

**International Master Programme at  
the Swedish Biodiversity Centre**

**Master theses  
No. 45  
Uppsala 2007  
ISSN: 1653-834X**

**Title: Conceptions of  
Sustainability in the  
Medicinal and Aromatic  
Plants Sector in Bosnia and  
Herzegovina**

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## **Abstract**

More than three-quarters of the world's population rely on local health practitioners and traditional medicines for their primary medical needs. At least 160 – 170 medicinal and aromatic plant (MAP) species are native to Bosnia and Herzegovina (BiH) where most are still collected. While the resource assessment has identified 'at risk' species based upon the current market situation, it is important to note that the demand for a specific species can rise dramatically in a very short period of time putting at risk species which are currently considered to be safe. The study was conducted as a survey where collectors and herbalists/buyers of MAPs from Northern Bosnia and Herzegovina region were interviewed. Collectors of MAPs in BiH belong to a poor and vulnerable group in society, and very often there is no other cash income in the household except the money earned from collection and selling the collected herbs. In that way direct exploitation and poverty of local people become the main threat to sustainable use of MAPs. It is more likely that collection in Herzegovina would be more sustainable, due to longer tradition and longer personal experience among the collectors. Around 75% of interviewed buyers consider cultivation as a solution for the safe future. There is a need for investigating and ensuring that harvest rates are sustainable, that legislation and policies are supportive and that consideration of harvesting is integrated into development initiatives. The greatest challenge in the new millennium is to integrate the traditional knowledge system with market needs to decelerate the pace of biodiversity loss and environmental degradation.



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## **Introduction**

In everyday life we use plants, parts of plants and their extracts. They are used in various ways: as food, medicines, in cosmetics industry, as coloring agents, detergents, perfumes and many other things. More than three-quarters of the world's population rely on local health practitioners and traditional medicines for their primary medical needs (The Crucible II Group, 2000). More than half of the world's most frequently prescribed drugs are derived from plants or they are synthetic copies of plant chemicals (Lange, 1998). A list of more than 21,000 plant species, which are globally used in medicine, has been compiled by the WHO (Groombridge, 1992).

Most of the MAP species which occur in Europe are present across many countries, but some are distributed to a more limited area in Europe. Within the Europe a rich sources for MAP species are found in the Mediterranean countries, especially the countries of South-eastern Europe and Eastern Europe (including Bosnia and Herzegovina).

**The aim** of this study is to provide an understanding of social and cultural aspects that are related to traditional ways of using natural resources and conceptions of sustainability, and to set up a development projection of herbal sector in Bosnia and Herzegovina. In exploring the relationship between MAPs diversity and sustainable use the study will investigate and evaluate the perceptions of traditional practices and their implications on MAPs biodiversity in BiH. The study will also try to provide an answer to the question of what are the main threats to sustainable use of MAP resources are in BiH. The specific goals are the following:

- (a) To gather information about the extent of collection,
- (b) To explore if there are regional differences between collectors and herbalists/buyers of MAPs,
- (c) To determine implication of traditional practices on sustainable use of MAPs biodiversity,
- (d) To investigate key issues that traditional methods need to incorporate in order to enhance MAPs biodiversity.

## **Background**

Bosnia and Herzegovina (BiH) is a country with a high biodiversity and it has rich and diverse landscapes. At least 160 – 170 MAP species are native to BiH and most of these are still collected (Kathe et al., 2002). The collection of wild MAPs has been important for centuries. In the period of the former Socialist

Federal Republic of Yugoslavia, BiH was mainly a provider of MAP raw material. As already mentioned many MAP species are utilised, and out of them 64 species are at risk due to unsustainable collection (Donnelly and Helberg<sup>1</sup>, 2003). This list includes several endangered species that are amongst the most traded ones (*Gentiana lutea*, *Arnica montana*, *Arctostaphylos uva ursi* and *Orchis spp.*).

In the past, the collection of the wild MAPs was mainly characterized by an uncontrolled and unsustainable use of the biodiversity, through which the national heritage of rare plant species (e.g. *Gentiana lutea*, *Arctostaphylos uva ursi*) was endangered (Pećanac, 2004).

The history of MAP collection and use in BiH is not well studied and documented, but it has been an important factor for centuries. For a long time, people collected MAPs for their own purposes or to provide their families or members of local communities with healing herbs. As industrialisation process began people from the towns gradually lost their direct contact with nature, and become dependent on natural medicines provided by the rural population and traders. At the same time the economic value of MAPs has increased.

During this period there were two large state traders active in that time: UPI Sarajevo and KLAS Sarajevo, which purchased the collected raw material provided by local collectors or cooperatives. After storage these traders either traded the raw material to the domestic, state-owned processing enterprises situated mainly in Serbia or Slovenia, or sold it further to the international market. There are no reliable data on quantities of the traded or exported material that originated from BiH or from other parts of former Yugoslavia. Even after the collapse of the state and the independence of BiH, detailed and reliable collection and trade data and statistics related to MAPs are difficult to obtain.

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<sup>1</sup> The IFC (International Finance Corporation) had a 3-stage approach to reviving the herbs industry in BiH. At the first stage, in 2001, BiH was made a participant to the Balkan forum on herbs, during which participants from all over the region had a chance to reestablish the disrupted contacts and marketing relationships. At the second stage, in 2003, the IFC issued a comprehensive study on herb market opportunities in BiH, which was followed in 2004-2005 by a set of concrete demonstration activities, resulting among other things in establishment of a North-West BiH MAP Association, functioning sustainably ever since. As replication few more relatively large-scale associations were established, including one on the federal level. For example, the North-West BiH MAP Association brings together 80 collecting companies/registered individuals, and 12 processing companies. It supports itself through fees collected from each member. It has official license for operation with non-timber forest products (NTFP). The IFC supported capacity building, information exchange, infrastructure development and marketing / promotion initiatives of the Association demonstrating better environmental and market sustainability of the organized approach as opposed to un-organized collection of herbs by separate individual collectors.



The agro-industrial sub-sector of medicinal and aromatic plants in BiH is dominated by wild-collection, an activity with long tradition. The first documents are dated from the 13<sup>th</sup> century (Devetak, 2001). The plant species inventory process that started before the last war was stopped; in addition many documents were lost during the war. The numbers of collectors affiliated to the companies participating in the GTZ programme range from 50 to an estimated 10 000 collectors with established companies. Altogether approximately 100 000 people are involved in the collection of medicinal and aromatic plants. Processing into value added natural products like essential oils, spices and teas has been established in more than 250 small and medium enterprises (Pećanac, 2004). National scientists have indicated that there are concerns over the status of a number of MAP species<sup>2</sup> and most MAP species regarded as endangered are still collected from the wild (see Appendix 1).

## Description of the study area

### Geographical position

Bosnia & Herzegovina (BiH) lies in the centre of former Yugoslavia and links the central plains, the mountains and the Adriatic coastal regions of the Balkans. BiH covers a territory of about 47 400 km<sup>2</sup> (22 580 km<sup>2</sup> in the Federation of Bosnia & Herzegovina (FBiH) that consists of 10 cantons and 24 820 km<sup>2</sup> in Republika Srpska {RS}). In both entities, about 52% of the land is agricultural, 43% is forest and 5% 'unproductive area' (in 1996; REC 2000). The major part of the country's surface is made up by mountain ranges. Only a short coastal stretch of about 20 kilometres opens BiH towards the shores of the Adriatic Sea, cutting Croatia in two sections. High mountains towards the Adriatic Sea (up to 2 380 metres), and the Dinaric Alps in the central and southern parts of Bosnia shape the country's relief. The country is made up of two different entities, each with a considerable political and legislative independence: the Federation of Bosnia & Herzegovina (FBiH) with its capital Sarajevo and the Republika Srpska (RS) with Banjaluka as administrative centre (Fig.1). The border between the two BiH-parts has a complicated course, depending on local population majorities.

Until 1990 only 0.55% of the territory of today's BiH was protected. The 253 protected areas consisted of five Strict Reserves, three Managing Reservations, two National Parks, 29 Special Reservations, 16 Natural Sights and 195 various natural monuments (REC 2000).

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<sup>2</sup> *Gentiana lutea*, *Arctostaphylos uva-ursi*, *Salvia officinalis*, *Juniperus communis*, *Hypericum perforatum*, *Veronica officinalis* (Kathe et al., 2002).

Fig.1 Bosnia & Herzegovina.



### Agro-ecological zones

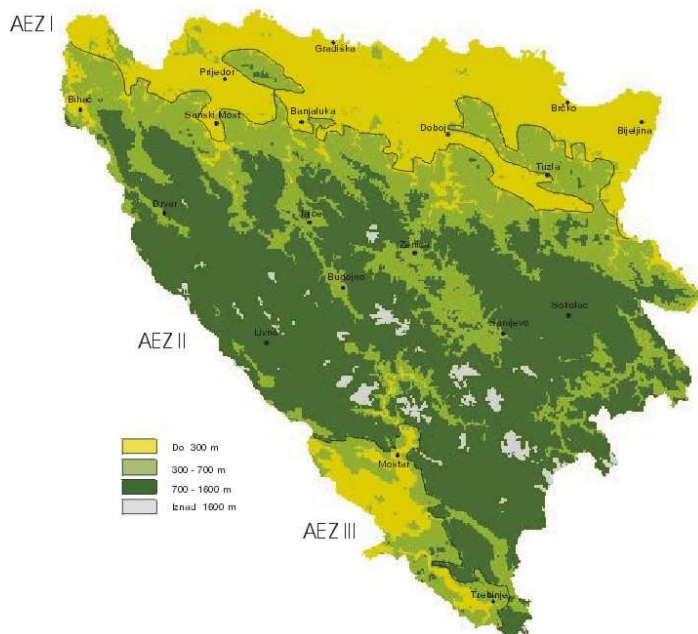
**Agro-ecological zones (AEZ)** can be shown on a map over soil resources which are defined through geological substrate, soil, relief, climate characteristics, and soil usage as well as through certain soil usage limitations such as erosion, floods, diggings, and in our conditions mine fields. Final result of agro-ecological zoning represents map of soil suitability for plant cultivation and planning of optimal soil usage.

Bosnia and Herzegovina is divided on three AEZ (Okiljević et al., 1997) which presents distribution based on relief and climate factors, so this distribution should be considered as conditional (Fig.2).

- **AEZ I** – plane and mild hilly area which covers northern part of Bosnia and Herzegovina with maximum altitude of 300m. Significant towns within the zone are: Kozarska Dubica, Prijedor, Gradiška, Banja Luka, Doboj, Modriča, Odžak, Orašje, Brčko, Tuzla and Bijeljina. Within the zone are situated the main agricultural surfaces of the country. The most productive soils belong to Prijedor and Lijevo field. Climate is temperate continental. Sum of the temperatures above 5°C is 3 613°C. Draught frequency within the zone is 33%, and draughts in

average last 37 days per year, mainly from beginning of August to beginning of September.

Fig. 2 Agro-ecological zones in BiH



- **AEZ II** – hilly part that covers the central and the largest part of Bosnia and Herzegovina. Significant towns within the zone are: Bihać, Sanski Most, Drvar, Jajce, Bugojno, Glamoč, Livno, Zenica, Sarajevo, Sokolac, Višegrad, Goražde and Foča. This zone has temperate continental climate but some parts due to influence of rivers have sub-continental climate. Sum of the temperatures above 5°C is 2 941°C. Annual amount of rainfall is 1 047mm. Draughts usually start at the end of July and last to the beginning of September.
- **AEZ III** – Mediterranean area that covers the southern, Mediterranean part of Bosnia and Herzegovina. Within this zone are located towns Mostar and Trebinje. Zone is characterized with Mediterranean climate with sum of the temperatures above 5°C in amount of 4 639°C. An average annual precipitation sum is 1 577mm. Draught frequency within the zone is 85% and it lasts annually 50 day in average (beginning of July till end of August).

## **Economic situation**

The 'Bosnian War' (1991–1995) had a tremendous impact on social structures and land-use in BiH. Many people were killed, others were driven from the land or – mainly the younger generation – fled the country. Many have started a new existence abroad and will not return to BiH. Those who have remained face serious social problems: about 60% of the population of BiH live below the line of poverty (UNDP 1998) and 61% of the population over 18 years of age are unemployed (REC 2000). The economy has largely been destroyed by the war. Public utilities can often not be paid and are therefore constantly on the verge of bankruptcy (REC 2000). Compared to 1991, the population of BiH has decreased by 9.8% in 1999, when about 3,400,000 people lived on BiH territory (REC 2000). The age groups 0-14 and 15-64 years were reduced as a consequence of war impacts and the percentage of the age group '65 and over' has doubled since 1991.

MAP harvesting and trade has at least three equally important dimensions: the ecological, the social and the economic issue. Due to over-exploitation, land use change, erosion, mine fields and other factors, the populations of some MAP plant species traditionally collected have considerably declined; some species have even become rare, threatened or vulnerable. This development not only endangers the plant species and their ecosystems but also the economic living of people involved in MAP collection and trade. Most collectors belong to poor or under-privileged groups of society and quite often depend on the additional income through wild harvesting of MAPs. But in addition, trade in medicinal plants is also an important factor in the countries' political economics. Consequently, over-exploitation of these natural resources has a negative impact on both the plant species, the welfare of the collectors and the states' economy (Kathe et al., 2002).

Collectors are collecting raw material mainly at the state property where they have free access. Small scale collection has been performed at the private property.

About 47% of the ploughed land has been abandoned by 1997 and about 60% of the livestock kept in BiH did not survive the war. Minefields often prohibit work on the land, and many villages have been completely deserted by the former inhabitants (REC, 2000). A re-development of agriculture is expected in the future, but it has a slow start.

## **Legislation**

In BiH legislation that regulates sector of medicinal and aromatic plants is rather complicated:

- (1) MAP sector belong under jurisdiction of Ministry of Agriculture, Forestry and Water Management when it is about cultivation and collection of wild growing herbs and NTFP, and Ministry of Health when it is about sale of herbal medicinal products at the market.
- (2) Each entity and district have legitimacy to create their own laws and regulations (Federation of BiH consists of 10 cantons and each canton have its own Government and accompanying legislation). In other words, it is very difficult, even when laws do exist, to put them into force.

The entity laws on forestry are only providing a framework for MAP collectors and processing. There is common agreement that both Federation of BiH (or preferably each of its 10 cantons), as well as Republika Srpska, require their own area specific and legally adopted regulations to replace the existing ambiguous by-laws that would clearly mark endemic and endangered plants, prohibit their collection, provide support for their cultivation, and explain other things such as harvesting techniques.

Specifically, there is a need to reconsider subsidizing of cultivation as the current regulations are very unspecific and give room for abuses. For example, many producers pretend planting MAPs and following inspectors' checks they receive the MAP cultivation subsidy. Once the subsidy is received, many cultivators change the use of the land for more profitable patterns.

The almanac of the 'Bureau for Protection of Monuments and Culture of NR Bosnia and Herzegovina' from 1962 (which is still valid in BiH) lists the following species as being endangered on the territory of today's BiH: *Leontopodium alpinum*, *Rhododendron hirsutum*, *Adiantum capillus-veneris*, *Drosera rotundifolia*, *Gentiana lutea ssp. symphyandra*, *Sibirea croatica* and *Notholaena marantae*.

## Material and methods

### Definitions

This work is providing information relating to collection of medicinal and aromatic plants, mainly vascular plants, although some lichens and fungi are relevant to the subject. Collectors of MAPs are people, usually from local communities, that are collecting MAP raw material from the wild and selling it to the herbalists, buyers or traders. There are also collectors, in local terms addressed as 'illegal collectors', who are described as coming from other municipalities in the country and that harvest plants without leaving almost any specimens (e.g. *Gentiana lutea*), interested only in fast profit.

Collectors are also divided into following 3 groups:

- 1) Commercial collectors – collecting MAPs aimed for sale,
- 2) Collectors collecting for the needs of their own household,
- 3) Devotees – people who like to be in the nature, like to learn more about herbs, scientific workers, students, etc.

In this work the term collector refers to commercial collectors.

There is no generally accepted definition of sustainability. Several questions need to be answered in order to clarify term of sustainability. What is sustainability? What does sustainable use mean? How it can be measured?

The concept of sustainability has been discussed extensively and Costanza & Patten (1995) give a fair description: “The basic idea of sustainability is quite straight-forward: a sustainable system is one which survives or persists. Biologically, sustainability means avoiding extinction and living to survive and reproduce. Economically, it means avoiding major disruptions and collapses, hedging against instabilities and discontinuities. Sustainability, at its base, always concerns temporality, and in particular, longevity. What passes as *definitions* of sustainability are therefore often *predictions* of actions taken today that one hopes will lead to sustainability. A system can only be known to be sustainable after it has been time to observe if the prediction holds true. Usually there is so much uncertainty in estimating natural rates of renewal, and observing and regulating harvest rates, that a simple prediction is always highly suspect, especially if it is erroneously thought of as a definition. Many elements of sustainability definitions are really predictions of system characteristics that one hopes lead to sustainability, not really elements of a definition. Like all predictions, they are uncertain and should rightly be the subject of much elaboration, discussion, and disagreement.”

However, the definition itself depends on the aim. It means that it can be observed in terms of:

- Extinction (sustainable if there is no risk of extinction),
- Viability (sustainable as long as maintain species viable),
- Genetic variability (preserve genetic diversity and variability),
- Threshold level,
- Resilience (situation when ecosystem does not break and change into another one – changes in dynamics do not effect the system),
- Time context (what is considered to be sustainable over 20 years does not necessarily mean it would be sustainable over 100 years),
- Complementary effect (if certain species is lost another can replace its functions in the ecosystem).

This unclear situation allows manipulation in usage of the term sustainability, especially regarding trade in raw material when companies stipulate the price because products (from countries that are raw material suppliers) are not collected in a 'sustainable manner'.

Sustainable use of MAP resources in this work means a life span that is consistent with the system's time and space scale. The key is differentiating between changes due to normal life span limits and changes that cut short the life span of the system. Under this definition, anything that reduces a system's natural longevity also reduces its sustainability (Costanza & Patten, 1995).

## **Method**

This study provides information on the current BiH market within the sector of medicinal and aromatic plants and it is based on information collected through:

- (1) interviews with collectors, traders and/or others knowledgeable concerning issues connected to collection, use and trade,
- (2) examination of national legislation,
- (3) review of catalogues and brochures of companies involved in the trade, and
- (4) evaluation of literature.

The study was conducted between July 2006 and November 2006 and covered the main collecting areas at northern part of Bosnia and region of Herzegovina.

The study was conducted as a survey where collectors and herbalists/buyers of medicinal and aromatic plants (MAPs) from these two regions were interviewed. However, from northern part of Bosnia are interviewed ten herbalists/buyers and 20 collectors from surroundings of following towns: Bihać, Bosanski Petrovac, Drvar, Ključ, Prijedor, Banja Luka and Kotor Varoš. From Herzegovina region were interviewed ten herbalists/buyers and 20 collectors from surroundings of Mostar, Ljubuški, Stolac, Ljubinje and Trebinje. From each municipality a key informant (a person who is involved in MAP sector with at least ten years of experience) was chosen using the information of extension service. Key informant would choose collecting area, assist in finding collectors and buyers, and was present during the interview. It was important to include local key informants because collectors are very suspicious and frightened and not used to be interviewed. It was also very important to assure them that collected information would be treated as highly confidential as possible and would not be spread away to any other source but

to purpose of this study only. Collectors were selected randomly and it might have similarities in real field situation. Each interview lasted for approximately 2 hours.

Two types of questionnaires, in Serbian language, were prepared:

- ~ Questionnaire for collectors (see appendix 2 in English translation)
- and
- ~ Questionnaire for herbalists/buyers of raw material (see appendix 3 in English translation).

In its basis they are the same but they were adjusted with certain specific questions for each group.

Each questionnaire was divided into 3 integral parts:

- (1) General part - contained personal information about interviewer (e.g. name, age, occupation, level of education),
- (2) Socio-economic part - provided information about social and economic background of interviewers (e.g. income generated through collection, prices of raw material, collected species, collected/purchased quantities of raw material, market information, etc.), and
- (3) Thematic part - provided information on interviewers' understanding on related issue (e.g. understanding of term sustainability, habitat changes, etc.).

## **Data analysis**

Information collected through data collection is largely qualitative and therefore analysis was largely based on descriptive statistics (percentage comparisons to provide a general overview of responses). Responses from open ended questions were grouped into the classes that are conceiving similar points of view. From the close ended questions were calculated percentages. Within mentioned analysis regional differences between Northern part of Bosnia and region of Herzegovina were compared. Nevertheless, quantitative information was analyzed, where were used the computer programmes and statistical tests (Minitab). For the calculation of the economic dependence the Mann-Whitney test was used, where differences between two regions were considered significant only for  $P < 0.05$ .



## Results and discussion

### Collectors

Collectors in BiH are often a very poor and vulnerable group. All groups of collectors, domicile, returnees and refugees have very difficult living conditions, in particular the returnees and refugees. Very often there is no other cash income in the household except money earned from collecting and selling the collected herbs. That is a reason why collectors often collect everything they can find in order to provide an income for their households. Almost all interviewed collectors agreed and emphasized that collection of wild growing MAPs is of great importance for their livelihood (Fig.3). For 60% of all interviewees 70% – 100% of their total income originates from collection.

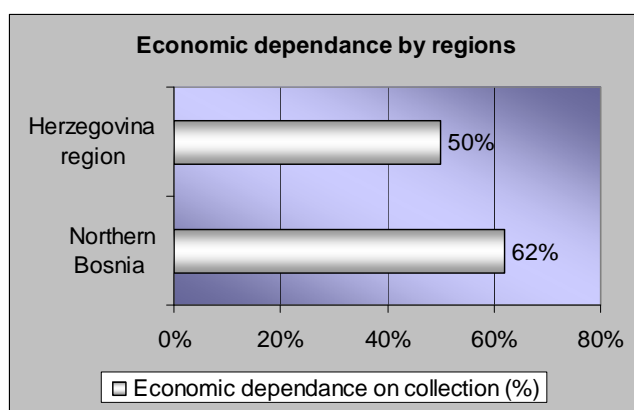


Fig. 3 Economic dependence of collectors by regions

When estimating the difference regarding economic dependence between the two areas the Mann-Whitney Test was used (or U – test). Each two samples for two regions contained 20 responses on economic dependence from collection. At a level of 5% of probability  $U = 151.00$ , and  $p$ -value  $> 0.05$  ( $H_0$  was not rejected), meaning that there is no statistically significant difference between the two areas!

Almost 65 % of collectors emphasized that they would quit collection if they could find an alternative source of income. When asked about the price of raw material about 85% of interviewees consider to be underpaid. That is why they have to collect larger quantities of fresh herbs in order to secure higher income. But, on the question if they consider collection as an economically perspective job around 70% of interviewees gave positive answer explaining that all they needed was secured market, organized purchase, more knowledge on MAPs, excellent alternative source of income and more work more profit.

Knowledge on MAPs usually was gained through self-education and personal experience, but in Herzegovina region collectors with traditional knowledge dominate (knowledge passed from generation to generation). The main reason could be the fact that before the last war (1991–1995) Herzegovina region was the main supplier of MAPs raw material to the former large state companies while the collection in the Northern part of Bosnia was small scale (mainly for personal usage). After the last war, collection in this part was intensified due to lack of industry or any other branch of economy. Around 74% of interviewed collectors from northern Bosnia started to collect after the war (without enough experience) at the same time there are 42% of post-war collectors in Herzegovina region. Taking this into account it is more likely that collection in Herzegovina would be more sustainable, due to longer tradition and longer personal experience among the collectors.

Collectors can also be grouped according to age:

- 20% of interviewed collectors were young people, teens mainly above school leaving age up to people in their 30s,
- Middle age people (30s to 50s) account for 50% of interviewed collectors,
- Older people (above 50s) account for 30% of interviewed collectors.

Most of the collectors have medium level of education (ca. 60% of all interviewees had finished high school). There are some slight differences between these two regions in level of collectors' education (Fig.4).

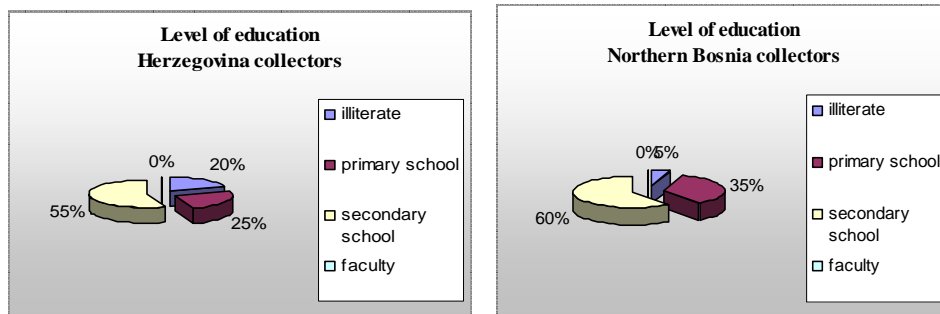


Fig. 4 Level of education of collectors

Collection of MAPs is performed by both men and women. Nevertheless, among the sample of interviewed collectors result differs where almost 70% in Northern Bosnia were male and the same figure for Herzegovina region was 45%, which is likely to represent the situation in the field.

Around 60% of all interviewed collectors collect not more than ten different herbs, 30% up to five and only 10% more than ten different plant species. Appendix 4 contains information on the most frequently collected plant species in northern Bosnia and region of Herzegovina based on the collector's answers.

In Herzegovina region almost all interviewed collectors are concerned that there in the future will be no raw material left for collection. The main reasons mentioned were:

- global climate changes – 55%,
- over-harvesting and inappropriate harvesting techniques – 45%,
- fires – 40%,
- lack of livestock and no agriculture – 40%,
- poor law implementation – 30%.

The interviewed collectors from Northern Bosnia are on the other side not concerned over lack of raw material in future. They state they will have enough raw materials for the next 20 to 30 years and even more. Generally, all had noticed changes regarding habitat such as disappearance of native plant species, appearance of new species, changed collecting calendar due to global climate change (collection starts much earlier than ever before). If no order is placed then collection will not occur. Buyers are the ones who decide which plant species are going to be harvested, determine the prices, quantities and quality parameters (plant parts, collecting calendar, collecting tools, drying conditions, etc.). After the harvest collectors perform cleaning, separation, drying and in some cases cutting if buyers request it. Collectors are collecting in the municipality where they live, and they collect at both state and private land. Mainly it is state property and small scale collection is performed on private property.

Interviewed collectors from Northern Bosnia had noticed that collectors from other municipalities were coming and harvesting in their areas (they call these collectors `illegal`), and they pointed them as the main cause for over-exploitation. In Herzegovina region there are no external collectors (Herzegovina is a large, poorly inhabited region). Around 60% of the interviewed collectors considered that the number of collectors had increased and is still increasing (due to lack of finances and high unemployment rate), but some, around 25% thought that the number of collectors was decreasing (unreliable sale, death of old traditional collectors) and 15% estimated the number to remain the same.

The main risks collectors are facing in this job according to themselves are:

- unreliable sale (there are no sale guaranties),
- insecure prices,
- difficult weather conditions (too warm during collecting season),
- snakes, insects and other organisms,
- mine fields.

Nevertheless, more than 80% of the interviewed collectors were planning to continue to collect even in the future (significant additional income)! According to WHO, IUCN and WWF the cultivation of plants as sources of drugs is the best and most promising way to satisfy the market's expanding demand for these raw materials. However, only 15% of the interviewed collectors were planning to start cultivating some plant species in the future in order to secure and/or enlarge the production (they were, however, aware of risks of such production – dependence on climate conditions, draught, poor soil, etc.). The rest of the collectors did not consider cultivation due to for example lack of finances, lack of private land and/or insecure market.

Utilization and commerce of wild plants resources are not damaging as such, but become a problem rather if demand exceeds supply. The drastic decline of a species is often due to international trade and not to the local needs. When asked about the term 'sustainable use' 97% of the interviewed collectors said they have never heard about such term. However, 75% stated to leave the roots and plant individuals for regeneration and next vegetation period. However, there was a difference between experienced traditional collectors and less experienced newer collectors. While the first group considered collection as a way of life the other group considered it as a way to earn money in the present (and preferably as much as possible). And, interviewees stress that while the number of the first group is decreasing due to aging and mortality, the number of the second group is increasing!

## **Buyers**

From this study it can be assumed that the buyers are not poor or vulnerable, on the contrary they can be considered as well situated, in a much better situation than collectors. Their position could be described as a strong middle class consisting of respected members of the local communities. Interviewed buyers were owners of small or medium size enterprises, where 65% of them were male and 35% female. From 20 interviewed buyers six were herbalists. Knowledge gained on MAPs originates from schooling for 40% of interviewees, traditional knowledge passed from generation to generation for 30% (mainly herbalists) and self-education for 30% of interviewed buyers. The buyers started being involved in MAP sector either through family business (30%) or because they considered it as well-paid and economically justified job that has secured future (70%). Around 60% started to work in MAP field before the war (more than 15 years) and 40% after the war (less than 15 years).

All of the interviewed buyers considered sector of MAPs as economically justified and profitable. They did not have significant problems in finding final buyers for their products. On the contrary, they had also noticed an increase in sale from year to year (increased production means increased demand for raw

material). All interviewed buyers from Herzegovina region export their products on the international market (some quantities are also sold on the national market too). In Northern Bosnia around 75% of buyers are only selling their products at the national market and in Herzegovina region 80% of interviewed buyers are exporting their products at international market (Fig.5). Exported products attain better price, higher quantities are generally requested and therefore there is larger pressure on these herbs and possibility of their over-exploitation.

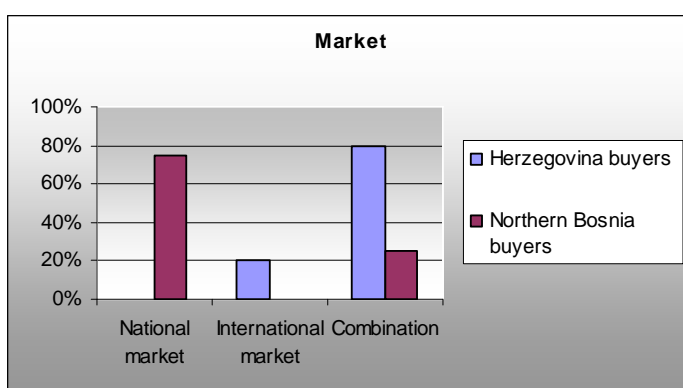


Fig. 5 Market participation

Before the beginning of a collection season the buyers announce (based on previous experiences, annual plan and available finances) which plant species they are going to purchase and the needed quantities. Table 1 and 2 shows the most often purchased plant species at Northern Bosnia and Herzegovina region based on answers of key informants.

Table 1 Preference ranking values (based on degree of their scarcity) of 5 medicinal plants in the Northern Bosnia

Medicinal plant	Key informants (coded A to E)					Total score	Ranking
	A	B	C	D	E		
<i>Gentiana lutea</i> L.	1	3	2	1	2	9	1
<i>Sambucus nigra</i> L.	2	2	3	4	1	12	2
<i>Thymus serpyllum</i> L.	3	1	4	3	4	15	3
<i>Hypericum perforatum</i> L.	5	4	5	2	3	19	4
<i>Urtica dioica</i> L.	4	5	1	5	5	20	5

Table 2 Preference ranking values (based on degree of their scarcity) of 5 medicinal plants in the Herzegovina region

Medicinal plant	Key informants (coded A to E)					Total score	Ranking
	A	B	C	D	E		
<i>Salvia officinalis</i> L.	1	2	1	2	2	8	1
<i>Helichrysum italicum</i> Roth.	2	1	3	1	3	10	2
<i>Satureja montana</i> L.	3	3	2	5	1	14	3
<i>Vitex agnus castus</i> L.	5	5	4	3	4	21	4
<i>Hypericum perforatum</i> L.	4	4	5	4	5	22	5

Each buyer has his own quality criteria which collectors must meet if they want to sell raw material (different quality – different prices). That is why buyers organize educational trainings for their collectors. Trainings are compulsory for buyers possessing organic certificate (there are several organic certifiers active in Bosnia and Herzegovina – IMO, KRAV, AIAB, Soil Association and national certifier Organska Kontrola, OK). Through demands from the organic certifiers producers became aware of the value of endangered and threatened plant species, and controlled and sustainable production. They have to keep the whole process of production well documented (certificate of origin, maps, purchase of raw material, etc.), have to have registered and trained collectors and are allowed to collect precisely determined annual quantities of raw material from certified region. Almost all interviewed buyers have attended educational courses organized by international organizations – GTZ, IMO/SIPPO, SEED, Association Zlatnica and USAID LAMP.

Usually buyers determine the prices themselves but very often they stated that it was the market that dictated the price. They do not negotiate about price with collectors (some said they were `making deals`). More than 70% stated they are satisfied with agreed price but all of them said they were able to sell everything they produced. In the same context is their observation that the number of buyers is permanently increasing since:

- people believe they could earn a lot of money in MAP sector,
- trend of traditional healing methods (on large scale) and
- high quality of domestic herbs.

All buyers were familiar with the term `sustainable usage of natural resources`, and they considered the following under it:

- Protection of natural resources,
- Secured regeneration of plant species for the future (in a way to leave certain percentage from collection which is enough to maintain population viable, education of collectors and collecting techniques etc.),
- Good Agricultural Practice and Good Wild crafting Practice (GAP and GWP) regarding collection, utilization, monitoring, control and education,
- Controlled exploitation of natural resources that include mapping of plant species and evaluation of existing resources.

Around 60% of buyers had noticed disappearance of native plant species due to over-harvesting (e.g. *Gentiana lutea*, *Adonis vernalis* and *Arnica montana*), inappropriate harvesting techniques, fires, habitat loss and land-use changes, lack of strategy for utilization of natural resources, lack of law implementation, high unemployment rate and difficult economic situation in the country. More than 85% of buyers are planning (or already perform) cultivation of some medicinal and aromatic plants (e.g. *Melissa officinalis*, *Calendula officinalis*, *Lavandula officinalis*, *Gentiana lutea*, *Mentha x piperita*, *Thymus vulgaris*, *Salvia officinalis*, *Helichrysum italicum*, *Nepeta cataria*, etc.) because of secured production. Around 75% of the interviewed buyers consider cultivation as a solution for a safe future!

The main risks buyers are facing in MAP sector are:

- Lack of initial finances and lack of favorable loans – 48%,
- Lack of State support – 45%,
- Too complicated export administration – 35%,
- Lack of equipment (drying facilities and other processing facilities) – 34%,
- Storage conditions – 34%,

- Difficulties in registration of herbal medicinal products – 20%,
- Price decrease (seasonal variations) – 11%,
- Quality maintenance of raw material – 10%.

Buyers consider the State should play a more active role in this sector. This could be achieved with incentive measures for production and cultivation, favorable loans, equipment (drying facilities, distillation units, etc.), granting, bringing legal acts, certification of collectors as a license for collection, concessions, to adopt a development strategy for MAP sector.

## Main threats to sustainable use of MAPs

### Direct exploitation and poverty

The main root cause is undoubtedly the **poverty of local people**. As already mentioned, collectors are usually poor and underprivileged group in society, and they therefore very often over-exploit the plant populations. Directly they cause the extinction of plant species in a way either down it to the last individual or down to such low number they are very likely of becoming extinct. Inappropriate harvesting techniques may cause the threat and damage to medicinal and aromatic plant species, where uprooting of the whole plant to use only aerial parts of the plant causes unnecessary depletion of population levels of the species and damage to the top-soil. Endemic and threatened plants such as *Gentiana lutea* and *Arctostaphylos uva-ursi* are among the most demanded by illegal purchasers, and people, driven by poverty, are collecting them in large quantities and with no heed to harvesting methods. Poverty drives people into the risk of getting caught for illegal sales. Illegal purchasers always offer a price only slightly higher than that guaranteed within legally registered enterprises. On the other hand, these legally registered enterprises do not have a convincing or inspecting power over outsiders.

However, what contributes to this difficult situation is the lack of enforcement capacity of the government inspectors. By law, non-timber forest products which include MAPs, fall under the jurisdiction of the ministries of agriculture in each entity. Each ministry has its forest inspectors, but their mandates are almost exclusively delineated by the boundaries of forests, i.e. these inspectors do not inspect open areas in between forest – this is where most of the MAPs are found in BiH. There is therefore an enforcement vacuum, of which illegal collectors are well aware, and are therefore taking the risk quite liberally.

Demand is driving the collection market. If no order is placed for a species from the purchasers, the plant will not be collected. The best way to place



orders is through organized collection check-points (in which case placing an order for a wild-grown endemic or endangered species is obviously ruled out as illegal). According to the President of North-Western MAP Association Zlatnica, collecting-points never accept limited quantities of endemic and no quantities of endangered species. Such organized collection checkpoints are very convenient for individual collectors as they are a stable source of demand, but they have only recently started to appear in some cantons, and associations need support to give them a boost all over the country, thus displacing (in a natural market way) *ad hoc* illegal sales.

### **Habitat loss, fragmentation and degradation**

As predicted from species-area relations, land use changes have brought about the loss of many species, and are the primary causes of species being listed as at high risk of extinction in the near future. Substantial land-use change is predicted to continue in the future, not simply as a consequence of direct human activities, but also as a consequence of anthropogenic global climate change. Many of the changes that humans are making to the landscape involve not simply the reduction of the areas of some vegetation types and the expansion of others, but also the fragmentation of vegetation (Gaston & Spicer, 2004.).

Erosion is another major concern. About 89% of the land is assumed to be endangered by erosion; 10% is heavily damaged by it (REC 2000).

Bosnia and Herzegovina is the country with the largest mine problem in the region. It is estimated that there are still around 1.000 000 of mines and UXO-s. So far 11.519 locations were defined with average microlocation size of 0,12 km<sup>2</sup>. Total suspected area is around 1889 km<sup>2</sup> - or approximately 3,68% of the territory and there are 1366 impacted communities 1,375,807 people or around one fourth of the estimated population (The Land Mine Impact Survey Report in Bosnia and Herzegovina 2003). Only a small portion of the mines and explosives has since been removed. Consequently, harvesting of wild MAPs is still a dangerous enterprise in many parts of BiH. About 47% of the ploughed land has been abandoned by 1997 and about 60% of the livestock kept in BiH did not survive the war. Minefields often prohibit work on the land, and many villages have been completely deserted by the former inhabitants (REC 2000). A re-development of agriculture is expected in the future, but it has a slow start.

### **Loss of genetic diversity**

Overexploitation of medicinal plant resources, which causes a clear reduction in population numbers and many even lead to the extinction of certain

populations, also result in a decline in genetic diversity. In areas with large number of MAPs occur this may lead to genetic erosion. The loss of genetic diversity in some species may cause enormous problems when attempts are made to cultivate them. These problems can be aggravated when growers try to optimize revenue or the active principles of these plants (through cultivation efforts extinction was prevented but the genetic variability has become very narrow) (Lange & Schippmann 1997).

### **Lack of knowledge**

Little research has been carried out to date on botanical drug species in Bosnia and Herzegovina. Most of them have not been investigated with regard to their chemical or pharmacological potential, or with regard to their population dynamics. There was no research on trade and consumption of the plant drugs concerned has been carried out. Bosnia and Herzegovina does not have an inventory of their botanical drug species, or even Red Book and Red List of protected plant species. An assessment of threat is therefore difficult to achieve. However, this information is essential to conservation efforts.

## **Conclusions**

Direct exploitation and poverty of local people become the main threat to sustainable use of MAPs including habitat loss, fragmentation and degradation, loss of genetic diversity and lack of knowledge. There will always be a certain share of people who do not consider MAP as their long-term business, but rather a short-term additional income-generation activity. In any case, these collectors have to comply with laws and corresponding regulations, but the problem is the availability of updated regulations and its implementation in the field.

Current harvesting levels for many MAP species are significantly below maximum sustainable levels, which can be the scope to increase the utilisation of these species. However, it is also evident that some species are being unsustainably utilised. Of the 227 MAP species in trade seven are endangered, 49 are vulnerable and eight are rare. While the resource assessment has identified 'at risk' species based upon the current market situation, it is important to note that the demand for a specific species can rise dramatically in a very short period of time, putting at risk, species which are currently considered to be safe (Donnelly and Helberg, 2003). Buyers especially export oriented might therefore increase their demand for raw material and thus put additional pressure on plant populations. This might increase the risk for unsustainable harvesting. Increased demand and the low prices that collectors get for collected herbs lead to over-exploitation in order to secure income for their households.

In any case the study shows that collectors with longer tradition in collection and longer personal experience are more likely to collect in more sustainable manner. However, in spite this, economical situation of the collector or different external influences might force collector to collect unsustainably. One of the possible solutions for the future is cultivation of some MAPs including conservation efforts, *in situ* and *ex situ*, and more State involvement in this issue. In the case of plant species that are critically endangered through overexploitation this is certainly the only method to stop their decline and thus secure their long term survival. But cultivation of plant sources will not be possible and/or economically feasible in every case. This is due to the lack of knowledge concerning efficient species-specific cultivation techniques. Therefore, the collecting of many of these species from the wild will certainly continue to play a significant role.

There will be a need in the future to harvest MAPs from the wild to satisfy the market demand, adequate control and conservation measures must therefore be taken to safeguard a species as well as the future market supply. Such measures must be highly species-specific and will require a profound knowledge of the species concerned and of its degree of threat (Lange & Schippmann, 1997). At the present, it is possible to design and carry out effective resource management plans for a very limited number of species.

Moreover, in the Balkan region including Bosnia and Herzegovina is running a SEEDNet project (South East European Development Network on Plant Genetic Resources) with aim:

- to contribute to the establishment and strengthening of national programmes on PGR in order to secure the conservation of PGR in the region;
- to promote a sustainable utilization of PGR; and
- to strengthen collaboration, networking and linkages among various stakeholders at both national and regional levels.

Conservation projects have shown that sustainable use of wildlife will work as a conservation strategy only if people convert unsustainable uses to more sustainable uses. This means reducing harvests of species that are overused, with people facing short-term economic costs. Over the long term, people gain economically if they use wildlife more sustainably because the benefits of use continue. For a functioning natural conservation strategy it is important that the local people are gaining from the conserved and sustainably used biological diversity. Otherwise the local people will not have any incentives for supporting the natural conservation activities. Rural development involves increasing the well-being and economic status of poverty-stricken rural people.

Rural development has a mandate to improve the livelihoods of local people, usually through income generation.

Due to lack of basic trader and resource base data, such as the exact number of local traders and sustainable harvest rates for key species, the national level trade findings are evaluated to be conservative estimates and it is not possible to assess the sustainability of current harvest levels. There is a need for investigating and ensuring that harvest rates are sustainable, that legislation and policies are supportive and that consideration of medicinal and aromatic plant harvesting is integrated into development initiatives. Traditional knowledge and traditional survival strategies should be adequately valued. In many cases, traditional methods of utilization of natural resources are regarded as sustainable, where demands of the population have not exceeded the resilience of the surrounding environment. The greatest challenge in the new millennium is to integrate the traditional knowledge with market needs to decelerate the pace of biodiversity loss and environmental degradation.

### **The ideal scheme for plant harvest**

Conservation of wild MAP populations and of their inherent genetic diversity will require systems of controlled harvesting. Any intended use of a species requires an effective management system and legal framework based on scientific information. There must be a balance between the interests in harvesting and marketing of these resources and the need for their long-term conservation.

For plant species used as sources of drugs, the resource management plan must address the following aspects of plant ecology and use (Lange & Schippmann, 1997):

- (1) Assessment of threat according to experts` experience and literature (global/regional)
- (2) Field research: collection of population data
- (3) Investigation of data on the biology of the species: distribution, life form, habitat requirements, plant community aspect, growth rates, reproductive biology, breeding system
- (4) Review of national regulations for the utilization
- (5) Extent of wild-harvesting versus cultivation
- (6) Review of volume of plant material harvested/ traded
- (7) Establishment of a management scheme: annual harvesting quotas, seasonal restrictions, regional restrictions, restrictions to certain plant parts or size classes, cultivation projects
- (8) Installation of a continuing monitoring and re-evaluation scheme
- (9) Raising public awareness.

## **Acknowledgements**

The author wishes to thank to supervisor Håkan Tunon for his guidance, fruitful advice and most important the patience during the creation of this work. Many thanks to the key informants and all the persons who let me interview them. A nod of gratitude to Swedish Biodiversity Centre and SEEDNet project for enabling this course! Very special thanks to the Faculty of Agriculture, University of Banja Luka with Professor Gordana Djuric ahead. Finally, thanks to my colleagues and friends I gained here for making this course unforgettable!

## References

- Bajaj, Y.P.S. (ed.), 1998. *The Conservation of Medicinal Plants*, Cambridge; Cambridge University Press
- Bosnia and Herzegovina Mine Action Centre, 2003. *The Land Mine Impact Survey – Bosnia and Herzegovina*, Sarajevo
- Costanza, R. and Patten, B.C. 1995, *Defining and Predicting Sustainability*, Ecological Economics 15: 193 – 196.
- The Crucible II Group, 2000. *Seeding Solutions (Volume 1. Policy Options for Genetic Resources: People, Plants and Patent Revisited)*, Canadian Cataloguing in Publication Data, Copublished by the International Development Research Centre, the International Plant Genetic Resource Institute and the Dag Hammarskjöld Foundation, Italy
- Devetak, Z. 2001. *Tradicionalno i sadašnje branje ljekovitog i aromatičnog bilja u Bosni i Hercegovini - Završni izvještaj*. GTZ, Sarajevo, Bosnia and Herzegovina
- Donnelly, R. and Helberg, U. 2003, *Inicijativa za herbalni razvoj na Balkanu – Fazza 1*, Finalni sažetak izvještaja – Bosna i Hercegovina, Dodatak 1, IFC/SEED, Sarajevo, Bosnia and Herzegovina
- Duerbeck, K. 1999; *Fact Finding Report*, GTZ, Germany
- Duerbeck, K. 2002; *Agricultural Sector Support, BiH, Final Report*, GTZ, Germany
- Gaston, K. J. and Spicer, J. I. 2004. *Biodiversity: An Introduction* (Second edition). Blackwell Publishing, London
- Groombridge, (ed.), 1992. *Global Biodiversity – Status of the Earth's Living Resources*. Chapman & Hall: London, Glasgow and New York
- Institute for Medicinal Plant Research “Dr. Josif Pančić”, 2001. VII Meeting “Days of Medicinal Plants”, *Book of Abstracts*, Belgrade, , Serbia
- Kathe,W., Honnef,S. & Heym,A. 2002. *Use of Medicinal and Aromatic Plants (MAPs) in Albania, Bosnia-Herzegovina, Bulgaria, Croatia and Romania* (A study about collection and trade of medicinal and aromatic plants and related legal regulations with special consideration of protected areas), Germany
- Lange, D. and Schippmann, U. 1997. *Trade Survey of Medicinal Plants in Germany* (A contribution to International Plant Species Conservation), Bundesamt für Naturschutz (German Federal Agency for Nature Conservation), Germany
- Lange,D. 1998. *Europe's Medicinal and Aromatic plants: Their Use, Trade and Conservation*. TRAFFIC International, United Kingdom
- Okiljević V. et al., 1997. *Poljoprivredna zemljišta RS, osnovni resurs u proizvodnji hrane*, Agroznanje, Banjaluka, Bosnia and Herzegovina
- Pećanac,D. 2005. *Stanje i perspektiva sakupljanja i plantažiranja ljekovitog bilja u Bosni i Hercegovini*, Faculty of Agriculture Banja Luka, Bosnia and Herzegovina

- Pećanac, D. 2004. *Medicinal Plant Conservation*, Newsletter of the Medicinal Plant Specialist Group of the IUCN Species Survival Commission, Volume 9/10, Bundesamt für Naturschutz, Germany
- Regionalni centar za okoliš za Centralnu i Istočnu Evropu (REC) 2000; *Izvještaj za Bosnu i Hercegovinu u okviru strateške okolišne analize za Albaniju, Bosnu i Hercegovinu, Kosovo i Makedoniju*; REC office for Bosnia and Herzegovina, Sarajevo and Banjaluka, Bosnia and Herzegovina
- UNDP 1998; *Izvještaj o razvoju ljudskih resursa*; UNDP, Sarajevo, Bosnia and Herzegovina
- World Wildlife Fund (nd); *Fact sheet 1: Towards Sustainable Herbal Medicine*

## Appendix 1. BiH MAP species status (Donnelly, R. and Helberg, U. 2003)

No	Species	Status			Quantity in trade			At Risk	Cites listed
		Rare	Vulnerable	Endangered	Most important	Important	In trade		
1	<i>Abies alba</i> Mill.		X			X		X	
2	<i>Achillea millefolium</i> L.				X				
3	<i>Aconitum toxicum</i> G. Beck								
4	<i>Acorus calamus</i> L.	X					X	X	
5	<i>Adiantum capillus veneris</i> L.	X					X	X	
6	<i>Adonis vernalis</i>			X			X	X	X
7	<i>Aesculus hippocastanum</i> L.					X			
8	<i>Agrimonia eupatoria</i> L.						X		
9	<i>Agropyrum repens</i> (L.) Beauv.						X		
10	<i>Ajuga reptans</i> L.						X		
11	<i>Alchemilla vulgaris</i> L.						X		
12	<i>Allium ursinum</i> L.		X				X	X	
13	<i>Althaea officinalis</i> L.		X			X		X	
14	<i>Anacamptis pyramidalis</i> (L.) Rich.								
15	<i>Angelica archangelica</i> L.		X			X		X	
16	<i>Antennaria dioica</i> (L.) Gaertn.						X		
17	<i>Anthyllis vulneraria</i> L.						X		
18	<i>Arctium lappa</i> L.					X			
19	<i>Arctostaphylos uva ursi</i> (L.) Spreng.			X	X			X	
20	<i>Arnica montana</i> L.		X			X		X	
21	<i>Artemisia absinthium</i> L.		X				X	X	
22	<i>Artemisia vulgaris</i> L.		X				X	X	
23	<i>Asarum europaeum</i> L.		X				X	X	
24	<i>Asperula odorata</i> L.						X		
25	<i>Atropa belladonna</i> L.		X			X		X	
26	<i>Ballota nigra</i> L.								
27	<i>Berberis vulgaris</i> L.	X				X		X	
28	<i>Betula pendula</i> Roth.				X				
29	<i>Borago officinalis</i>						X		
30	<i>Bidens tripartita</i> L.						X		
31	<i>Calamintha officinalis</i> Moench.						X		
32	<i>Calendula officinalis</i> L.					X			
33	<i>Caluna vulgaris</i> (L.) Hull.					X			
34	<i>Capsella bursa-pastoris</i> (L.) Med.					X			
35	<i>Carlina acaulis</i> L.						X		
36	<i>Carum carvi</i> L.					X			
37	<i>Castanea sativa</i> Mill.		X		X			X	
38	<i>Centaurea cyanus</i> L.						X		
39	<i>Centaureum umbellatum</i> Gilib.					X			
40	<i>Cetraria islandica</i> Achr.		X		X			X	
41	<i>Chamaenerion angustifolium</i> (L.) Scop.						X		
42	<i>Chelidonium majus</i> L.		X				X	X	
43	<i>Cichorium intybus</i> L.					X			
44	<i>Cnicus benedictus</i> L.			X			X	X	



No	Species	Status			Quantity in trade			At Risk	Cites listed
		Rare	Vulnerable	Endangered	Most important	Important	In trade		
45	<i>Colchicum autumnale</i> L.		X				X	X	
46	<i>Conium maculatum</i> L.								
47	<i>Convallaria majalis</i> L.		X			X		X	
48	<i>Cornus mas</i> L.		X			X		X	
49	<i>Corydalis cava</i> (L.) Schweigg. & Koerte						X		
50	<i>Corylus avellana</i> L.						X		
51	<i>Cotinus coggygria</i> Scop.								
52	<i>Crataegus monogyna</i> Jacq.		X		X			X	
53	<i>Crataegus oxycantha</i> L.		X		X			X	
54	<i>Crocus sativus</i> L.		X				X	X	
55	<i>Cyclamen purpurascens</i> Miller		X			X		X	
56	<i>Cynoglossum officinale</i> L.						X		
57	<i>Datura stramonium</i> L.						X		
58	<i>Daucus carota</i> L.					X			
59	<i>Digitalis ambigua</i> Murr.						X		
60	<i>Digitalis feruginea</i> L.						X		
61	<i>Digitalis lanata</i> Ehrh.						X		
62	<i>Dryopteris filix-mas</i> (L.) Schott.						X		
63	<i>Drosera rotundifolia</i> L.			X			X	X	
64	<i>Equisetum arvense</i> L.					X			
65	<i>Eryngium campestre</i> L.								
66	<i>Euphrasia officinale</i> L.					X			
67	<i>Fagus sylvatica</i> L.						X		
68	<i>Fagus ulmaria</i> (L.) Maxim.						X		
69	<i>Fragaria vesca</i> L.						X		
70	<i>Frangula alnus</i> Miller				X				
71	<i>Fraxinus excelsior</i> L.		X				X	X	
72	<i>Fraxinus ornus</i> L.						X		
73	<i>Fumaria officinalis</i> L.						X		
74	<i>Galega officinalis</i> L.						X		
75	<i>Galeopsis segetum</i> Necker						X		
76	<i>Gentiana asclepiadea</i> L.						X		
77	<i>Gentiana lutea</i> L.			X	X			X	
78	<i>Geranium macrorrhizum</i> L.						X		
79	<i>Geranium robertianum</i> L.						X		
80	<i>Geum urbanum</i> L.						X		
81	<i>Glechoma hederacea</i> L.						X		
82	<i>Gnaphalium uliginosum</i>						X		
83	<i>Glycyrrhiza glabra</i> L.						X		
84	<i>Gratiola officinalis</i> L.						X		
85	<i>Gymnadenia conopsea</i> (L.) R.						X		
86	<i>Hedera helix</i> L.					X			
87	<i>Helichrysum italicum</i> L.		X		X			X	
88	<i>Helleborus odorus</i> W. & K.						X		
89	<i>Hepatica nobilis</i> Mill.					X			
90	<i>Herniaria hirsuta</i> L.						X		

No	Species	Status			Quantity in trade			At Risk	Cites listed
		Rare	Vulnerable	Endangered	Most important	Important	In trade		
91	Hieracium pilosella L.						X		
92	Humulus lupulus L.						X		
93	Hyosciamus niger L.						X		
94	Hypericum perforatum L.						X		
95	Hyssopus officinalis L.		X			X		X	
96	Inula helenium L.					X			
97	Iris florentina L.		X				X	X	
98	Iris germanica L.		X				X	X	
99	Juglans regia L.		X			X		X	
100	Juniperus communis L.				X				
101	Juniperus oxycedrus L.						X		
102	Juniperus sabina L.						X		
103	Leonurus cardiaca L.						X		
104	Levisticum officinale Koch						X		
105	Lycopodium clavatum L.	X				X		X	
106	Lycopus europaeus L.		X				X	X	
107	Lysimachia vulgaris L.								
108	Lythrum salicaria L.		X				X	X	
109	Malva moschata L.						X		
110	Malva silvestris L.					X			
111	Marrubium vulgare L.						X		
112	Matricaria recutita L.					X			
113	Melilotus officinalis (L.) Pallas		X				X	X	
114	Melissa officinalis L.		X			X		X	
115	Mentha longifolia L.						X		
116	Mentha piperita L.					X			
117	Mentha pulegium L.						X		
118	Menyanthes trifoliata L.		X				X	X	
119	Micromeria thymifolia (Scop.) Fritsch.		X						
120	Morus alba L.						X		
121	Morus nigra L.						X		
122	Nasturtium officinale R. Br.					X			
123	Nepeta cataria L.						X		
124	Nigella sativa L.								
125	Numphar luteum (L.) Sm.						X		
126	Ononis spinosa L.					X			
127	Orchis morio L.	X				X		X	
128	Orchis simia L.						X		
129	Origanum vulgare L.		X			X		X	
130	Paeonia officinalis L.						X		
131	Palurus spina-christi Mill.						X		
132	Papaver rhoeas L.						X		
133	Pastinaca sativa L.						X		
134	Petasites hybridus (L.) G.M.Sch.		X				X	X	
135	Peuceadum oreoselinum (L.) Moench.						X		
136	Physalis alkekengi L.						X		

No	Species	Status			Quantity in trade			At Risk	Cites listed
		Rare	Vulnerable	Endangered	Most important	Important	In trade		
137	<i>Pimpinella saxifraga</i> L.					X			
138	<i>Pinus cheldreichii</i> Christ		X				X	X	
139	<i>Pinus mugo</i> Turra			X			X	X	
140	<i>Pinus nigra</i> Arnold		X				X	X	
141	<i>Pinus silvestris</i> L.		X			X		X	
142	<i>Platanthera bifolia</i> (L.) Rich.						X		
143	<i>Plantago lanceolata</i> L.		X		X			X	
144	<i>Plantago media</i> L.						X		
145	<i>Plantago major</i> L.						X		
146	<i>Polygonatum odoratum</i> (Mill) Druce						X		
147	<i>Polygonum aviculare</i> L.						X		
148	<i>Polygonum bistorta</i> L.						X		
149	<i>Polygonum hydropiper</i> L.						X		
150	<i>Populus nigra</i> L.		X				X	X	
151	<i>Populus tremula</i> L.		X				X	X	
152	<i>Potentilla erecta</i> (L.) Rauschel						X		
153	<i>Primula veris</i> Huds.	X				X		X	
154	<i>Primula officinalis</i> L.						X		
155	<i>Prunella vulgaris</i> L.						X		
156	<i>Prunus spinosa</i> L.					X			
157	<i>Pulmonaria officinalis</i> L.						X		
158	<i>Punica granatum</i> L.						X		
159	<i>Quercus cerris</i> L.						X		
160	<i>Quercus petraea</i> (Matt.) Liebl.						X		
161	<i>Quercus pubescens</i> Willd.		X				X	X	
162	<i>Quercus robur</i> L.		X			X		X	
163	<i>Reseda luteola</i> L.								
164	<i>Rhamnus catharticus</i> L.						X		
165	<i>Rhamnus fallax</i> Boiss.					X			
166	<i>Ribes grossularia</i> L.						X		
167	<i>Ribes multiflorum</i> Kit.						X		
168	<i>Rosa canina</i> L.				X				
169	<i>Rosmarinus officinalis</i> L.					X			
170	<i>Rubia peregrina</i> L.						X		
171	<i>Rubus idaeus</i> L.					X			
172	<i>Rubus fruticosus</i> Auct.					X			
173	<i>Rumex crispus</i> L.						X		
174	<i>Ruscus aculeatus</i> L.		X				X	X	
175	<i>Ruscus hypoglossum</i> L.		X				X	X	
176	<i>Ruta graveolens</i> L.	X					X	X	
177	<i>Salix alba</i> L.		X			X		X	
178	<i>Salix fragilis</i> L.		X				X	X	
179	<i>Salix purpurea</i> L.						X		
180	<i>Salvia officinalis</i> L.		X		X			X	
181	<i>Salvia pratensis</i> L.						X		
182	<i>Sambucus nigra</i> L.				X				

No	Species	Status			Quantity in trade			At Risk	Cites listed
		Rare	Vulnerable	Endangered	Most important	Important	In trade		
183	<i>Sanguisorba officinalis</i> L.						X		
184	<i>Sanicula europaea</i> L.								
185	<i>Saponaria officinalis</i> L.		X				X	X	
186	<i>Satureja montana</i> L.		X		X			X	
187	<i>Satureja subspicata</i> Vis.						X		
188	<i>Sedum acre</i> L.						X		
189	<i>Sempervivum heuffeli</i>						X		
190	<i>Sinapsis arvensis</i> L.						X		
191	<i>Sisymbrium officinale</i> (L.) Scop.								
192	<i>Solanum dulcamara</i> L.						X		
193	<i>Solanum nigrum</i> L.						X		
194	<i>Solidago virgaurea</i> L.						X		
195	<i>Sorbus torminalis</i> (L.) Crantz								
196	<i>Stachys officinalis</i> (L.) Trevis Betony						X		
197	<i>Symphytum officinale</i> L.						X		
198	<i>Tamus communis</i> L.						X		
199	<i>Tanacetum macrophyllum</i> (W.&K.) C.H. Schultz								
200	<i>Tanacetum vulgare</i> L.						X		
201	<i>Taraxacum officinale</i> Weber					X			
202	<i>Taxus baccata</i> L.			X			X	X	
203	<i>Telekia speciosa</i> (Schreb.) Baumg.								
204	<i>Teucrium arduini</i> L.						X		
205	<i>Teucrium chamaedrys</i> L.						X		
206	<i>Teucrium montanum</i> L.				X				
207	<i>Teucrium polium</i> L.						X		
208	<i>Teucrium scordium</i> L.						X		
209	<i>Thymus serpyllum</i> L.				X				
210	<i>Thymus</i> sp.						X		
211	<i>Tilia cordata</i> Miller				X				
212	<i>Tilia platiphyllus</i> Scop.				X				
213	<i>Tussilago farfara</i> L.					X			
214	<i>Urtica dioica</i> L.					X			
215	<i>Vaccinium myrtillus</i> L.				X				
216	<i>Vaccinium vitis idaea</i> L.	X				X		X	
217	<i>Valeriana officinalis</i> L.					X			
218	<i>Valeriana montana</i> L.		X				X	X	
219	<i>Veratrum album</i> L.		X			X		X	
220	<i>Verbascum phlomooides</i> L.						X		
221	<i>Verbascum thapsus</i> L.				X				
222	<i>Verbena officinalis</i> L.						X		
223	<i>Veronica officinalis</i> L.					X			
224	<i>Viburnum opulus</i> L.						X		
225	<i>Vinca minor</i> L.						X		
226	<i>Viola biflora</i>						X		
227	<i>Viola odorata</i> L.						X		

## Appendix 2. Questionnaire for collectors

International Master of Science in Biological Diversity

Swedish Biodiversity Centre CBM, Uppsala Sweden

NR: .....

1. Name:.....	2. Sex: <input type="checkbox"/> male, <input type="checkbox"/> female
3. Year of birth: .....	
4. Level of education: .....	
5. Village: .....	
6. Region: .....	
7. Occupation.....	

1. For how long you have been collecting MAPs?  before the war,  after the war,  recently.
2. How did you obtain knowledge about MAP?  passed from generation to generation,  self-education,  other.
3. For how long you have been living here? Where before?  domicile,  refugee,  returnee?
4. Do you consider it as economically perspective job?  yes,  no  
Please explain  
.....
5. How many different plants (species) do you collect?  
.....
6. Mention 10, economically, the most important plants?  
.....
7. Express the money, obtained from selling herbs, in percentage of your total income?  
.....
8. Would you do anything else, if you would have opportunity, instead collection?  yes  no

If yes, please explain why  
.....

9. Did you notice that some plant species are starting to disappear?  yes,  no

If yes, what do you think why and which?  
.....

10. What do you consider under the term *controlled usage* of natural resources?  
.....

11. Are you concerned in future you would have nothing to collect?  yes,  no

If yes, please explain why:  
.....

12. Do you recognize some changes in habitat?  
 appearance of new species,  disappearance of native species,  other

13. If there is no specific order from the buyer would you collect?  
.....

14. Who decides the quantity of collected herbs?  
.....

15. How do you decide what plant species you are going to collect?  
.....

16. During collection do you leave some species to recover or you collect everything you find?  
.....

17. Where do you collect?  state property,  private property

18. Do you go to other municipalities to collect herbs?  
.....

19. Did you notice collectors from other places to come and collect?  yes,  no

If yes, do you consider them as potential threat and why?  
.....

21. Do you get instructions from buyers how to collect?  
.....

22. Do you get instructions from buyers about quality of collected herbs?  
.....

23. What buyers require?  
.....

24. Have you ever heard of programme for education of collectors?  yes,  no  
If yes, did you attend such?  yes,  no  
Who organized it?  GTZ,  SEED,  USAID LAMP,  other.
25. Who determines the prices of raw material?  
.....
26. Do you negotiate the price with buyers / why?  
.....
27. Are you satisfied with the price?  
.....
28. Do you know the price before collecting season?  
.....
29. Do you collect for same buyer for many years or you sell to different buyers/traders?  
.....
30. Did you notice number of collectors to be increased or decreased and why?  
.....
31. What do you do after collecting season?  
.....  
.
32. How do you process raw material?  clean,  dry,  cut,  other.
33. What are the main risks you are exposed to during collection?  
.....
34. Are you planning to collect herbs in future / why?  
.....
35. What are the biggest problems you are faced with?  
.....
36. Do you plan to cultivate some plant species / why?  
.....
37. Do you think the State could help you / how?  
.....
38. Have you ever heard about term `sustainability`?  yes,  no  
If yes, what do you consider under it?  
.....

## Appendix 3. Questionnaire for buyers

International Master of Science in Biological Diversity

Swedish Biodiversity Centre CBM, Uppsala Sweden

2. Name:.....	Sex: <input type="checkbox"/> male, <input type="checkbox"/> female
3. Year of birth: .....	
4. Level of education: .....	
5. Place: .....	
6. Occupation.....	

3. How did you obtain knowledge about MAP?  passed from generation to generation,  self-education,  other.
4. How did you start to work in MAP field?  
.....
5. For how many years / Why?  
.....
6. Do you consider it as economically perspective job?  yes,  no  
Please explain  
.....
7. How many different plants (species) do you buy?  
.....
8. Mention 10, economically the most important plant species, for your enterprise?  
.....
8. Have you ever heard about term `sustainability`?  yes,  no  
If yes, what do you consider under it?  
.....
9. Did you notice that some plant species are starting to disappear?  yes,  no  
If yes, what do you think why and which?  
.....
10. What does it mean *sustainable and controlled usage* of natural resources in your opinion?  
.....



11. Are you concerned in future you would have nothing to buy?  yes,  no  
If yes, please explain why  
.....
12. Do you recognize some changes in habitat?  
 appearance of new species,  disappearance of native species,  other
13. Do you have problems in finding buyers for your products?  
.....
14. Where do you sell your products?  national market,  regional market,  international market,  combination.
14. How you decide the quantity of purchased herbs?  
.....
18. Did you notice collectors from other places to come and collect?  
.....
19. Do you consider them as potential threat / why?  
.....
20. Do you give instructions to collectors how to collect?  
.....
21. Do you give instructions about quality of collected herbs?  
.....
23. Did you organize programme for education of collectors?  yes,  no
24. Did you attend some educational programme?  yes,  no  
If yes, who organized it?  GTZ,  SEED,  USAID LAMP,  other.
23. Who determines the prices of raw material?  
.....
24. Do you negotiate the price with buyers / why?  
.....
25. Are you satisfied with the price?  
.....
26. Do you determine the price before collecting season?  
.....
27. Are you satisfied with price that you obtain for your products and why?  
.....
28. Are you able to sell everything / explain?  
.....

28. Did you notice number of buyers to be increased or decreased and why?  
.....
30. How do you process raw material?  clean,  dry,  cut,  production of essential oils,  other.
31. What are the main risks you are exposed in herb business?  
.....
32. Do you consider the future of herb business to be secured and why in future / why?  
.....
33. What are the biggest problems you are faced with?  
.....
34. Do you plan to cultivate some plant species / why?  
.....
35. Do you think the State could help you / how?  
.....

## **Appendix 4. The most often collected plant species (based on collectors' answers)**

<b>Plant species</b>	<b>Northern Bosnia</b>	<b>Herzegovina</b>
Achillea millefolium	x	x
Allium ursinum	x	
Arctostaphylos uva ursi	x	x
Artemisia absinthium	x	x
Articum lappa		x
Calamintha officinalis	x	x
Cornus mas	x	
Crataegus laevigata	x	
Crataegus monogyna	x	
Epilobium agustifolium	x	
Erythrea centaurium	x	
Gentiana lutea	x	x
Helichrysum italicum		x
Hypericum perforatum	x	x
Hyssopus officinalis		x
Juniperus communis	x	
Laurus nobilis		x
Mellisa officinalis	x	
Nepeta cataria	x	x
Orchis morio		x
Origanum vulgare		x
Rosa canina	x	
Salvia officinalis		x
Sambucus nigra	x	
Satureja montana		x
Taraxacum officinalis	x	x
Teucrium montanum		x
Thymus serpyllum	x	x
Tussilago farfara	x	x
Urtica dioica	x	x
Vitex agnus castus		x