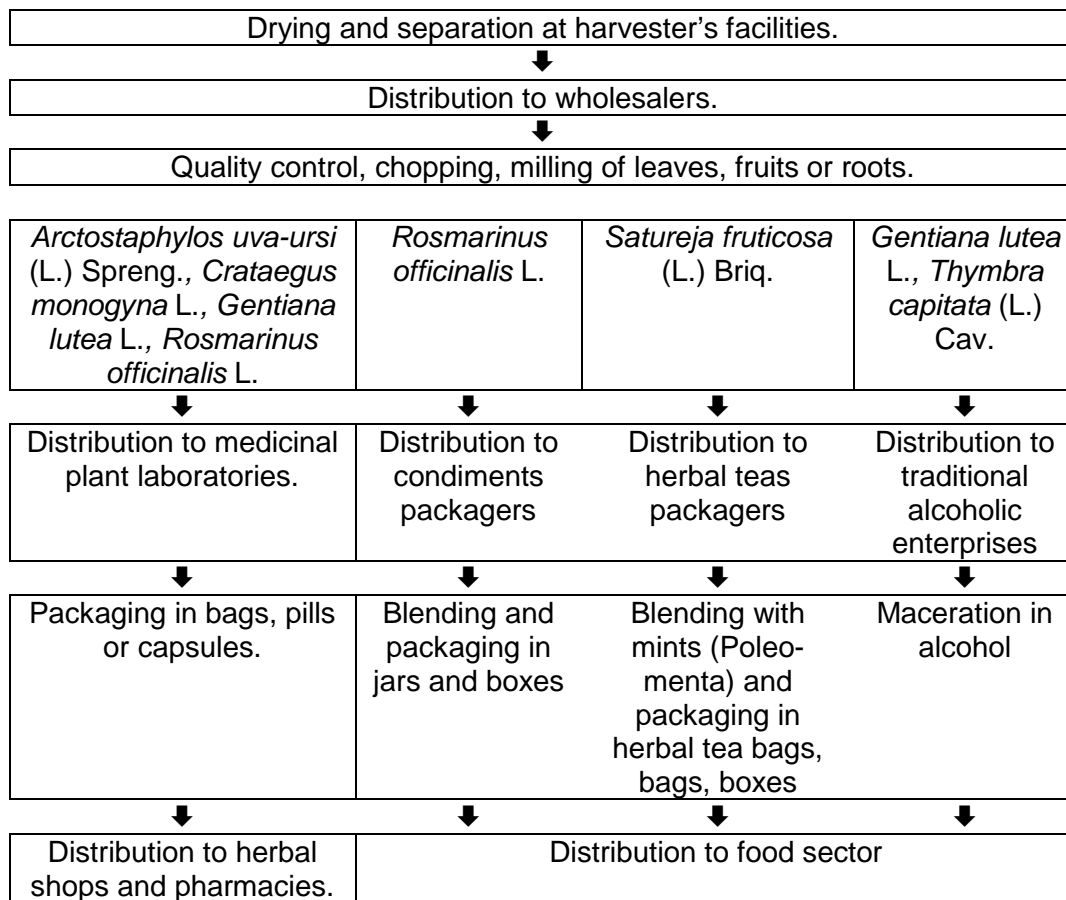


Figure 4 . Value chain of dry herb raw material obtained from wild species in Spain.

EXTRACTS

From *Arctostaphylos uva-ursi*, *Crataegus monogyna* and *Rosmarinus officinalis* can be obtained extracts addressed to the phytotherapy market and in the case of *Rosmarinus officinalis* after distillation, a extraction process allows the obtaining of antioxidants.

The product process through the value chain is the following:

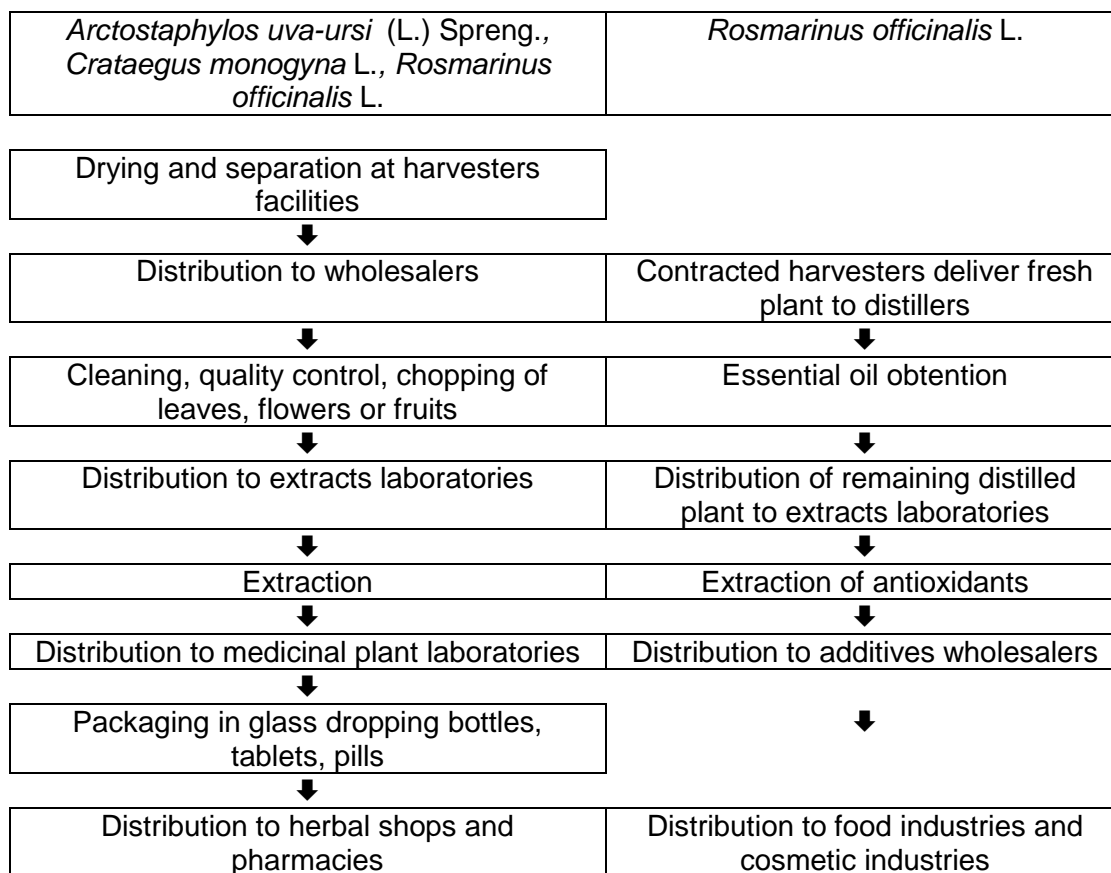


Figure 5. Value chain of extract raw material obtained from wild species in Spain.

ESSENTIAL OILS AND ESSENCES

From *Rosmarinus officinalis*, *Thymbra capitata*, *Lavandula latifolia*, *Thymus zygis*, *Thymus mastichina* and *Cistus ladanifer* can be obtained essential oils which can be addressed to different markets like as the medicinal (phytomedicines and aromatherapy), food (flavours) and perfumery. In the case of *Cistus ladanifer* other fragrant raw material can be obtained.

The product process through the value chain is the following:



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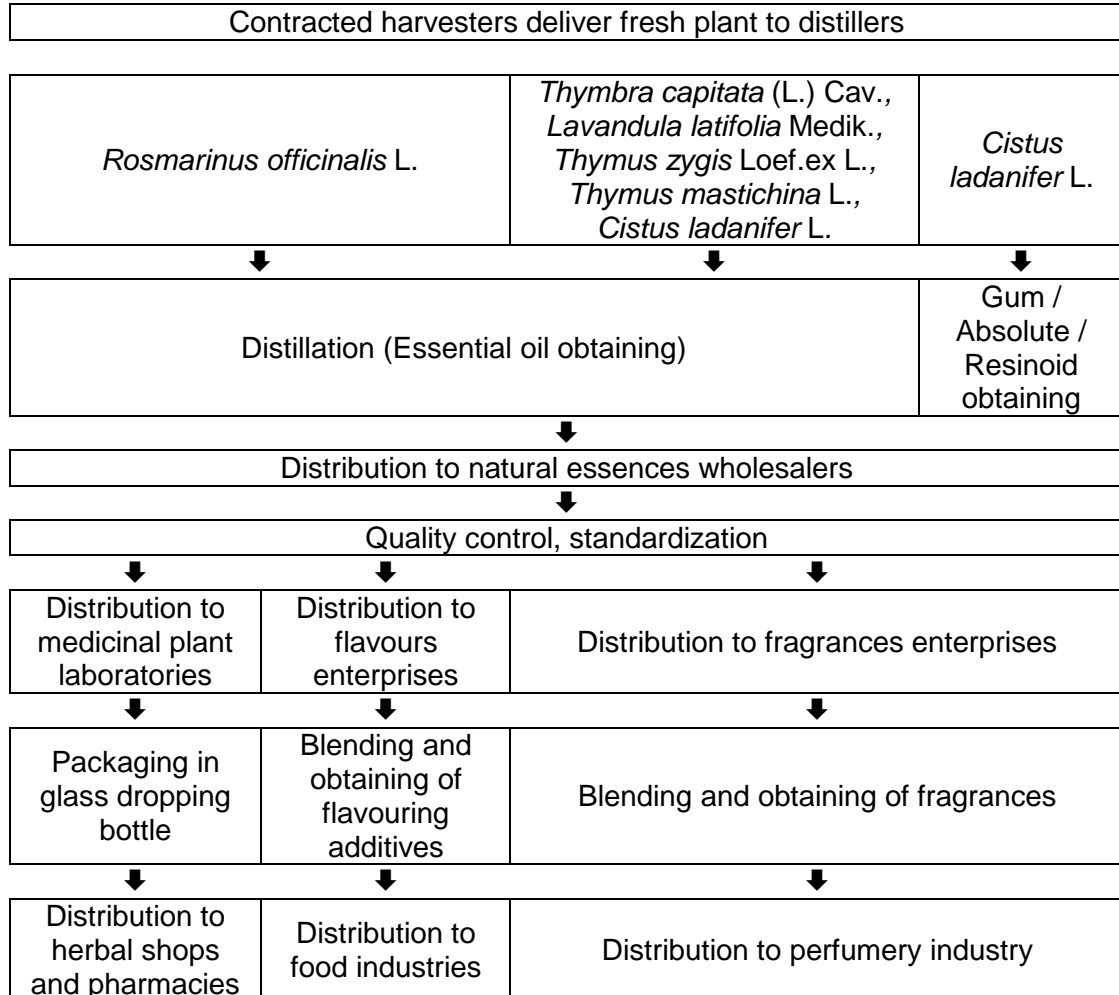


Figure 6. Value chain of essential oil and essences raw material obtained from wild species in Spain.

Finally, there has been identified 15 enterprises dealing with MAPs wild harvesting in Spain: 7 in Catalonia, 3 in Andalucia, 2 in Castilla y León, 1 in Castilla la Mancha, 1 in Aragon and 2 in C.Valenciana. It has been noted that the most important stakeholders involved in the wild harvesting are local population and groups of harvesters commissioned by buyers.



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Table 5. Stakeholders involved in dealing with MAPs wild harvesting in Spain

Species	Raw material	Prices (€/kg)	Stakeholders involved	Enterprises dealing with MAPs WH
<i>Arctostaphylos uva-ursi</i> (L.) Spreng.	2, 4	3,00 (dry leaves)	1, 2	Lluch Recolectors, Plantarom, Herbocat (Lleida, Girona, CATALONIA), Soria Natural, S.A. (Soria, CASTILLA Y LEÓN)
<i>Crataegus monogyna</i> L.	2, 4		1	Lluch Recolectors , Herboristeria Nogué , Plantarom, Herbocat (Lleida, Girona, CATALONIA)
	3		4	
<i>Gentiana lutea</i> L.	2	8,00 (dry root)	2, 3	APROGEN - Asociación Promotora de la Genciana y otras plantas de interés de la montaña occidental leonesa (León, CASTILLA Y LEÓN), 2 (Lleida, Girona, CATALONIA)
<i>Satureja fruticosa</i> (L.) Briq.	2		1, 3	
<i>Rosmarinus officinalis</i> L.	1		4	Laboratorios Alqvimia, Cosméticos Giura, S.C.P. Girona, CATALONIA), Matarrania (Teruel, ARAGON)
	2	1,65 (dry leaves)	1, 3	Peñarrubia del Alto Guadiana, S.L. (Albacete, CASTILLA LA MANCHA), Ecoaromuz, Siempreviva, Coop.V. (Valencia, C.VALENCIANA), Lluch Recolectors (Girona, CATALONIA)
	4, 5	36 (essential oil)	1, 2	Peñarrubia del Alto Guadiana, S.L. (Albacete, CASTILLA LA MANCHA), El Jarpil (Granada, ANDALUCIA), Ecoaromuz, Siempreviva, Coop.V. (Valencia, C.VALENCIANA),
<i>Thymbra capitata</i> (L.) Cav.	2		1, 2	
	5	88 (essential oil)	1, 3, 4	El Jarpil (Granada, ANDALUCIA)
<i>Lavandula latifolia</i> Medik.	5	36 (essential oil)	1, 2	Peñarrubia del Alto Guadiana, S.L. (Albacete, CASTILLA LA MANCHA), El Jarpil (Granada , ANDALUCIA), 2 C.VALENCIANA (Valencia)
<i>Thymus zygis</i> Loef.ex L.	5	85 (essential oil)	1, 2	El Jarpil (Granada, ANDALUCIA)
<i>Thymus mastichina</i> L.	5	80 (essential oil)	1, 2	Peñarrubia del Alto Guadiana, S.L. (Albacete, CASTILLA LA MANCHA), El Jarpil (Granada, ANDALUCIA)



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Species	Raw material	Prices (€/kg)	Stakeholders involved	Enterprises dealing with MAPs WH
<i>Cistus ladanifer</i> L.	5, 6	85 (essential oil)	1, 2, 3, 4	El repión , Biolandes Andalucía, S.A. (Huelva, ANDALUCIA), Peñarrubia del Alto Guadiana, S.L. (Albacete, CASTILLA LA MANCHA)

Raw material: 1.fresh herb 2.dry herb 3.juice 4.extract 5.essential oil 6.essences

Stakeholders:
 1.local population (work commissioned by a buyer)
 2.group of harvesters (work commissioned by a buyer)
 3. professional harvesters (selling to different buyers)
 4. Enterprises (auto consumption for elaborating products)

SWOT analyses

The businesses dealing with medicinal and aromatic plants wild harvesting in Spain are characterized by these strategic aspects:

Strengths	Weaknesses
<ul style="list-style-type: none"> • Freedom of action due to the few control on certain species • Not many competence (not many harvesters) • Rich flora with high content in active compounds (mainly essential oils) • Important traditional consumption of MAPs, mainly for seasoning • MAPs products could be sold during the year because they are dried or distilled, not sold fresh 	<ul style="list-style-type: none"> • High labour costs (50 years before harvesting was done by gypsy families). • Current high competence of products from Western Europe and Northern Africa • Few knowledge on botanics and chemistry (ex.chemotypes) • Not local harvesters (commissioned by buyers) have not information on the surroundings • Few information on correct transformation and good manufacturing practices • Few information on standards and procedures • Obsolete technologies (distillers and dryers). There is no willing to modernise as it is a secondary activity • Harvesters use ancient harvesting techniques and they are not willing to change



Opportunities	Threats
<ul style="list-style-type: none"> • Professional harvesting enterprises for medicinal high valued botanicals • Harvesting of aromatic plants to obtain chemotyped essential oils • Harvesting based on sustainability and organic production • Crisis will increase the number of people desiring to participate in this activity • A serious survey on value chain and the creation of producers organisations would offer new opportunities on wild harvesting of MAPs • Research and implementation of comprehensive technology transfer in ecological, technical and economic issues. • Sustainable management of forest use, taking into account operating systems, population dynamics and erosion, to maintain the resource in long term. 	<ul style="list-style-type: none"> • Old harvesters have disappeared and there has not been knowledge transmission • New harvesters have not enough knowledge on botanics identification leading to species misunderstanding • Not local harvesters (commissioned by buyers) do not care about species or habitat conservation • New harvesters have not knowledge in sustainable wild harvesting • New harvesters have not information about plants transformation and processing to obtain a quality raw material • More frequently droughts are decreasing the wild harvests • Most collected species (e.g. <i>Thyme</i> sp., <i>Rosmarinus officinalis</i> and <i>Cistus ladanifer</i> in Andaluca) have risks of overexploitation

Sources of information

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LITHUANIA

The 10 most commercialized species from the wild considered are:

1. *Arctostaphylos uva-ursi* (L.) Spreng. (Lt. Miltinė meškauogė)
2. *Hypericum perforatum* L. (Lt. Paprastoji jonažolė)
3. *Menyanthes trifoliata* L. (Lt. Trilapis pupalaiškis)
4. *Urtica dioica* L. (Lt. Didžioji dilgėlė)
5. *Thymus* spp. (Lt. Čiobrelis)
6. *Vaccinium vitis-idaea* L. (Lt. Bruknė)
7. *Rubus idaeus* L. (Lt. Paprastoji aviate)
8. *Lycopodium* spp (Lt. Pataisas)
9. *Artemisia absinthium* L. (Lt. Kartusis kietis)
10. *Cetraria islandica* (L.) Ach. (Lt. Islandinė kerpena)

Resource description and distribution

The types of vegetation where these species can be found are:

Types of vegetation	Species
<i>Agropyretalia repentis</i> ,	<i>Hypericum perforatum</i> L.
<i>Artemisietea vulgaris</i>	<i>Artemisia absinthium</i> L., <i>Urtica dioica</i> L.
<i>Epilobietea angustifolii</i>	<i>Rubus idaeus</i> L., <i>Hypericum perforatum</i> L.
<i>Festuco-Brometea</i>	<i>Thymus pulegioides</i> L.
<i>Galio-urticetea</i>	<i>Urtica dioica</i> L.
<i>Molinio-Arrhenatheretea</i>	<i>Hypericum perforatum</i> L., <i>Thymus pulegioides</i> L.
<i>Nardetea strictae</i>	<i>Thymus pulegioides</i> L.
<i>Scheuchzerio - Caricetea nigrae</i>	<i>Menyanthes trifoliata</i> L.
<i>Trifolio-Geranietea sanguinei</i>	<i>Hypericum perforatum</i> L., <i>Thymus pulegioides</i> L.
<i>Vaccinio – Piceetea</i>	<i>Arctostaphylos uva-ursi</i> (L.) Spreng., <i>Cetraria islandica</i> (L.) Ach., <i>Lycopodium</i> spp., <i>Thymus serpyllum</i> L. <i>Vaccinium vitis-idaea</i> L.

Lithuania territory has two different biogeographical regions: *Boreal* in the northern part and *Continental* in the southern part.



SOURCE: EEA (European Environment Agency) Report No 1/2002

All the concerned species are growing in territory of Lithuania from sea level to 300 m (highest altitude in Lithuania). *Hypericum perforatum*, *Urtica dioica*, *Rubus idaeus*, *Menyanthes trifoliata*, *Thymus* spp., *Vaccinium vitis-idaea*, are common species and are growing in the majority of administrative Lithuanian regions, while *Artemisia absinthium*, *Arctostaphylos uva-ursi*, *Lycopodium* spp. and *Cetraria islandica* are mainly present in the south-eastern part (continental region) of the country.

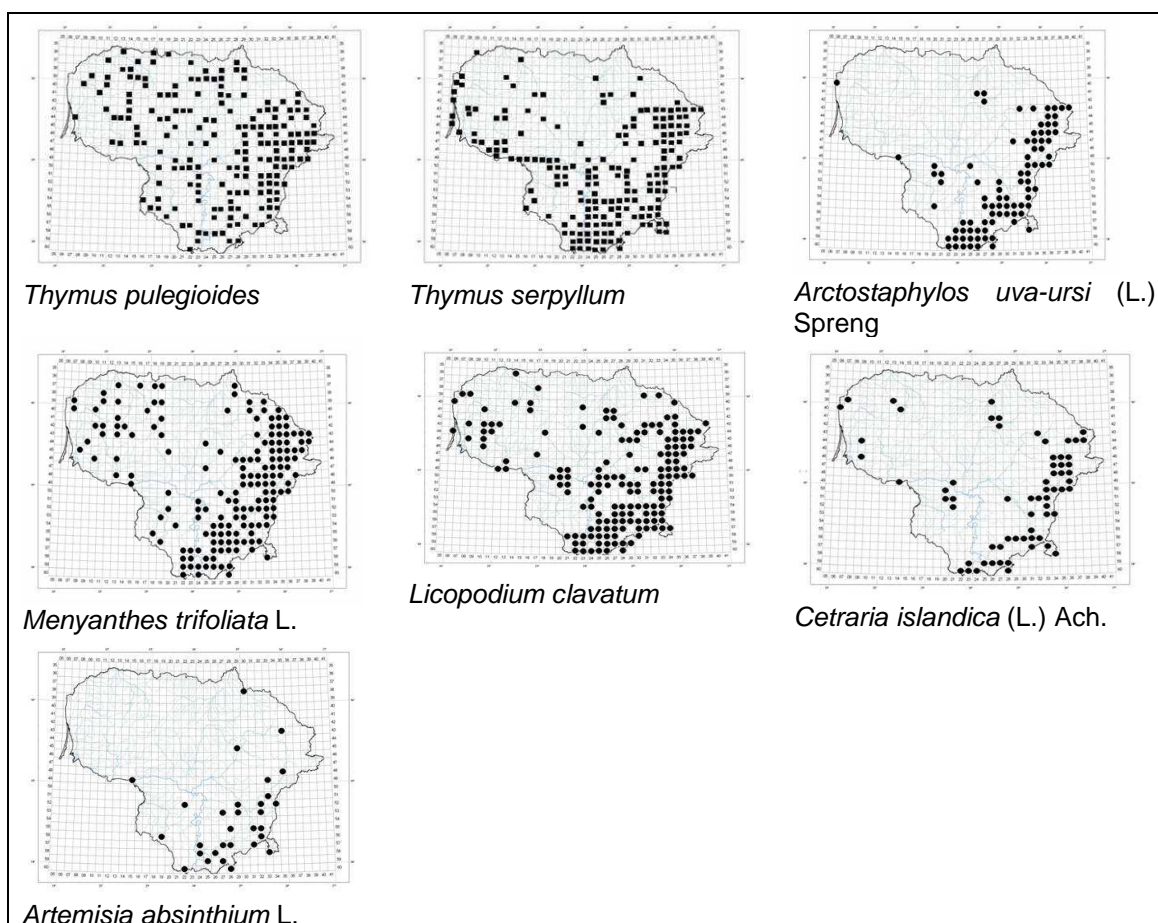


Figure 7. National distribution of several wild harvested MAPs in Lithuania

Production and use estimation

For obtaining the production estimation of wild plants a monitoring was conducted in 5320 forest plots (15% of territory – southern area) from 1979 to 1990. Data was gathered related to: area occupied, relief, type of soil, type of vegetation and age of forest trees.

200 MAPs species were inventoried, obtaining information on: abundance (percentage of species coverage), state of population, vegetation type (VT), biomass of MAP species in each VT, biological yield, periodicity of collecting and mass of raw material that could be collected annually.

Table 6. Annual production estimation of most commercial important MAP species in south-eastern part of Lithuania

Species	Collected part	kg biomass of plant/ ha of pure (100%) stand	kg collected part/ ha of pure (100%) stand
<i>Arctostaphylos uva-ursi</i> (L.) Spreng.	leaves	1.000	120
<i>Hypericum perforatum</i> L.	herb	1.800	630
<i>Menyanthes trifoliata</i> L.	leaves	930	370
<i>Urtica dioica</i> L.	leaves	1.400	800
<i>Thymus spp.</i>	herb	815	65
<i>Vaccinium vitis-idaea</i> L.	leaves	980	120
<i>Rubus idaeus</i> L.	leaves		
<i>Lycopodium spp</i>	spores		30
<i>Artemisia absinthium</i> L.	herb	1.850	650
<i>Cetraria islandica</i> (L.) Ach.	thallus	1.000	50

SOURCE: Wild Plant Recourses Assessment Methodology (2000)

According to the corresponding study⁵ some species shown an interesting potential for wild harvesting as there is few production in rest Lithuania compared with the possible yield in south-eastern part of the country.

Table 7. Comparing production of biomass of four commercial important MAP species in south-eastern part with all collected raw material in Lithuania

Species	Biomass in south-eastern part (t/ year)	Collected raw material (t/year)	Price (€/kg)
<i>Rubus idaeus</i>	Plant name	7.2	0.9-3.0
<i>Urtica dioica</i>	626.7	6.7	0.9-1.4
<i>Vaccinium vitis-idaea</i>	475.7	3.0	3.5
<i>Hypericum perforatum</i>	10.8	4.7	1.6



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Table 8. Annual average production of medicinal and aromatic plants from forests of Lithuania

Species	Collected part	total production (t)	Economic value (€)
<i>Arctostaphylos uva-ursi</i> (L.) Spreng.	leaves	6,2	23.374
<i>Hypericum perforatum</i> L.	herb	4,7	7.520
<i>Menyanthes trifoliata</i> L.	leaves	3,7	18.204
<i>Urtica dioica</i> L.	leaves	6,7	8.040
<i>Thymus</i> spp. L.	herb	5,6	16.240
<i>Vaccinium vitis-idaea</i> L.	leaves	3	10.500
<i>Rubus idaeus</i> L.	leaves	7,2	14.400
<i>Lycopodium</i> spp.	spores	2,6	49.400
<i>Artemisia absinthium</i> L.	herb	3,7	4.070
<i>Cetraria islandica</i> (L.) Ach.	thallus	3,9	12.441
TOTAL		47,3	164.189

SOURCE: Ministry of Environment ¹

This quantity is small compared with the production of other non-wood forest products in Lithuania, like as mushrooms (2.000 t/year) or berries (1.209 t/year).

Arctostaphylos uva-ursi, *Thymus* spp., *Vaccinium vitis-idaea*, *Lycopodium* spp., *Artemisia absinthium* and *Cetraria islandica* are collected mainly in the south-eastern part of Lithuania. Most part of wild harvesting takes place in public lands, except for *Hypericum perforatum*, *Urtica dioica* and *Artemisia absinthium* that are gathered mainly in private lands.

The purchase of raw material of corresponding species during 5 years (2005-2009) varied from year to year and in different species. Production of *Arctostaphylos uva-ursi*, *Menyanthes trifoliata* and *Artemisia absinthium* was decreasing, while *Thymus* spp., *Lycopodium* spp. and *Cetraria islandica* was increasing. In the case of *Hypericum perforatum*, *Urtica dioica*, *Vaccinium vitis-idaea* and *Rubus idaeus* the raw material purchase increased in the last year.

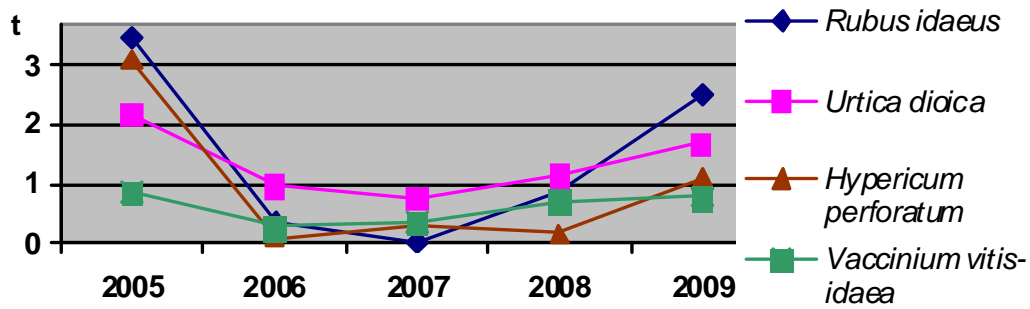


Figure 8. Evolution of wild harvesting production of MAPs species in Lithuania during 2005–2009

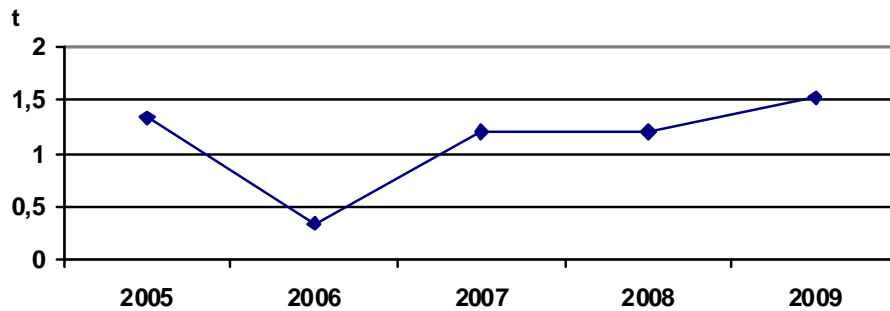


Figure 9. Evolution of wild harvesting production of *Thymus* spp. in Lithuania during 2005–2009

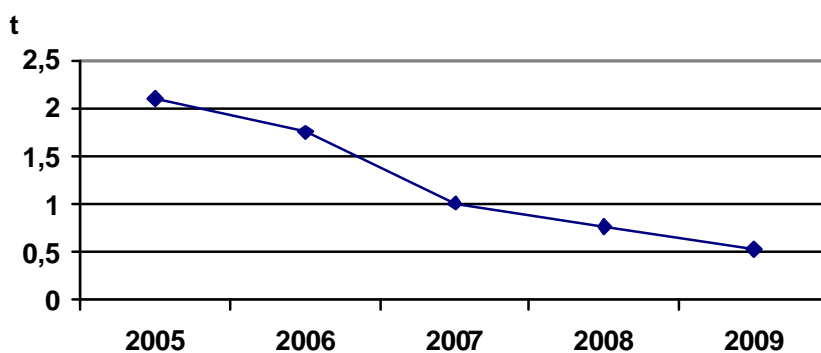


Figure 10. Evolution of wild harvesting production of *Arctostaphylos uva-ursi* in Lithuania during 2005–2009



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Value chain

Most species collected in Lithuania are used in the pharmaceutical market mainly as a therapeutic herbal tea. Apart from dry herb, extracts are obtained from *Urtica dioica* for elaborating phytomedicines and cosmetics. Among the corresponding species only *Artemisa dracunculus* used as condiment and also *Lycopodium* spp. spores as a special powder.

Table 9. Main products obtained from the wild harvested MAPs in Lithuania

Species	Collected part	Raw material	Market	Elaborated products
<i>Arctostaphylos uva-ursi</i> (L.) Spreng.	1	2	1	2
<i>Hypericum perforatum</i> L.	5	2	1	2
<i>Menyanthes trifoliata</i> L.	1	2	1	2
<i>Urtica dioica</i> L.	5	4	1, 3	1, 8
	1	2	1	2
<i>Thymus</i> spp. L.	5	2	1	2
<i>Vaccinium vitis-idaea</i> L.	1	2	1	2
<i>Rubus idaeus</i> L.	1	2	1	2
<i>Lycopodium</i> spp.	6	spores	1	powder
<i>Artemisia absinthium</i> L.	5	2	1, 2	2, 3
<i>Cetraria islandica</i> (L.) Ach.	5 (thallus)	2	1	2

Collected part:

1.leaves 2.roots 3.flowers 4.fruits 5.plant 6. spores

Raw material:

1.fresh herb 2.dry herb 3.juice 4.extract 5.essential oil 6.essences

Market:

1.medicinal 2.food 3.cosmetic 4.perfumes 5.other

Elaborated products

1.phytomedicines 2.herbal teas 3.condiments 4.food supplements
5.liquors and wines 6.colorant 7.antioxidants 8.cosmetics
9.perfumery 10.aromatherapy

From dry herbs can be obtained mainly herbal teas addressed to medicinal market. Therefore often the dry herb material is directly sold by the harvesters in fairs or markets.

The product process through the value chain is the following as in Fig. 11.

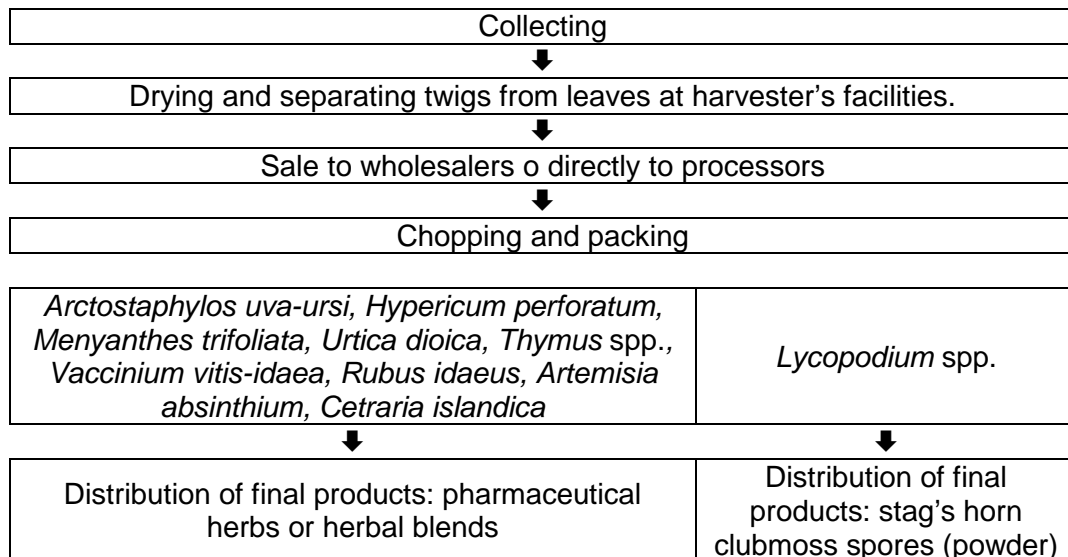


Figure 11. Value chain of dry herb raw material obtained from wild species in Lithuania

In the case of extracts obtained from nettles (*Urtica dioica*), pine (*Pinus* spp.) and juniper (*Juniperus communis*) the process of production is more industrialized and is carried out in specialised laboratories.

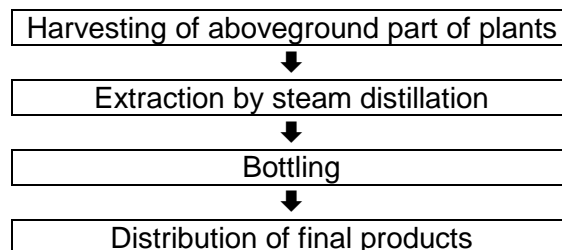


Figure 12. Value chain of extracts raw material obtained from wild species in Lithuania



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There are around 20 enterprises dealing with MAPs wild harvesting in Lithuania. The most important are: “Švenčionių vaistažolės”, “Mėta”, “Acorus calamus” which are located in the northeast part of Lithuania.

Table 10. Stakeholders involved in dealing with MAPs wild harvesting in Lithuania

Species	Raw material	Prices (€/kg)	Stakeholders involved	Enterprises dealing with MAPs WH
<i>Arctostaphylos uva-ursi</i> (L.) Spreng.	2	3,80	1, 3	3
<i>Hypericum perforatum</i> L.	2	1,60	1, 3	15
<i>Menyanthes trifoliata</i> L.	2	4,90	1, 3	2
<i>Urtica dioica</i> L.	2	0,90-1,40	1, 3, 4	12
	4		4	1
<i>Thymus</i> spp.	2	2,90	1, 3	18
<i>Vaccinium vitis-idaea</i> L.	2	3,50	1, 3	12
<i>Rubus idaeus</i> L.	2	0,90-3,00	1, 3	16
<i>Lycopodium</i> spp	spores	19,00	1, 3	6
<i>Artemisia absinthium</i> L.	2	1,14	1, 3	5
<i>Cetraria islandica</i> (L.) Ach.	2	3,20	1, 3	5

Raw material:

1.fresh herb 2.dry herb 3.juice 4.extract 5.essential oil
6.essences

Stakeholders:

1.local population (work commissioned by a buyer)
2.group of harvesters (work commissioned by a buyer)
3. professional harvesters (selling to different buyers)
4. Enterprises (auto-consumption for elaborating products)

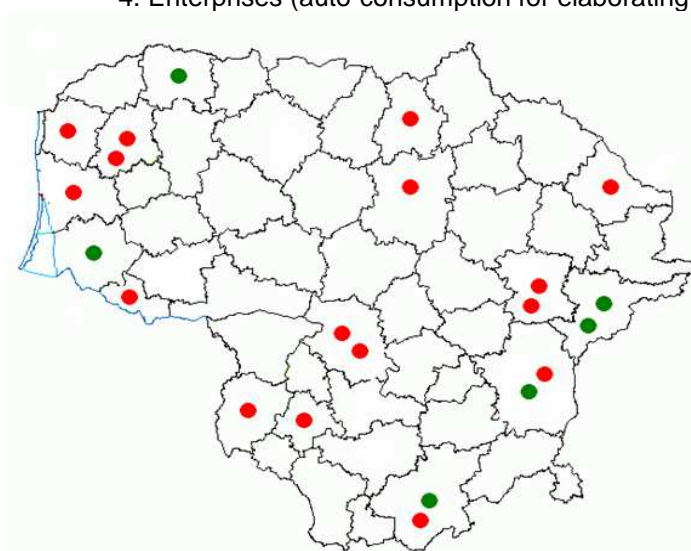


Figure 13. Situation of the enterprises dealing with MAPs wild harvesting in Lithuania

SWOT analyses

The businesses dealing with medicinal and aromatic plants wild harvesting in Lithuania are characterized by these strategic aspects:

Strengths	Weaknesses
<ul style="list-style-type: none"> • The gradual increase of non-timber forest production in the last five years. • The harvesting of MAP had old traditions and provides additional income for the local community. • The use of waste of timber industry (pine and birch branches) for production of extracts and essential oils. • The inventory of plant resources and elaborating of sustainable MAP harvesting methodology have been carried out from 1980. 	<ul style="list-style-type: none"> • Low prices of MAP raw material. • Manufacturers and wholesalers prefer large quantities of raw materials. • Most collectors are elderly people. • Lack of the people's knowledge on sustainable harvesting and use of MAP.
Opportunities	Threats
<ul style="list-style-type: none"> • Broader use of waste of timber industry for production of extracts and essential oils. • Great unused resources of common MAP species. • There are many abandoned lands where various MAP could be harvested. • Land and forest owners are highly potential harvesters for sustainable use, maintain and restoration of MAP wild resources. 	<ul style="list-style-type: none"> • Spontaneous market and weak control lead to the overexploitation of MAP resources. • Great demand on plants with limited resources or long period of restoration. • The self-educated harvesters become physicians and instruct customers. • Increased cutting intensity and decreased forest stand age could impact MAP species composition and resources

Sources of information

1. <http://db1.stat.gov.lt/statbank/SelectVarVal/Define.asp?Maintable=M5020403&PLanguage=1>
2. Radušienė J. Trade, use and conservation of medicinal and aromatic plants in Lithuania. *Acta Horticulturae* 2004;629:31-7.
3. Data on the purchase of species raw material were collected from the users reports (1996-2009) submitted to the Ministry of Environment.
4. Order of the Minister of Environment regarding the Wild Plant Recourses Assessment Methodology. *Valstybės žinios*: 2000, Nr.: 31 -881.



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The most commercialized species from the wild used for aromatic and medicinal purposes are:

TREES:

1. *Eucalyptus globulus* Labill (pt. Eucalipto)
2. *Pinus pinaster* Ait. (pt. Pinheiro bravo)

PLANTS:

1. *Cistus ladanifer* L. (pt. Esteva)
2. *Equisetum telmateia* Ehrh. (pt. Cavalinha)
3. *Pterospartum tridentatum* L. Willk. (pt. Carqueja)
4. *Centaurium erythraea* Rafn (pt. Fel da Terra)
5. *Tilia platyphyllos* Scop. (pt. Tília)
6. *Fraxinus angustifolia* Vahl (pt. Freixo)
7. *Matricaria recutita* L. (pt. Camomila)
8. *Malva sylvestris* L. (pt. Malva)
9. *Sambucus nigra* L. (pt. Sabugueiro)
10. *Chamaemelum nobile* (L.) All. (pt. Macela; Camomila romana)

Resource description and distribution

Types of vegetation where these species can be found are:

Types of vegetation	Species
<i>Festuco-Brometea</i>	<i>Centaurium erythraea</i> Rafn
<i>Molinio-Arrhenatheretea</i>	<i>Chamaemelum nobile</i> (L.) All.
<i>Cisto-Lavanduletea</i>	<i>Cistus ladanifer</i> L.
<i>Salici purpureae-Populetea nigrae</i>	<i>Equisetum telmateia</i> Ehrh., <i>Eucalyptus globulus</i> Labill
<i>Salici purpureae-Populetea nigrae</i>	<i>Fraxinus angustifolia</i> Vahl
<i>Artemisietea vulgaris</i>	<i>Malva sylvestris</i> L.
<i>Stellarietea mediae</i>	<i>Matricaria recutita</i> L., <i>Pinus pinaster</i> Ait.
<i>Ericenion umbellatae</i>	<i>Pterospartum tridentatum</i> L. Willk.
<i>Rhamno-prunetea</i>	<i>Sambucus nigra</i> L., <i>Tilia platyphyllos</i> Scop.

The main biogeographical region in Portugal is Mediterranean, a little area in the north is Atlantic and the islands are Macaronesian.

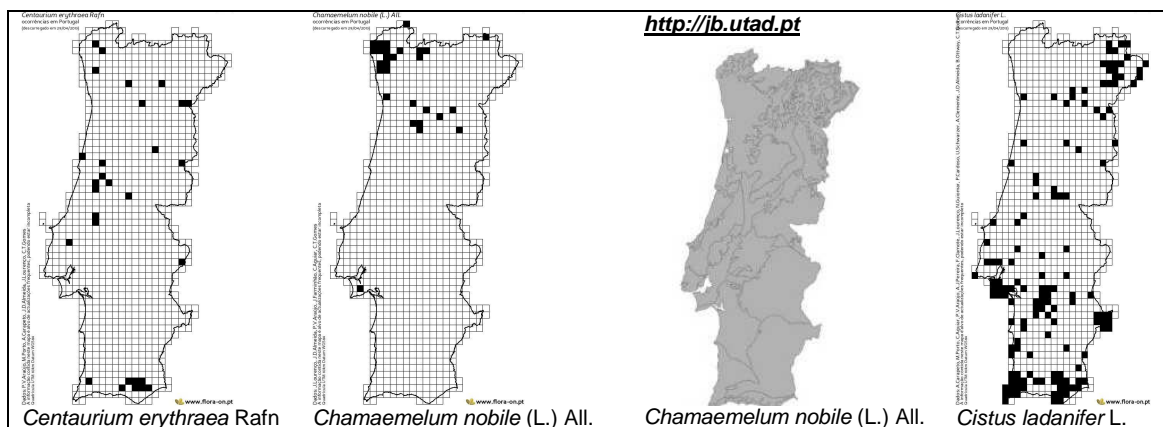


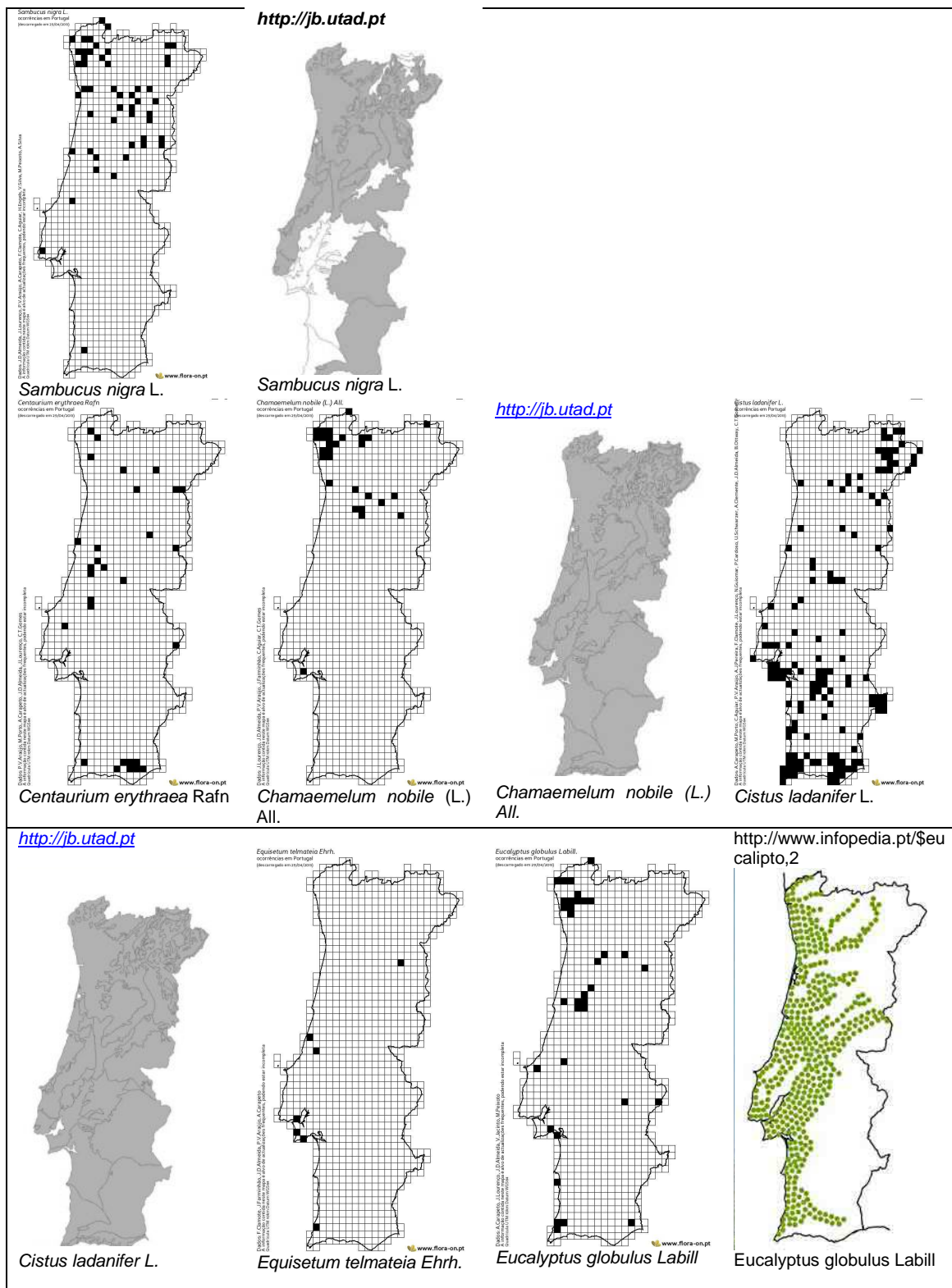
SOURCE: <http://www.icnf.pt/portal/naturaclas/rn2000/resource/implement/reg-biogeog-terr/view>

Related to the most important MAPs species collected from the wild, *Malva sylvestris* and *Chamaemelum nobile* are present mainly in the Atlantic region, while *Cistus ladanifer*, *Equisetum telmateia*, *Tilia platyphyllos* and *Matricaria recutita* are found in the Mediterranean region. The other species grow indistinctly in both biogeographical regions. No species of commercial importance are found in the Macaronesian region.

The altitude range is very wide. The species growing lowest is *Equisetum telmateia* (from 16 to 102 m of altitude). Until 700 m we can find *Eucalyptus globulus* (0-700 m) and *Centaurium erythraea* (10-703 m), until 800 m *Malva sylvestris* (10-815 m) and until 950 m *Cistus ladanifer* (0-949 m). Beyond 1000 m there are: *Matricaria recutita* (0-1000 m), *Sambucus nigra* (10-1099 m), *Fraxinus angustifolia* (9-1141 m), *Pinus pinaster* (0-1229 m), *Chamaemelum nobile* (8-1251 m), *Pterospartum tridentatum* (13-1310 m), and the one growing highest is *Tilia platyphyllos* (50-1700 m).

These species are distributed all along Portuguese territory as shown in Figure 14 related to botanical registrations or with natural conditions to be present (*Chamaemelum nobile* (L.) All., *Cistus ladanifer* L., *Eucalyptus globulus* Labill, *Fraxinus angustifolia* Vahl, *Malva sylvestris*, *Pinus pinaster* Ait., *Pterospartum tridentatum* L. Willk. and *Sambucus nigra* L.).







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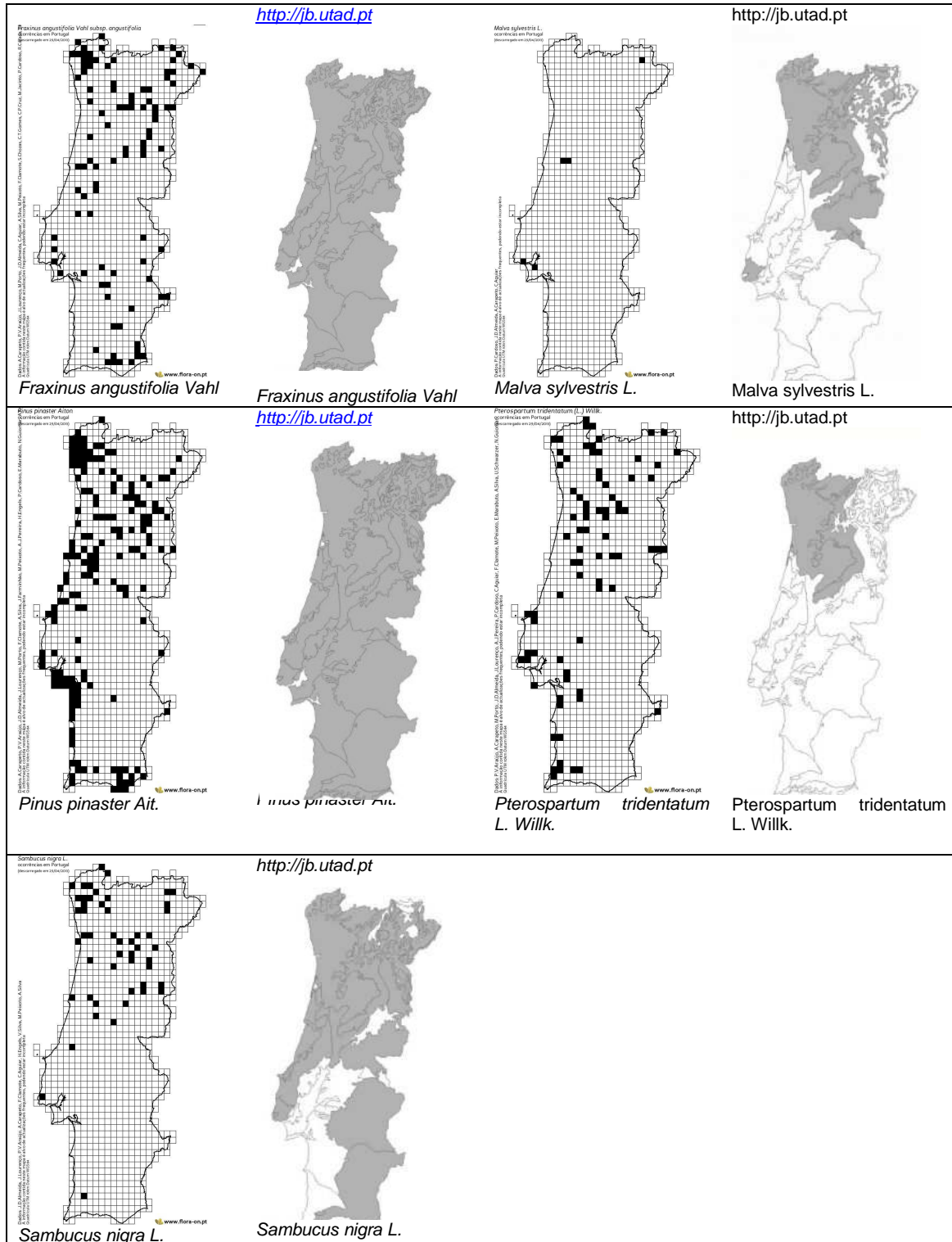


Figure 14. National distribution of several wild harvested MAPs in Portugal



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Production and use estimation

Table 11. Annual medicinal and aromatic plants production (collected from the wild) in Portugal

Species	Collected part	total production (t)	Associated surface (ha)
<i>Eucalyptus globulus</i> Labill	leaves	48,30	739.515
<i>Pinus pinaster</i> Ait.	Buds, needles	30,00	885.019
<i>Cistus ladanifer</i> L.	Flowering shoots	7,50	
<i>Equisetum telmateia</i> Ehrh.	Sterile stems	4,45	
<i>Pterospartum tridentatum</i> L. Willk.	Flowering shoots, flowers	3,30	
<i>Centaureum erythraea</i> Rafn	Flowering shoots	1,07	
<i>Tilia platyphyllos</i> Scop.	Inflorescences, inner bark	0,85	
<i>Fraxinus angustifolia</i> Vahl	Leaves, bark	0,42	
<i>Matricaria recutita</i> L.	Flower heads	0,41	
<i>Malva sylvestris</i> L.	Flowers, leaves	0,31	
<i>Sambucus nigra</i> L.	Flowers, fruits, bark	0,20	
<i>Chamaemelum nobile</i> (L.) All.	Flower heads	0,09	
TOTAL		96,89	

SOURCE: Ana Cristina Figueiredo (2012)¹⁰

It must be noted that, the main part of the production (78,3 t) comes from trees obtained in private land properties, and while eucalyptus production is increasing, pine tree is decreasing.

Value chain

All the species harvested in Portugal are used as herbal teas, both for food or medicinal market. Some are addressed to the elaboration of phytomedicines (*Cistus ladanifer*, *Equisetum telmateia*, *Sambucus nigra*) even pharmaceuticals (*Eucalyptus globulus*, *Pinus pinaster*). Other uses in the food market are the flavouring of wines and liquors (*Pterospartum tridentatum*, *Matricaria recutita*, *Malva sylvestris*, *Chamaemelum nobile*) or their use as food colorant (*Malva sylvestris*, *Sambucus nigra*).



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Table 12. Main products obtained from the wild harvested MAPs in Portugal

Species	Collected part	Raw material	Market	Elaborated products
<i>Eucalyptus globulus</i> Labill	1	1, 2, 4	1, 4, 5 (aromatic)	1
<i>Pinus pinaster</i> Ait.	1 (buds, needles)	5	1, 4	1
<i>Cistus ladanifer</i> L.	5 (flowering)	2, 5	1, 4, 5 (ornamental, mellific)	1
<i>Equisetum telmateia</i> Ehrh.	5 (sterile stems)	1, 2	1	1, 2
<i>Pterospartum tridentatum</i> L. Willk.	3, 5 (flowering)	1, 2	1, 2, 5 (ethnographic uses)	2, 5
<i>Centaurium erythraea</i> Rafn	5 (flowering)	1, 2	1	2
<i>Tilia platyphyllos</i> Scop.	3, 6 (inner)	1, 2, 5	1, 3, 4, 5 (ornamental, mellific)	2
<i>Fraxinus angustifolia</i> Vahl	1, 6	1, 2, 5	1, 3, 4, 5 (ornamental, mellific)	2
<i>Matricaria recutita</i> L.	3	1, 2, 5	1, 3, 4	2, 5
<i>Malva sylvestris</i> L.	1, 3	1, 2	1, 2	2, 5, 6
<i>Sambucus nigra</i> L.	3, 4, 6	1, 2	1, 2, 5 (ornamental)	1, 2, 5
<i>Chamaemelum nobile</i> (L.) All.	3	1, 2, 5	1, 2, 3, 4	2, 5

Collected part:

1.leaves 2.roots 3.flowers 4.fruits 5.plant 6. bark

Raw material:

1.fresh herb 2.dry herb 3.juice 4.extract 5.essential oil 6.essences

Market:

1.medicinal 2.food 3.cosmetic 4.perfumes 5.other

Elaborated products

1.phytomedicines 2.herbal teas 3.condiments 4.food supplements
5.liquors and wines 6.colorant 7.antioxidants 8.cosmetics 9.perfumery
10.aromatherapy

The product process by the harvesters is the following:

Distillation with fresh herbs	<i>Eucalyptus globulus</i> , <i>Pinus pinaster</i> , <i>Cistus ladanifer</i>
Collection ➔ Chopping ➔ Drying ➔ Packaging	<i>Equisetum telmateia</i> , <i>Malva sylvestris</i>
Collection ➔ Drying ➔ Packaging	<i>Pterospartum tridentatum</i> , <i>Centaurium erythraea</i> , <i>Tilia platyphyllos</i> , <i>Fraxinus angustifolia</i> , <i>Matricaria recutita</i> , <i>Sambucus nigra</i> , <i>Chamaemelum nobile</i>



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According to Epam (Empreender na fileira das plantas aromáticas e medicinais em Portugal)¹⁴ in Portugal there are around 57 producers of MAPs, but only two of them are dealing with wild harvesting (Planalto Dourado, Quinta Essência). Other enterprise that obtains plants from the wild is Ervital (during 2012: 1450 kg of *Pterospartum tridentatum*, 230 kg of *Tilia platyphyllos*, 220 kg of *Matricaria recutita*, 120 kg of *Equisetum telmateia*, 75 of *Chamaemelum nobile*, 65 of *Malva sylvestris*, 50 kg of *Sambucus nigra* and 40 kg of *Fraxinus angustifolia*).

Table 13. Stakeholders involved in dealing with MAPs wild harvesting in Portugal

Species	Raw material	Prices (€/kg)	Stakeholders involved	Enterprises dealing with MAPs WH
<i>Eucalyptus globulus</i> Labill	1, 2, 4		1, 2	Segredos da Planta; Green Planet; Socidestilda
<i>Pinus pinaster</i> Ait.	5		1, 2	Socidestilda
<i>Cistus ladanifer</i> L.	2, 5		1, 2	Quinta Essência; Socidestilda
<i>Equisetum telmateia</i> Ehrh.	1, 2		1, 2	Ervital; Segredos da Planta; Green Planet; Socidestilda
<i>Pterospartum tridentatum</i> L. Willk.	1, 2		1, 2	Ervital; Segredos da Planta; Green Planet; Costa Bela Luz; Socidestilda
<i>Centaurium erythraea</i> Rafn	1, 2		1, 2	Segredos da Planta; Green Planet; Socidestilda
<i>Tilia platyphyllos</i> Scop.	1, 2, 5		1, 2	Ervital; Segredos da Planta; Green Planet; Socidestilda
<i>Fraxinus angustifolia</i> Vahl	1, 2, 5		1, 2	Ervital; Segredos da Planta; Green Planet; Socidestilda
<i>Matricaria recutita</i> L.	1, 2, 5		1, 2	Ervital; Segredos da Planta; Green Planet; Planalto Dourado; Socidestilda
<i>Malva sylvestris</i> L.	1, 2		1, 2	Ervital; Segredos da Planta; Green Planet; Socidestilda
<i>Sambucus nigra</i> L.	1, 2		1, 2	Ervital; Segredos da Planta; Green Planet; Socidestilda
<i>Chamaemelum nobile</i> (L.) All.	1, 2, 5		1, 2	Ervital; Segredos da Planta; Green Planet; Socidestilda

Raw material:

1.fresh herb 2.dry herb 3.juice 4.extract 5.essential oil 6.essences

Stakeholders:

1.local population (work commissioned by a buyer)
2.group of harvesters (work commissioned by a buyer)
3. professional harvesters (selling to different buyers)
4. Enterprises (autoconsumption for elaborating products)



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SWOT analyses

The businesses dealing with medicinal and aromatic plants wild harvesting in Portugal are characterized by these strategic aspects:

Strengths	Weaknesses
<ul style="list-style-type: none"> • Financial support for training. • Human resources prepared for training. • Strong scientific knowledge. • MAPs Research on going. • MAPs sector has potential to growth. • MAPs sector produces tradable products with export potential. • Linked to tourism and gastronomy. • Biodiversity of each country. • Juvenile sector and higher education. 	<ul style="list-style-type: none"> • Research on wild MAPs harvesting is fragile. • Lack of monitoring in wild areas and the forest is private. • The international markets, to support the economy, are very weak. • Little concern about the sustainability of resources and quality of products. • More knowledge about diseases and forest fires is needed. • Weak differentiation, innovation, investment in the sector. • Weak representation and agents. • Weak response on the demand for non-timber products
Opportunities	Threats
<ul style="list-style-type: none"> • Juvenile sector with higher education. • Essential element in rural tourism related to environment. • MAPs and gastronomic value. • Economic ecological value. • There are conditions for domestic and export markets. 	<ul style="list-style-type: none"> • Age of collectors. • Type of collectors / knowledge of collecting. • The existing knowledge especially in elderly populations, fashion, tradition. • Crescent complexity of this sector organizations and economic agents.



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Production and use estimation / Elaborated products and services

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TURKEY

The 10 most commercialized species from the wild are:

1. *Laurus nobilis* L. (tk. Defne, Akdeniz defnesi)
2. *Ceratonia siliqua* L. (tk. Keçiboynuzu)
3. *Capparis spinosa* L. (tk. Kebere, Gebre, Kapari, Keditırnağı)
4. *Rhus coriaria* L. (tk. Debbağ sumacı, derici sumacı, sumak, tatari, tekri ağ., tetri, tirimli)
5. *Origanum onites* L. (tk. İzmir kekiği, bilyalı kekik)
6. *Rosmarinus officinalis* L. (tk. Hasalban, kuşdili, biberiye)
7. *Glycyrrhiza glabra* L. (tk. meyan kökü, piyan)
8. *Tilia* spp. (tk. İhlamur)
9. *Prunus mahaleb* L. (tk. mahlep, melem)
10. *Thymbra spicata* L. (tk. Zahter, Karabaş kekik)

Resource description and distribution

The types of vegetation where these species can be found are:

Types of vegetation	Species
Mediterranean - type shrub	<i>Laurus nobilis</i> L., <i>Ceratonia siliqua</i> L., <i>Capparis spinosa</i> L., <i>Rhus coriaria</i> L., <i>Rosmarinus officinalis</i> L., <i>Glycyrrhiza glabra</i> L., <i>Tilia</i> spp., <i>Prunus mahaleb</i> L., <i>Origanum onites</i> L., <i>Thymbra spicata</i> L.
Steppe	<i>Capparis spinosa</i> L., <i>Rhus coriaria</i> L., <i>Rosmarinus officinalis</i> L., <i>Glycyrrhiza glabra</i> L., <i>Prunus mahaleb</i> L., <i>Origanum onites</i> L., <i>Thymbra spicata</i> L.

The different characteristics of the seas that surround Turkey, namely the Black Sea, the Marmara, the Aegean and the Eastern Mediterranean, have resulted in the diversification of the biological resources they contain.

Related to the most important MAPs species collected from the wild, *Laurus nobilis* and *Rosmarinus officinalis* are present in the all the Mediterranean region, while *Ceratonia siliqua* and *Rhus coriaria* are growing mainly in the Aegean region, and *Origanum onites* and *Thymbra spicata* are located in the Eastern Mediterranean region. Other species are found to the Anatolian bioregion, like us *Glycyrrhiza glabra*, *Tilia* spp. and *Capparis* spp., but the two last genera can also be found in the Mediterranean zone (*Capparis* spp.) and in the Black sea zone (*Tilia* spp.).



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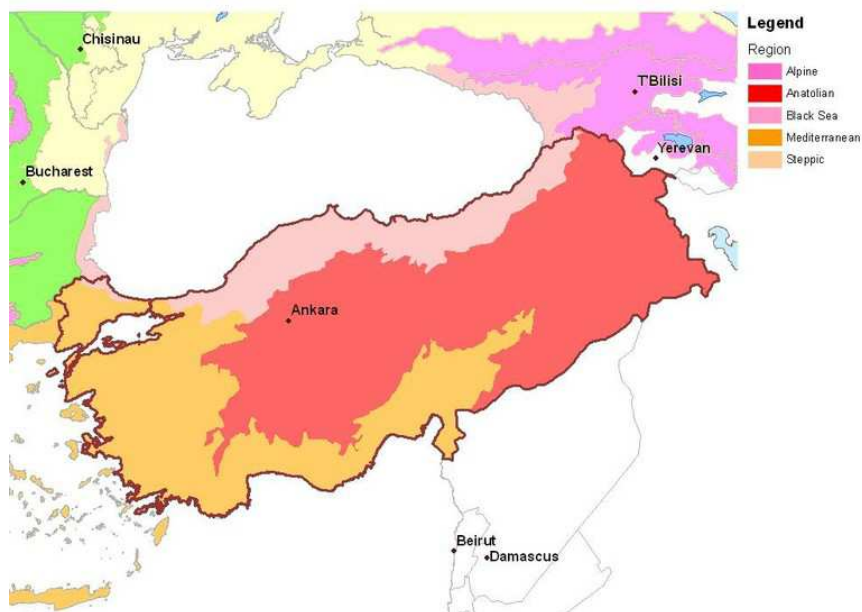
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Biogeographical zones of Turkey



SOURCE: European Environment Agency

The altitude range is very wide. The species growing lowest are *Rosmarinus officinalis* (30-250 m) and *Ceratonia siliqua* (300-500 m). Until 1000 m we can find *Capparis spinosa* and *Thymbra spicata*. Between 1000 and 1500 m: *Laurus nobilis* (0-1200 m), *Origanum onites* (0-1400 m) and *Tilia* spp. (300-1500 m). Beyond 1800 m there are: *Glycyrrhiza glabra* (0-1800 m), *Prunus mahaleb* (300-1850 m) and *Rhus coriaria* (600-1900 m).

Laurus nobilis is distributed through all coastlines of Turkey. It is mainly spread in the provinces of Balıkesir, Bursa, İstanbul, Zonguldak, Kastamonu, Sinop, Trabzon, Rize, İzmir, Muğla, Antalya, Mersin, Hatay, and Maraş. The distribution of carob (*Ceratonia siliqua*) is commonly the eastern Mediterranean and specifically in the provinces Antalya, Mersin, Muğla.

In the case of *Capparis spinosa*, despite it is mainly naturally grown in Mediterranean region, it can be seen in all regions except the Black Sea coast. The same occurs with *Rhus coriaria*, while it is intensively distributed in the western and southern parts of Turkey, it is almost wide-spread in all regions.

Rosemary (*Rosmarinus officinalis*) is dominant in the semi-arid Mediterranean climate, but it ranges from the sub-humid to the upper arid. Licorice (*Glycyrrhiza glabra*) is commonly harvested in Anatolia even it was frequently found in Aegean parts (in İzmir). Therefore, it is often produced in Southern and Eastern regions of Turkey.

Linden (*Tilia* spp.) is commonly distributed on the west and Northern Anatolia, and *Prunus mahaleb* is widely distributed in Eastern and Northern regions of Turkey.



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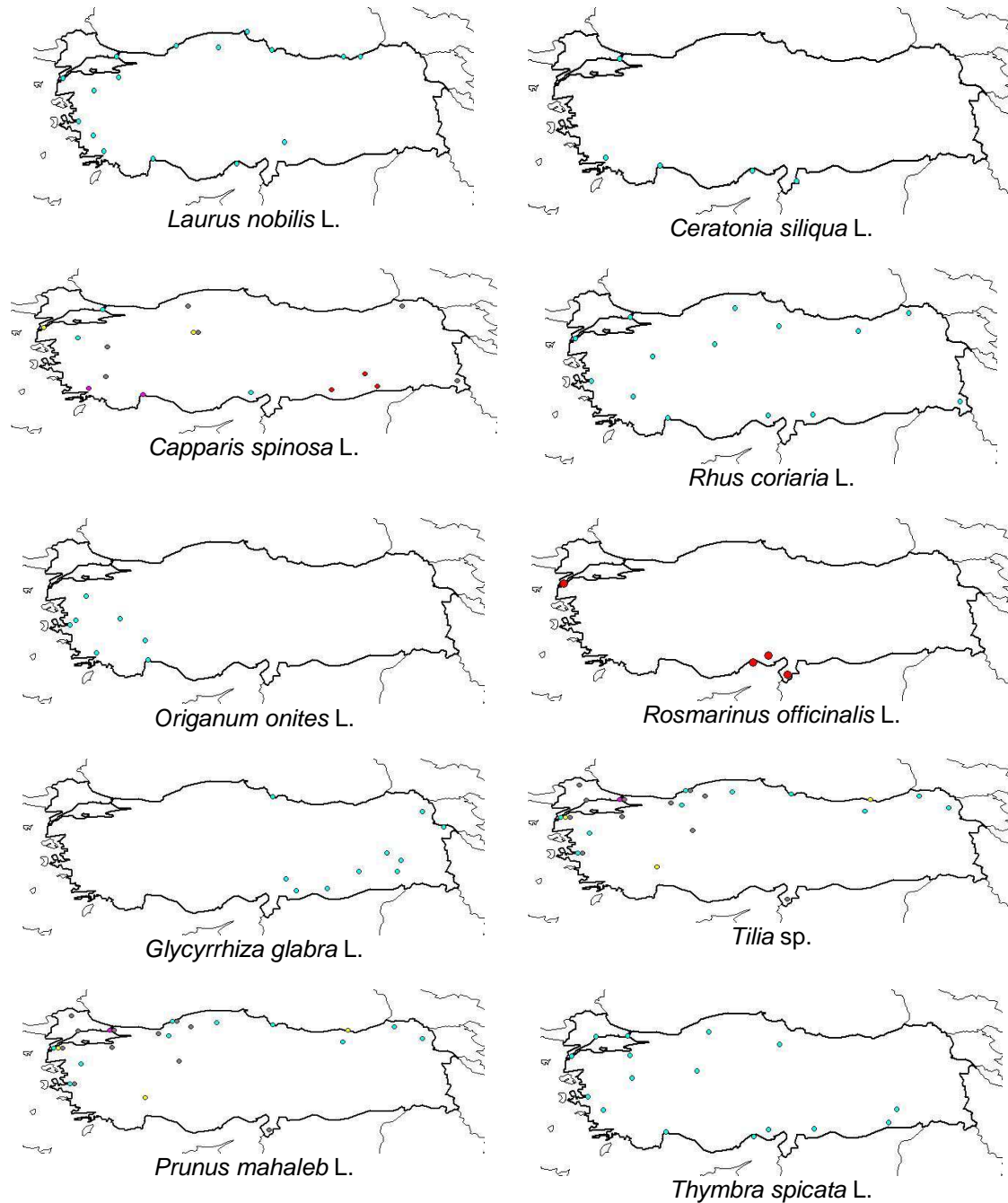


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Thymbra spicata can be found in South-eastern (Kilis, Diyarbakır) and center Anatolia, even in the Mediterranean and Thrace regions.

And finally, *Origanum onites* is commonly produced in South-western Anatolia even it is frequently found in Antalya, Muğla, Denizli, İzmir. Nowadays, it is cultivated in South-western regions of Turkey.



SOURCE: Turkish Plants Data Service (Türkiye Bitkileri Veri Servisi),
<http://turkherb.ibu.edu.tr/>

Figure 15. National distribution of several wild harvested MAPs in Turkey



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Production and use estimation

The number reported of commercially wild collected plants in Turkey is about 347.

According to statistical data, the most wild collected and exported MAPs from Turkey in 2008 were:

Table 14. Annual medicinal and aromatic plants production from wild in Turkey (2008)

Species	Collected part	Total production (t)	Economic value (1000 USD)
<i>Laurus nobilis</i> L.	Leaf, fruits	6.933	20.007
<i>Ceratonia siliqua</i> L.	Fruit	3.559	4.326
<i>Capparis spinosa</i> L.	Bud	2.051*	3.581
<i>Rhus coriaria</i> L.	Fruit	1.175	1.771
<i>Origanum onites</i> L.	Herb	937	4.216
<i>Rosmarinus officinalis</i> L.	Leaf	573	1.588
<i>Glycyrrhiza glabra</i> L.	Stolon	227	431
<i>Tilia</i> spp.	Flower	121	1.392
<i>Prunus mahaleb</i> L.	Kernel	102	897
<i>Thymbra spicata</i> L.	Herb (Dried), sprout (fresh)	25	75
TOTAL		15.678	38.209

SOURCE: Minister of Food, Agriculture and Livestock. 2011 General Agricultural Census.

* 2006

There is also important the wild production of *kekik*, Turkish name referred to different wild species of the genera *Origanum* spp., *Thymus* spp., *Thymbra* spp., *Satureja* spp., that with a production of 1.937 t represents the 20 % of the total exports.

All the wild harvesting takes place in public lands and forests.

In the last 10 years, most of the concerned species have maintained their production from the wild, except for *Tilia* spp., no further maintained, *Capparis spinosa*, with a sharp decline after 2007, and *Glycyrrhiza glabra* and *Thymbra spicata*, which show a decline trend. On the contrary, the production of *Laurus nobilis* has gradually increased by the years in Turkey.

Some of wild collected plant species have started to domesticated and cultivated in the fields, recently. This is the case of oregano (*Origanum onites* L. and *Origanum syriacum* L.) whose cultivation started in last decades in western part of Turkey.

Nowadays, almost all the exported oregano (80 %) has been cultivated under field conditions according to organic farming rules. Only 20 % of the material has been wild-collected from nature.



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The current production of *Capparis spinosa* and *Rhus coriaria* comes from all the Turkish regions. Also *Prunus mahaleb* and *Thymbra spicata* are obtained everywhere, except in the Eastern part.

Ceratonia siliqua are produced only in the Mediterranean area, and *Origanum onites* also in the Aegean area. *Rosmarinus officinalis* is harvested in the Mediterranean and Marmara regions, and *Laurus nobilis* also in the Black sea region.

In the case of *Tilia* spp., it is only harvested in Marmara and Black sea region, and *Glycyrrhiza glabra* only in the South-eastern area.

Value chain

Several species harvested in Turkey are used addressed to medicinal market, like as *Laurus nobilis*, *Origanum onites*, *Rosmarinus officinalis*, *Glycyrrhiza glabra*, *Thymbra spicata*, for producing phytomedicines and herbal teas, and *Tilia* spp. only as herbal teas, while *Prunus mahaleb* is used for elaborating phytomedicines.

Many others are used in the food market as dry herb for condiment: *Laurus nobilis*, *Rhus coriaria*, *Origanum onites*, *Prunus mahaleb*, *Thymbra spicata*, or fresh for elaborating pickles: *Capparis spinosa*, *Thymbra spicata*.

Other food products are the molasses from *Ceratonia siliqua* and *Rhus coriaria*, or even food additives (*Ceratonia siliqua* and *Glycyrrhiza glabra*).

In addition, essential oils and distilled waters are obtained from different species (*Laurus nobilis*, *Origanum onites*, *Rosmarinus officinalis*, *Thymbra spicata*) that are addressed to cosmetic and perfumery market.



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Table 15. Main products obtained from the wild harvested MAPs in Turkey

Species	Collected part	Raw material	Market	Elaborated products
<i>Laurus nobilis</i> L.	1	2, 5	1, 2, 3, 4	1, 2, 3, 8, 9
	4	7	3	8
<i>Ceratonia siliqua</i> L.	4	2	2	5, 6 (thickening)
<i>Capparis spinosa</i> L.	3 (bud)	1 (salted pickle)	2	3 (pickle)
<i>Rhus coriaria</i> L.	4	2 (fruit cover powder), 3 (sauce)		3, 5
<i>Origanum onites</i> L.	5	2, 5, 6 (distilled water)	1, 2, 3, 4	1, 2, 3, 8, 9, 10
<i>Rosmarinus officinalis</i> L.	1	2, 5	1, 2, 3, 4	1, 2, 3, 8, 9, 10
<i>Glycyrrhiza glabra</i> L.	2	2, 4 (water extract)	1, 2	1, 2, 6
<i>Tilia</i> spp.	3	2	1, 2	2
<i>Prunus mahaleb</i> L.	4 (kernel)	2	1, 2, 3	1, 3, 4
<i>Thymbra spicata</i> L.	5	2, 5, 6 (distilled water)	1, 2, 3, 4	1, 2, 3, 8, 9, 10
	5 (sprout)	1	2	3 (pickles)

Collected part: 1.leaves 2.roots 3.flowers 4.fruits 5.plant

Raw material: 1.fresh herb 2.dry herb 3.juice 4.extract 5.essential oil 6.essences 7.fatty oil

Market: 1.medicinal 2.food 3.cosmetic 4.perfumes 5.other

Elaborated products: 1.phytomedicines 2.herbal teas 3.condiments 4. wines 5.molasses 6.food additive 7.antioxidants 8.cosmetics 9.perfumery 10.aromatherapy

According to raw material, the products process through the value chain is the following:

FRESH HERB

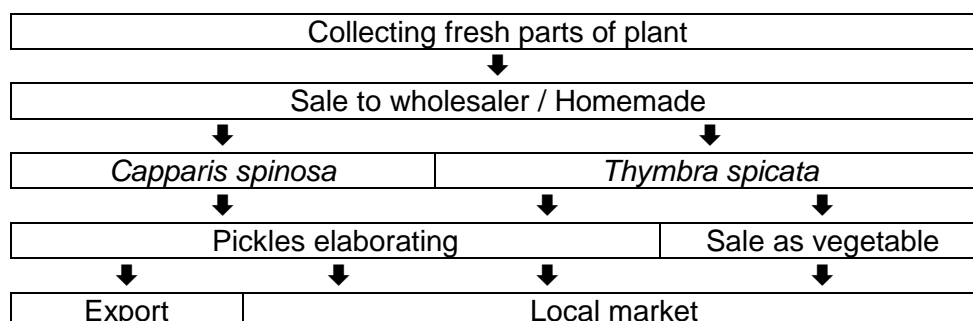


Figure 17. Value chain of fresh herb obtained from wild species in Turkey.



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FRUITS

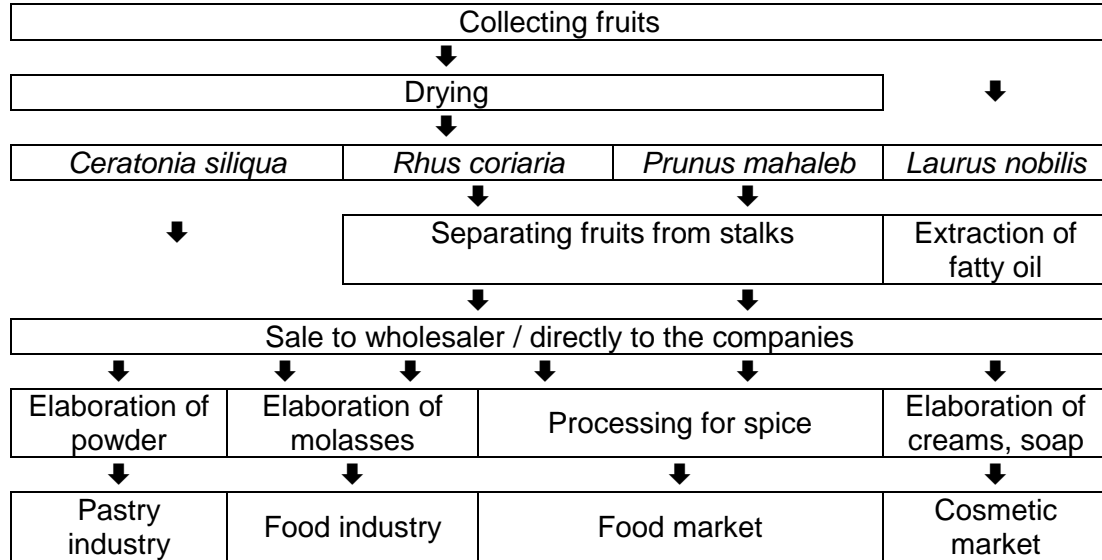


Figure 16. Value chain of fruits obtained from wild species in Turkey.

DRY HERB

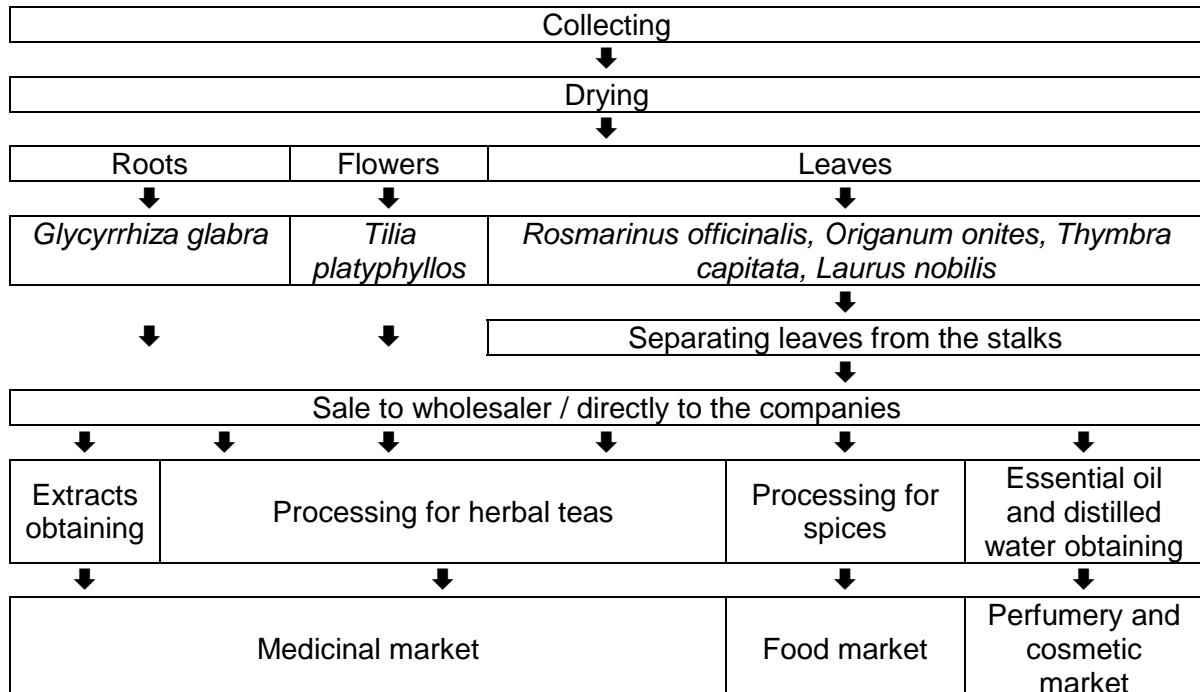


Figure 18. Value chain of dry herb obtained from wild species in Turkey.



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There are more than ten enterprises dealing with MAPs wild harvesting in different parts of Turkey, mainly located in the Mediterranean, Aegean and South-eastern Anatolia regions.

Table 16. Stakeholders involved in dealing with MAPs wild harvesting in Turkey

Species	Raw material	Prices (€/kg)	Stakeholders involved	Situation of enterprises dealing with MAPs WH
<i>Laurus nobilis</i> L.	2, 5, 7	2,00	1, 2, 3, 4	1, 2, 5
<i>Ceratonia siliqua</i> L.	2	2,00	1, 2, 3, 4	1
<i>Capparis spinosa</i> L.	1 (salted pickle)	3,00	1, 2, 3, 4	1, 2, 4
<i>Rhus coriaria</i> L.	2 (fruit cover powder), 3 (sauce)	2,00	1, 2	4
<i>Origanum onites</i> L.	2, 5, 6 (distilled water)	2,00	1, 2, 3, 4	1, 2, 3
<i>Rosmarinus officinalis</i> L.	2, 5	1,50	1, 2, 3, 4	1, 2
<i>Glycyrrhiza glabra</i> L.	2, 4 (water extract)	1,00	1, 2, 3, 4	1, 2
<i>Tilia</i> spp.	2	20,00	1, 2, 3	3, 5
<i>Prunus mahaleb</i> L.	2	2,00	1, 2	4, 5
<i>Thymbra spicata</i> L.	1, 2, 5, 6 (distilled water)	2,00	1, 2	4

Raw material: 1.fresh herb 2.dry herb 3.juice 4.extract 5.essential oil 6.essences 7. fatty oil

Stakeholders: 1.local population (work commissioned by a buyer)
2.group of harvesters (work commissioned by a buyer)
3. professional harvesters (selling to different buyers)
4. Enterprises (auto-consumption for elaborating products)

Regions of enterprises: 1.Mediterranean 2.Aegean 3.Marmara 4.South-eastern 5.Blacksea



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SWOT analyses

The businesses dealing with medicinal and aromatic plants wild harvesting in Turkey are characterized by these strategic aspects:

Strengths	Weaknesses
<ul style="list-style-type: none">• Plant diversity and richness.• Huge export capacity of MAPs.• Developing industry of MAPs.• Good scientific knowledge for processing of MAPs.• Diversity of MAPs products.• Organic certificated MAPs products.	<ul style="list-style-type: none">• Dark market.• Raw material export and processed import.• Less knowledge of wild harvesting and postharvest.• Fluctuation in raw material prices.• Insufficient legal regulations.
Opportunities	Threats
<ul style="list-style-type: none">• Developing MAPs market on the world.• Interest in MAPs cultivation and production.• Huge demand for Turkish MAPs products.• Governmental support for MAPs projects.	<ul style="list-style-type: none">• Dark market.• Excessive wild harvesting of some plant species.• Loss of Ethnobotanic information.• Adulteration of some MAPs products.

Sources of information

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Discussion

Training needs of businesses wild harvesting

Partners considered different stakeholders as the most important to train according to business needs (from 1 *more importance* to 6 *less importance*). The major agreement was in relation with little importance of training wholesalers and companies (buyers). In the case of collectors: professional harvesters and enterprises are considered the key ones, while local population, group of harvesters and forest owners seem to have fewer needs.

According to the considerations of the different partners participating in the meeting on businesses of wild harvesting of medicinal and aromatic plants (1 vote per country), the training addressed to **collectors** should be mainly focused in the following aspects:

- *Sustainable wild techniques* (addressed to all types of collectors, and very few for forest owners).
- *Good collecting practices* (addressed to all types of collectors, and less importance for forest owners).
- *Transformation training _drying / distilling_* (mainly addressed to local population and professional harvesters, but also important for groups of harvesters and forest owners, and less important for enterprises doing auto-consumption).

In second level, other training aspects to consider are the *commercialisation and market aspects* (mainly addressed to professional harvesters, enterprises and forest owners) and the *standards and procedures* (mainly addressed to professional harvesters and enterprises, but also important for forest owners)

In the case of **buyers** of wild plants, specific training subjects are:

- *Good manufacturing practices.*
- *Standards and procedures.*

Other aspects to consider in the training to these stakeholders are: the *commercialisation and market aspects*, and the *sustainable wild harvesting techniques* (mainly for companies).



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Table 17. Training needs of main stakeholders involved in the MAPs wild harvesting

Stakeholders involved in MAPs wild harvesting	Average Importance (more 1 to 6 less)	Training subjects							
		A	B	C	D	E	F	G	H
collectors									
1. Local population (work commissioned by a buyer)	4,00 (s 1,87)								I
2. Group of harvesters (work commissioned by a buyer)	4,25 (s 2.05)				I				I
3. Professional harvesters (selling to different buyers)	3,50 (s 1,80)								
4. Enterprises (auto-consumption for elaborating products)	3,75 (s 1,92)					I			
5. Other (Forest owners)	4,00 (s 1,41)	I			I				
buyers									
wholesalers	4,75 (s 1,09)								
companies	4,50 (s 1,12)								

A – Sustainable wild harvesting techniques B – Good collecting practices C – Transformation training (drying/distilling) D – Good manufacturing practices E – Products elaboration F – Commercialisation and market aspects G – Standards and Procedures H - Other

Regarding the **training actions** for improving the knowledge of the different stakeholders of the wild MAPs' value chain, in the case of **collectors**, the best ones considered, are:

- *Open seminars* (for all the collectors, and less important for group of harvesters).
- *Voluntary training* (mainly for local population, group of harvesters and forest owners, and less important for professional harvesters and enterprises doing auto-consumption).
- *Regular training* (mainly for group of harvesters and professional harvesters, and less important for enterprises doing auto-consumption).
- *Technical documents* (mainly for professional harvesters and enterprises doing auto-consumption, and less important for forest owners).

In second level, other training actions to consider are: *Leaflets, posters, CD, DVD* (for all collectors), *media actions* (for local population and forest owners) and *on-line training* (for professional harvesters and forest owners). Therefore for the last one, internet access and learners skills on ITC tools must be taken into account.

In the case of training addressed to **buyers**, the best training actions are *Technical documents*, and in second level: *Regular training, Open seminars and Leaflets, posters, CD, DVD*.



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Knowledge transfer to buyers could also be reach through specialized media actions (e.g. professional magazines).

Finally, mobile apps were not considered as training tool as this tool could be mainly addressed to domestic harvesters.

Table 18. Best training actions to reach the main stakeholders involved in the MAPs wild harvesting.

Stakeholders involved in MAPs wild harvesting	Training actions								
	A	B	C	D	E	F	G	H	I
collectors									
1. Local population (work commissioned by a buyer)	I	IIII	III	II	IIII		III		
2. Group of harvesters (work commissioned by a buyer)	IIII	IIII	III	II	III		II		I
3. Professional harvesters (selling to different buyers)	IIII	III	III	IIII	IIII	I	I	III	
4. Enterprises (auto-consumption for elaborating products)	III	III	III	IIII	IIII	I	I	II	I
5. Other (Forest owners)	II	IIII	III	III	IIII	I	III	III	
buyers									
wholesalers	III	I	III	IIII	III	I	II	I	I
companies	III	II	III	IIII	III	I	II	II	I

A – Regular training (courses, workshops) B – Voluntary training (courses, workshops) C – Leaflets, posters, CD, DVD D – Technical documents E – Opens seminars F – Mobile apps G – Media actions (TV, press) H – On-line training I – Other (Enterprise training)



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Conclusions

There is an **important traditional consumption** of MAPs, mainly for seasoning, fact that is usually linked to gastronomy and tourism, which provides **additional income for local communities**.

In addition, because of the **demand for raw plant material by industry** and **final natural products by consumers**, wild MAPs market and organic certified products are increasing, offering young people with good scientific knowledge a **challenging entrepreneurial environment**.

In each country, there are many different MAPs species and varieties, with **high richness diversity**, present in wild habitats. Then wild **MAPs are used in different sectors** from cosmetic, pharmaceuticals to food industries. This reality leads to the production of tradable products with **export potential**.

So, it has been stated a **gradual increase of non-wood forest production** in the last years, even the use of waste of timber industry (e.g. pine, birch, eucalyptus) for production of extracts and essential oils has to be taken into account.

Nevertheless, it is difficult to know who is working in wild harvesting, as this is a **dark sector**. And nowadays the **number of professional harvesters is decreasing** as they are getting older, so traditional knowledge is disappearing with them.

Unfortunately, there is stated **few knowledge on botanic and chemistry** and **lack of information on the habitats of new harvesters** commissioned by buyers.

Misidentification of species, by not very well taught people, could involve **real health danger to consumers**. Incorrect knowledge could affect health security. Sometimes self-educated people teach other people, who are going to do wild harvesting, in plant uses, and they will also transfer uncompleted information to consumers.

But even professional harvesters have **incorrect information** on sustainable harvesting and use of MAPs, and on proper transformation and good manufacturing practices, linked to **obsolete technologies and ancient harvesting techniques**. Furthermore, **legal framework and procedures are insufficient and not well known**.

So, there is little concern about the sustainability of resources needed and the quality of products. **Existing collectors do not want to change their way of doing wild harvesting**, thus sometimes it is difficult to convince them to receive training about sustainable techniques as these are not profitable in a short term.

Manufacturers and wholesalers demand large quantities of raw material and **prices paid to harvesters are very low**, as many products have high competence from other countries, being submitted to prices fluctuation. Even though, the problem is that most



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of these countries export raw material and import processed products, without profiting the added value. So, if prices are low, **income will not be interesting for harvesters**, so few people will be interested in being trained on wild harvesting of several species.

Sometimes, despite the increasing industry demand, there is a weak response of harvesting sector, thus **stakeholders are not well represented and there is little differentiation, innovation and investment in the sector.**

In addition to that, research on wild MAPs harvesting is fragile and insufficient (lack of information on diseases, forest fire effects...) and **there is not enough control and monitoring by the administration in wild areas** thus many forests are private. So, increasing training on wild harvesting could raise the number of people accessing to nature to exploit natural resources, endangering species in certain areas.

Some opportunities for training MAPs wild harvesting have to be taken into account:

- There is a broader use of timber industry waste and great unused resources of common MAPs species, mainly for the production of extracts and essential oils. So, there is need of training on the current demand and the raw material's industrial processing of these **new products**.
- As traditional knowledge on wild harvesting and plant uses is kept by older people, it is important to ensure the **knowledge transfer to the younger generation**.
- Due to the crisis, more people is searching new business or labour opportunities in rural areas, so **more people are interested in wild harvesting of wild MAPs**, and they want to learn extended topics about wild harvesting methods.
- New collectors have low **information in botanical identification and habitats knowledge**, so training is needed on both subjects.
- New entrepreneurial opportunities related to wild harvesting of MAPs need **updated information or training on different uses of value chain** (good collection practices, good manufacturing practices, market information) in order to obtain **quality products**.
- Harvesters that do collection and sell the **product certified organically** need to be trained in sustainable wild harvesting techniques as this training is not always provided by the certifying entities.



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- Existing collectors do not always do the wild harvesting in a correct way, in order to maintain the species and the habitats in long term. International strategies on conservation of biodiversity are pushing to **implement sustainable wild harvesting techniques and good collection practices**, so it would be prescribed to do training in order to show them that this will be profitable for them, if the resources are preserved.
- Existing collectors harvest everything they find in the nature without differentiating qualities. It is important training people about the **richness of MAPs in the different active compounds** that could be different from one place to other for the same species (local chemotypes).
- **Even enterprises** that use high quality botanicals for medicinal products, chemotyped essential oils for aromatherapy, and fresh herb for obtaining extracts addressed to natural cosmetics, **need to be trained** on varieties and habitat identification, phenology of each species related to the major active compounds content, as well in good collection and manufacturing techniques, overall if they collect directly from the nature (even if they commission groups of harvesters to do this activity).
- Many harvesters use obsolete transformation facilities for processing the collected plant (dry in the sun, iron distillers...) that leads to a low quality product. They should be trained about the **correct way to do the manufacturing and the use the proper facilities** (dryers, stainless steel distillers...).
- There are many abandoned lands where various MAPs could be harvesters. Land and **forest owners are highly potential harvesters** for sustainable use, maintenance and restoration of MAPs wild resources.
- Forest owners do not have enough information on the possible incomes from the non-wood forests products. **Training on entrepreneurial opportunities** and on the sustainable forest management and use should be done in order to maintain the resources in a long term concept.
- MAPs wild harvesting contribute to **population fixation in rural areas** of the interior, using those species to generate richness, to have a better quality of life and promotion of **endogenous values of each region and territory**, like us the rural tourism linked to the ecological value, and the restaurants offer and handicraft products linked to gastronomic value.



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Finally, some recommendations are counselled:

- Non professional harvesters, commissioned by buyers, should receive **regular training** in order to assure the sustainability of the activity
- Local population and professional harvesters should receive **updated information** about good collection and manufacturing practices, in order to obtain good **quality raw material**.
- The **use of good practices** for the wild harvest of MAP plants, with support in the laws and with control, is needed to ensure that these natural resources are **long term sustainable**.
- Create an **effective management information system** which is based on professional knowledge of plant reproductive biology and accounting methodology of plant harvesting for sustainable use of wild resources of MAPs.
- To avoid overexploitation, a local or regional entity should be responsible for the MAPs **wild harvesting activity control**.