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Dear readers,

With great pleasure we announce that SEEFOR Journal, from this year, has been included in CAB Abstracts database. For us this is a great recognition and also big obligation to continue with committed and dedicated work.

This issue comprises of six interesting scientific and professional papers covering different aspects of forestry which, we hope, will occupy your interest. Success of forest owner's organizations in North and Central Portugal and quantity of services which they provide are evaluated by Feliciano and Mendes. Savić et al. analyze competitiveness of Macedonian forest industry and factors that influences the creation and development of competitive advantages. Attitude towards hunting of the local population from two settlements of Skopje suburb is the topic of the paper written by Nikolovski et al. With research conducted by Nevenić et al. we continue to cover theme on conflicts in forestry sector started with Kiš in last issue. Nevenić et al. dealt with collision between forestry and environmental legislation; related institutions and organizations in the National Park ''Fruška gora''.

Another paper of Serbian researchers emphasizes the importance of forest monitoring upon which are presented some indicators of beech forests vitality. And last presented research is coming from production side of forest bringing conversion coefficients for distilling wood in running standards and everyday practice which has been investigated by researches from Banja Luka (Ljubojević et al).

Variety of presented research topics indicate wideness and complexity of forest science and profession, which together have big responsibility for conservation, sustainable management and development of forests as most valuable renewable natural resource. United Nations has also pointed out importance of forests declaring this year, at Croatia's proposal, as International Years of Forests. So we would like to add to the numerous different activities and discussion on the forests' importance dedicating this issue to the same goal.

Enjoy reading,

Dijana Vuletić, Editor-in-chief

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Forest Owners' Organizations in North and Central Portugal – Assessment of Success

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Background and purpose:
The emergence of forest owners' organizations (FOOs) in Portugal occurred in the 1990s. Fifteen years later there were 173 FOOs providing services to the private forest owners and also to the whole of society. This study aims to evaluate the success of FOOs in increasing their membership and the quantity of services provided.

Material and methods:
Eight FOOs from the North and Central Portugal were chosen as case studies. Quantitative data on membership numbers and number of services provided by the eight case studies were collected from the archives of FORESTIS or directly at the FOOs headquarters. Qualitative data from newsletters, annual reports, local newspapers and letters were also collected to be further analysed. Secondary data collected cover a period of substitute 10 years by 11 years (1994-2005). In addition, eight interviews to members of staff or FOOs directors were conducted in 2005. It was hypothesised that the number of members and the quantity of services provided may be interrelated and that the turnover of staff and their productivity influence the success of FOOs in increasing their membership and providing technical advice services.

Results and conclusion:
The study showed that although most FOOs were successful in making their membership grow, there were big differences in the number of members, in the forest area covered by them and in the quantity of services provided. It was concluded that human capital, financial capital and path dependence were the factors that most constrained the success FOOs in North and Central Portugal.

Keywords:
Forest owners' organizations, private forestry, success, membership

INTRODUCTION

In Portugal, where about 93.4 % of the forest is privately owned [1], forest owners' organizations (FOOs) only emerged at the beginning of the 1990s [2]. In 2005 there were 173 FOOs located all over the country and in a very different state of evolution. In other countries, such as Australia, Austria, Belgium, Canada, Finland, Sweden, Denmark, Germany, France, Japan, South Korea, Switzerland, Netherlands, United Kingdom, Ireland, New Zealand, Norway, Lithuania and Slovenia, more than 3.6 million forest owners are members of forest owners' organizations or cooperatives [3]. Small-scale forest owners can achieve similar benefits of large-scale forest owners if they are members of a FOO [3]. By joining together, non-industrial private forest owners (NIPF) can improve their bargaining power and have a say in the forest policy decision-making processes [4].

In some countries there is a long tradition of forest owners' organizations and in others forest owners' organizations are a recent phenomena. For example, in Finland and Norway, FOOs date from the beginning of the 20th century whereas in Portugal and Slovakia they date from the end of the 20th century [2-5]. In Serbia and Croatia they were only established in the new millennium. The differences in the year of implementation of FOOs in each country cause differences in their stage of development. In addition, there

are also several organizational models according to the different political, natural and cultural contexts of each country. For example, in Norway, the main objective was the marketing of wood, but nowadays increased attention is been given to sustainable forest management [2-5]. Other examples of common marketing of wood for FOOs members are Central and Eastern European countries such as Slovakia [6]. In Finland, Slovenia and Canada, FOOs own machinery rings that allow forest owners to share equipment for forest works and construction of roads [3]. In Portugal, FOOs started by giving support to forest owners in writing up the applications for incentive systems to forest investment and by providing services in order to reduce the risk of forest fires [7]. In Romania, FOOs are still dealing with the issues associated to land restitution characterised by a gradual increase of the private forest ownership after the communist regime [5].

Traditionally, FOOs were area-based entities dealing with support to private forestry in specific tracts of land. Historically, many FOOs were closely affiliated to farmer federations. In the present, however, some new challenges are emerging throughout Europe rural out-migration of forest owners, leading to absenteeism, the ageing of active forest owners and the decline of active management by forest owners [12]. Those who inherit forest holdings often live at a distance from them. The historic local stewardship of forests for subsistence or market needs is declining in many countries. Active management has not been helped by low timber prices. FOOs have had to address these challenges and the successful ones are doing so.

This paper aims to examine, for the first time, the differences in the number of members and in the quantity of services provided to the members of FOOs located in North and Central Portugal. It also aims to examine the main constraints facing these FOOs to increase their membership and the quantity of services provided. It was considered that the number of members and services provided to their members over the years are indicators of FOOs' success in achieving their mission of organizing the collective action of private forest owners in North and Central Portugal. According to Mendes et al [8], private forest owners contribute to sustainable forest management when they become collectively organized through the setting up of organizations that support the cooperation among themselves and represent and protect their common interests in their interactions with other stakeholders.

It was hypothesized that the number of members and the quantity of services provided may be interrelated and that the turnover of staff and their productivity are important to increase the membership of FOOs and the quantity of services provided.

THE ORGANIZATION OF PRIVATE FOREST OWNERS IN PORTUGAL

In 1986, with the entry of Portugal into the European Union, private forest owners benefited from a set of programmes and financial incentives for afforestation, reforestation and improvement of existing forest stands [1-9]. The first programme was the Forest Action Plan (PAF in Portuguese initials) which run from 1986/87 to 1996, and subsequently the Forest Development Programme (PDF in Portuguese initials) which run from 1994 to 1999. In the first programme, there was funding to set up a forest extension service which could support the establishment of FOOs, but this action was not implemented [5].

Because of the increasing demand for technical assistance by the NIPF owners driven by the existence of such programmes and the inexistence of a forest extension service capable of responding to this demand, FOOs started to emerge, mostly in the North and Central Portugal where small scale forestry prevails. The growing risk of forest fires which is relatively more severe in those regions also made forest owners increasingly aware of the benefits of collective action [1-10].

In North and Central Portugal a major initial step for the establishment of FOOs was the creation of FORESTIS (initially named "Forest Association of the North and Centre of Portugal" and now called "Forest Association of Portugal") in 1992. The main original mission of FORESTIS was to support the creation of local FOOs mostly in the small scale forestry regions of North and Central Portugal. This organization was relatively successful in accomplishing this mission, so that it gradually moved more to a position of becoming a federation of local FOOs representing their interests at the national and international levels. By 2005, from the 173 organizations registered as FOOs by the State Forest Services, 27 of them were represented by FORESTIS. It should be mentioned that some of the existing organizations have not much more than a nominal existence, or are mostly agricultural organizations without a strong engagement in forestry.

THEORETICAL FRAMEWORK

In Europe, there are several organizational models for FOOs emanating from different political, natural and cultural contexts [2-5]. The socio-economic context surrounding FOOs determines the objectives and the type of services provided [11]. In Norway, for example, the main objective is the marketing of timber, in Portugal it is to provide technical advice and services aiming at the reduction of the risk of forest fires and in Finland, Slovenia and Canada, FOOs own

equipment and machinery rings [5]. Torrijos et al [12] state several advantages of FOOs, namely to promote action among small-scale owners, to improve the profitability of non-industrial private forestry, to pro-motion forest multi-functional uses and to promote a sustainable use of forest resources. In economic terms, the range of services provided by FOOs falls in the following categories [2]:

Private services: e.g. technical advice, harvesting, or marketing services provided to each individual mem-ber;

Club goods: e.g. the implementation of a forest cer-tification scheme;

Public goods: e.g. the contribution to the reduction of the risk of forest fires or to the increase in the provi-sion of positive forest externalities such as landscape quality, climate regulation or recreation.

According to Olson's "selective incentives" theory [13], the voluntary contribution to the provision of public goods by joining an organization delivering that kind of goods is stimulated by the joint produc-tion of these goods with private goods or services benefiting the individual members who decide to join in. Since the main purpose of an organization (FOOs and others) is to further the interests of their members, and if the success of an organization is de-scribed as the capacity to achieve its objectives [14], a FOO is successful if it is capable of organizing collec-tively the forest owners with land within its boundar-ies. In this study, the delivery of an increasing volume of forest services and the increase in the number of members were considered as indicators of the FOO ability to organize collectively the forest owners and to contribute the sustainable forest management of the region were it is implemented.

Following a similar approach to the one proposed by Mendes [2], the supporting and impeding fac-tors to FOOs success can be identified by looking at this kind of organization as structured in terms of principal-agent relationships. That is, relation-ships between a principal, who delegates or hires an agent to perform a work [15]. In the case of FOOs, these relationships occur between the members of the board of directors and the FOOs' staff and be-tween the members of the FOOs and the FOOs themselves, represented by their staff and directors. This study focus on the relationships between the FOOs and the private forest owners who joined in by assuming that the staff and directors embodied the societal goal of promoting the collective action of those owners. The FOOs were, therefore, considered to be the principal and the forest owners the agents.

To increase the number of members and of services provided, the principal faces the following types of constraints:

a) *Feasibility constraints:* to get more members and to increase the quantity of services provided to the members, FOOs depend on the availability of human, physical, financial, and social capital.

Human capital: The human capital embodied in the staff and members of the board is crucial for the per-formance of the organization. The accumulation of that human capital comes not only from their educa-tional background and experience exogenous to the organization, but also from the experience of work-ing in the organization [16]. Given the nature of the services provided by FOOs where the knowledge of local conditions and specific characteristics of local forest owners matter, organization-specific human capital accumulation is very important for the perfor-mance of an organization.

Physical capital: Even though the quality of human capital is of crucial importance, appropriate office space and office equipment, vehicles and other physi-cal capital are also needed for the activities of FOOs at least at a minimum level of supply below which the organization cannot work.

Financial capital: In Portugal, FOOs were set up with very insufficient equity to provide for the finan-cial needs of their operations where a great deal of services are of a public goods nature, or are private services provided to forest owners at prices below average production costs. To survive, FOOs apply to public financial incentives to forestry and other activi-ties where they may fit. This usually involves substan-tial transaction costs in terms of the time and other efforts needed to prepare and do the follow up of the applications. Also, when applications are approved for funding often there are long delays between the time the money is spent by the FOOs and the time the reimbursement by the incentive scheme is paid.

Social capital: Social capital in the sense defined by Coleman [17] can be accumulated through ex-ternal networks (outward looking) and internal net-works (inward looking), according to the terminology proposed by Putnam [18]. In the case of the staff working for the FOOs, the internal networks are the relationships connecting them to their members. The external networks are the connections of the organi-zation with other organizations (other FOOs, munici-palities, Forest Services, other public agencies, forest contractors, forest industries, research institutions, etc.). When these relationships have a cooperative nature they may have an important role in the devel-opment of the organization.

Characteristics of the socio-economic and environ-mental context: The socio-economic and environmental context in which the FOO operates is a conditioning fac-

tor of the availability of resources and the easiness with which the organization accomplishes its activities [14].

b) Individual rationality constraints: Without selective incentives to motivate participation, collective action is unlikely to occur even when large groups of people with common interests exist [13]. Membership to a FOO is a voluntary action, thus, to become members of a FOO the services that members get from this organization have to make them better off. The provision of these services has to be designed, therefore, in order to meet this constraint of members' welfare improvement and consequently, to contribute to the FOO development.

c) Incentive compatibility constraints: There are asymmetric information problems of various types in the functioning of FOOs. Moral hazard and adverse selection problems may exist in the relationships between the organization and its members when the staff does not have perfect information about the members' actions or characteristics which are relevant for their deals with the organization [19]. This is likely to happen in a country without cadastre for most of its forest land. To cope with these problems a FOO has to be managed by providing appropriate (positive and negative) incentives the forest owners to behave in a way that is compatible with the development of the organization.

d) *Path dependence:* Since we are dealing here with the history of human organizations, it is possible that the conditions (economic, social, cultural, political) prevailing at the moment when they got started may have an influence in the subsequent stages of their development [20].

MATERIALS AND METHODS

To assess of the success of Portuguese FOOs in increasing the number of members and the quantity of services provided to their members a case study approach was followed. The case study approach is appropriate when the research questions are of the types "how" and "why" and the researcher does not have much control over the events which are currently evolving within their real context [21]. In addition, with no quantitative database available about the structure and operations of FOOs in Portugal, it was not feasible to collect quantitative data about all the existing FOOs and in a complete way for each of them. As it will be seen, there are many missing values in the quantitative data reported in the next section and, therefore, there will be no attempt to estimate quantitative models.

By taking the cases of the FOOs which was possible to observe in the time frame of this study, the main purpose here is not so much to examine the empirical validity of a theoretical hypothesis, but to specify for those cases the theoretical framework proposed in the previous section, still as an hypothetical explanation for the evolution and success of those organizations. The case studies correspond to eight FOOs affiliated with FORESTIS, the most representative federation of FOOs for small-scale forestry in Portugal. As it was said in a previous section, this type of forestry and the strongholds of FORESTIS correspond to North and Central Portugal. Some of the eight FOOs chosen for this project are the oldest ones among those affiliated with FORESTIS. The group of FOOs was chosen in order to cover a representation of the various sub-regions of North and Central Portugal, different years of implementation, different environmental and social contexts and different management strategies.

The eight FOOs chosen were:

- *AFEDV:* Associação Florestal de Entre Douro e Vouga,
- *AFL:* Associação Florestal do Lima,
- *AFLODOUNORTE:* Associação Florestal do Douro Norte,
- *AFVS:* Associação Florestal do Vale do Sousa,
- *APFLOR:* Associação dos Produtores Florestais de Pedrógão Grande,
- *SFATB:* Secção Florestal do Alto Tâmega e Barroso-Cooperativa Agrícola de Boticas,
- *PORTUCALEA:* Associação Florestal do Grande Porto,
- *URZE:* Associação Florestal da Serra da Estrela.

There were two stages of data collection. Firstly, quantitative and qualitative data was collected from the archives of FORESTIS. The sources of data included annual reports of FOOs activities, FOOs newsletters, financial reports, correspondence exchanged between FORESTIS and FOOs staff and news on forest issues published in local newsletters. Secondly, eight interviews were undertaken with staff members and, in some cases, with the members of the board of directors. At this stage, additional sources data not available at FORESTIS archives were provided by the staff and directors interviewed.

Data collected includes quantitative data on the evolution of membership numbers and of quantity of services provided by each case-study over the years as well as the total forest area owned by the members of each FOO. It also includes qualitative and quantitative data that was used as indicators of the constraints facing by the FOOs (principal) to increase the number of members and the quantity of services provided, and qualitative information on whether the FOOs members (agents) take into account the technical advice given by the staff or not. The constraints to the increase of membership numbers and quantity of

services provided are feasibility constraints, individual compatibility constraints, incentive compatibility constraints and path dependence. To each constraint the following indicators were chosen:

a) Feasibility constraints:
- Human capital: Number of staff members, training sessions attended by the members of staff, staff's turnover, staff's high education background;
- Physical capital: Availability of basic material needed to provide services of technical advice to the members (e.g. office, phone, internet access, ArcGIS software;);
- Social capital: Existence or not of external networks with other entities such as municipalities, other FOOs, regional Forest Services, pulp and paper industries;
- Characteristics of the socio-economic and environmental context: Data for this section is mainly qualitative and it was provided by the people interviewed. It covers information on the absenteeism or active management of forest owners in region, infrastructures such as forest roads, payment of membership fees, participation of forest owners in FOOs activities (e.g. meetings, seminars), predominant forest management systems and tree species existing in the region.

b) *Individual rationality constraints*: The ratio between the number of technical advice meetings and the number of members of each FOO was the data used to examine these constraints. Meetings for technical advice happen between the forest owners who are members of the FOOs and the FOOs staff. The objective of these meetings is the provision of advice on forest management practices, forest policies or other forest-related issues. When the ratio between the number of meetings to provide technical advice services and the number of members is higher than one, it means than on average, the FOOs members asked for advice to the staff more than once. This was considered an indicator of the members satisfaction for the services provided by the FOOs' staff.

c) *Incentive compatibility constraints*: The evidence of incentive compatibility constraints came from the interviews undertaken with the staff or board of directors. The question that gathered information on this type of constraint was: How do the FOO members take into consideration the advice given by the members of staff on forest management practices? Additional information published in the annual activity reports was also taken into account.

d) *Path dependence*: Data on path dependence was collected by interview. It was asked to the directors and members of staff if any decision taken in the period of implementation its FOOs determined its subsequent trajectory.

RESULTS

A comparative study aimed at identifying the relevant differences in the evolution of the number of members and quantity of services provided in each case study was undertaken. It was not possible to compare all indicators of success for all FOOs because of limited data availability.

Number of members and quantity of the services provided

The evolution in the number of members is presented in Figure 1. The general trend is positive, i.e., there is an increase in membership over the years. There are differences, however, in the individual trend for each FOO which deserve further analysis. Some interesting differences can be noticed:

- AFVS and AFL initiated their activity in the same year (1994), but AFVS had much more members in 2005 than AFL. This difference is disproportionate with respect to the differences in the number of forest owners in the areas of the two FOOs. The same remark can be made about AFLODOUNORTE and PORTUCALEA, both started in 1997 and with a big difference in the number of members in 2005;
- A rapid increase in the membership of AFLODOU-RONORTE, APFLOR and URZE between 2000 and 2005.
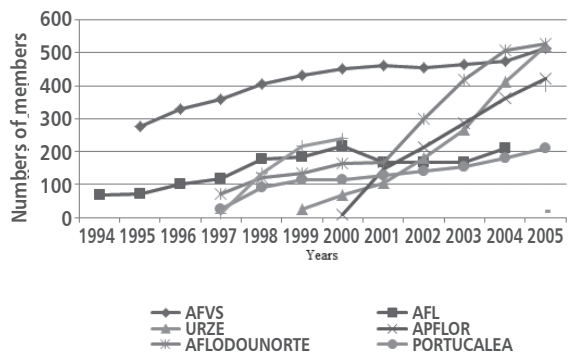
FIGURE 1
Evolution of the number of members in each FOO between 1994 and 2005

The total forest land owned by the members of each FOO is presented in Figure 2. AFVS stands out as by having reached the highest value for this indicator with all the others far behind. This means that for those with high rates of growth in the last part of the period covered by this data collection (AFLODOU-RONORTE, APFLOR, URZE), there was a large room for recruiting new members since the initial number of members was very small. The more intriguing cases are those (PORTUCALEA, AFL) where there has been a
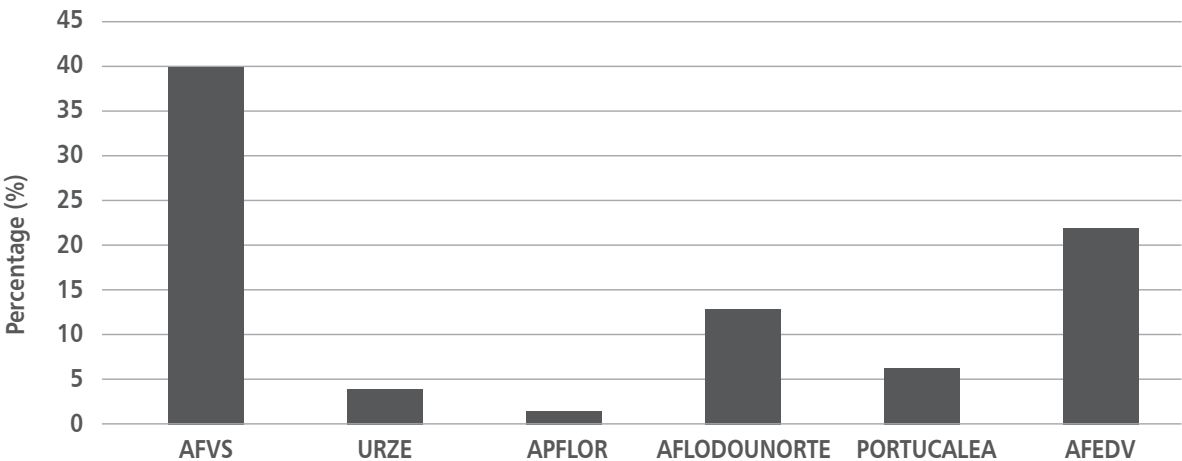
FIGURE 2
Percentage of forest area owned by the members of each FOO as a proportion of the total forest area in the territory of each FOO in 2005 (data not available for AFL and SFATB)

slower growth in membership, in spite of a relatively large potential for recruiting new members.

Concerning the volume of services provided to the members (Table 1), data available was very scarce and it was only possible to collect information for a very small number of FOOs (AFVS, AFL, PORTUCALEA). Data covers the number of meetings between the staff and the FOOs' members to provide them technical advice on forest management, clarification on forest policies or any other forest-related issues.

Considering now the ratio of the number of encounters between the staff and the members with respect to the total number of members of each FOO (Figure 3), AFVS stands out very clearly for its fast increasing trends whereas AFL and PORTUCALEA have declining or stagnating ratios. For example, in 2005, each member of AFVS met, on average, a staff member nine times to ask for technical advice. In the cases of AFL and PORTUCALEA, the ratio is less than one which means that, on average, there were members that did not meet a member of staff to ask for technical advice even once.

It is also reported the ratio between the number of members of staff and the number of meetings for technical advice recorded in AFVS and PORTUCALEA (Figure 4). It can be noticed the big disparity exist-

ing when these two FOOs are compared. In 2005, in AFVS, each member of staff participated, on average, in about 1000 meetings with the FOO's members while in PORTUCALEA the number of meetings between the members of staff and the FOO's members was very low.

It is now compared the indicators of the constraints faced by FOOs in North and Central Portugal to increase their membership and the number of services provided. These indicators were mentioned previously in the methodological section.

a) Feasibility constraints

Human capital
AFVS was the FOO with the highest capacity to provide technical advice services (Figure 3 and 4) and also the one with greatest increase in the number of members over the years (Figure 1). It should be noticed that in 2005, AFVS had only one member of staff more than PORTUCALEA (five against four). As the services provided by the FOOs in North and Central Portugal are similar, this may indicate that AFVS' staff was more able to recruit new members and to provide them technical advice services than the PORTUCALEA's staff. Another hypothesis is that the AFVS' staff is better managed than the PORTUCALEA's staff.

TABLE 1
Number of technical advice meetings in each FOO

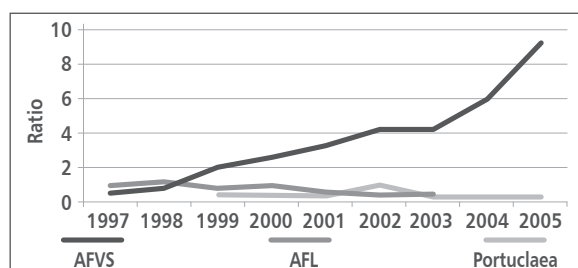|	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
AFVS		173	365	866	1194	1535	1906	2006	2841	4776
AFL		93	126	149	175	140	85	63	93	126
PORTUCALEA				25	30	25	115	52	59	63

FIGURE 3
Ratio between the number of technical advice meetings and the number of members
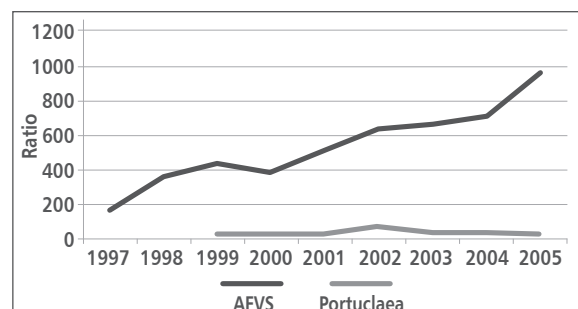

FIGURE 4
Ratio between the number of technical advice meetings and the number of staff members in AFVS and PORTUCALEA

Another indicator related to human capital is the turnover of staff. It is considered that a higher turnover of the members of staff corresponds to less human capital accumulated within the organization over the years. AFVS, URZE and AFLODOUNORTE were the organizations with the lowest turnover in its technical staff and PORTUCALEA and AFL the organizations with the highest turnover.

In terms of high education background of the staff, no significant differences were found between the FOOs studied. Some differences were found, however, in the number of training courses or seminars attended by the staff after being hired by the FOOs. AFL and AFEDV were not very enthusiastic in supporting their staff to attend this kind of training. AFVS, SFABT and PORTUCALEA showed great support to their staff in attending training sessions.

Physical capital
There were no significant differences in physical capital endowment between the eight FOOs studied. This physical capital usually consisted in an office that was usually rented or provided free of charge by local authorities, some office equipment, telephone and internet, tools for forest works, and pick up trucks.

Financial capital
This factor was mentioned in the interviews as having a very important influence on the success of FOOs. This may have happened because FOOs started with an amount of permanent capital very insufficient to make them at ease in terms of providing for the short term needs of their operations. By far, the major source of funds of all of them in this initial stage of their lives was what they could get by applying to financial public incentive programmes co-funded by the European Union, or simply national. Usually these programmes did not provide any cash advance, so the FOOs first had to implement and pay the actions supported by these programmes in advance and get partially reimbursed afterwards. Often there were long delays between the moment of spending the money and the moment of being reimbursed causing difficulties to FOOs to pay the staff wages and other expenses on time. This was pointed out as a factor of high staff turnover and a constraint to the recruitment of new members because the members of staff were busy trying to apply for new funding or simply trying to get a faster reimbursement of the money previously spent.

There are differences between the FOOs observed in terms of their degree of autonomy concerning public funding (Table 2). The FOOs which were less dependent of public funding, i.e., with higher percentage of

TABLE 2
Financial indicators

	AFVS	AFL	URZE	APFLOR	AFLODOUNORTE	SFATB	PORTU-CALEA	AFEDV
Net income over the years (% of total revenues)	[15-62]	[4-55]	[13-29]	[27-58]	[2-25]	n.a.	[13-26]	[5-28]
Time period	1995-2005	1995-2003	2002-2005	2000-2003	1999-2004	n.a..	1998-2005	1998-2001
No of years with net income <0	1	3	0	1	1	n.a.	1	4
Time period	1995-2005	1995-2003	2002-2005	2000-2003	1998-2001	n.a.	1998-2005	1998-2000

total revenues in the given range of years, were AFVS, APFLOR and URZE. In addition, AFVS only had one year with negative net income and URZE managed to have four years with positive net income. Again, it seems to exist here some connection between less dependency of public funding and the evolution in the number of members and quantity of technical advice services provided to the members, in the FOOs studied.

Social capital

The major external stakeholders of FOOs were the municipalities, the universities with forest education and pulp and paper industries. No major differences were found here between the FOOs in terms of the intensity and quality of their relations with this kind of stakeholders.

Characteristics of the socio-economic and natural context of the FOOs

One of the characteristics of the socio-economic context considered important by the staff and members of the board of directors interviewed was the ageing of forest owners and the tendency for out-migration of the rural population. Their views on how these facts influence the success of the FOOs to get more members and for them to provide more services differed from one FOO to another. In one hand, AFL and AFEDV considered these facts to be a constraint on their activities. In the other hand, URZE, and APFLOR considered these facts to be an opportunity for the development of their services in response to the growing difficulties of forest owners to manage their forests. In the case of AFVS, because most forest owners live no further than 40 km from their forest holdings, their willingness to manage their forests, to become members of the organization and to ask for forest services was perceived to be higher than in regions affected by land abandonment.

Another factor mentioned to be relevant in the success of FOOs was the surrounding natural environment. Members of staff and directors of AFVS, AFEDV and APFLOR stated that it was favourable for their organization to be in a region suitable for growing tree species with commercial value such as eucalyptus and maritime pine. In the case of URZE, whose territory is mostly in a natural conservation area, the organization seems to be more oriented towards a multifunctional approach, with the members of staff having other professions besides foresters (e.g. environmental and agricultural engineers).

b) Individual rationality constraints

It was assumed that for a forest owner to become and remain member of a FOO he/she was better off in this condition than staying out. The more the FOO is able to benefit its members, the more they will de-

mand its services. In the same line of thought, it was assumed that forest owners were better off by being a member of a FOO when the ratio between the total number of times the members met the FOOs' staff for technical advice services from the FOO and the total number of members over the years. In the case of AFVS, the ratio increases by increased for the period covered by data collected, reaching a ratio of almost 10 in 2005. In the cases of PORTUCALEA and AFL the ratio hardly ever reached one (Figure 3). This fact may indicate the satisfaction of members by the technical advice services provided by AFVS' staff.

c) Incentive compatibility constraints

Data collected during interviews with staff members and board the directors did not indicate the existence of opportunistic behaviours of members in the use of the services provided by the FOOs studied. It was stated in unanimity that forest owners demanded services from the FOOs with a true interest in improving the management of their forests. It was mentioned that the FOOs' staff closely monitored the provision of services, decreasing the possibility of incentive compatibility constraints.

d) Path dependence effects

Apart from AFVS, which started with 250 members, the remaining seven FOOs studied were created by a small group of forest owners, together with other people concerned with forest-related issues. FORESTIS had an important role in their start up. So, in all of them the affiliation with FORESTIS remains. Also, some of the founding members have kept a leading position in the board of directors, if not from the very beginning, at least since very early years in the lives of these organizations. Their strategies, internal organization and external relations have been, therefore, strongly influenced from what happened in the initial stages of their existence.

DISCUSSION

Data collected and the comparative study undertaken revealed that there was a positive trend in the evolution of the number of members over the years for most of the FOOs studied. Some FOOs, however, were able to increase their membership faster than others as is the case of APFLOR, URZE and AFLODOUNORTE (Figure 1). An interesting aspect is that these three FOOs were not those covering the highest forest area but AFVS (Figure 2). This aspect leads to suppose that a combination between the number of members and the area of forest owned by these members is likely to be a more effective indicator of the success of FOOs in organising forest collective action than only the increase in the number of members over the years.

In relation to the number of services provided, it was estimated a high ratio between the number of meetings for technical advice and the number of members in AFVS, this suggesting that the level of satisfaction of the members for the services provided was high (Figure 3). A big discrepancy (almost a tenfold) in the number of meetings for technical advice per member of staff in AFVS and PORTUCALEA was found (Figure 4). As mentioned before, this may indicate poor staff management or low staff productivity of the staff in PORTUCALEA and a high productivity or better management of staff in AFVS, reflecting its higher number of members and services provided. It is difficult to corroborate this, based in the comparison of only two cases because even though the services provided by the FOOs studies are similar, there are always some differences in their strategy. The case of URZE is an example of a FOO where part of the services provided is related to conservation issues because this organization is located and has members who own forest area within the boundaries of the Natural Park of Serra da Estrela.

In terms of services provided, there seems to be a positive correlation between the number of members and the number of services provided. This correlation implies circular causation, i.e., on the one hand the increasing number of members generates a higher demand for the provision of services and on the other hand, the increasing number of services provided by a FOO contributes to attract a higher number of members.

There is some evidence pointing to the hypothesis that two factors contributing to sustain this mechanism are a relatively low turnover in the FOOs staff and a relatively high productivity of this staff. It was often mentioned during the interviews that the members of staff with more years of experience in the same FOO were more knowledgeable about the forest area and forest owners and were more effective in accomplishing their tasks of recruiting new members and providing quality services to the existing ones. Since the recruitment and the design of incentives provided to the staff are under the responsibility of the board of directors, this means that the composition of this body is also likely to have strong influence in the success of the FOOs.

After the identification of these correlations and despite the gaps in data collected, another factor that seems to contribute to the success of FOOs is the lack of individual rationality constraints. In the case of AFVS, the satisfaction of the members by the services provided indicates they are likely to ask for more services and that they are better off by being members of this organization.

The financial capital is expected to be another factor influencing the success of FOOs in increasing the number of members and of services provided since less dependency of public funds appears to be associated with higher number of members - cases of AFVS, URZE and APFLOR. Even though all FOOs were implemented with low financial resources, which may have limited their success in the long-term, the management of financial capital towards less dependency of public funds appears to have positive repercussions on the turnover of staff and consequently their productivity. This contributes to an increase in the recruitment of forest owners and the faster delivery of technical advice services.

In what is concerned to the characteristics of the socio-economic and natural environment surrounding the FOOs it is important to notice that the proximity of the forest owners to their land and willingness to manage their forests in the area where AFVS is implemented coincide with the highest number of members and services provided in this organization. This suggests that this may also be a factor contributing to the FOOs' success.

Finally, it is considered that the effects of path dependence are also relevant in the success of FOOs. Even though the services provided by the FOOs studied were similar, the trajectories followed by each FOOs were very different and that was likely to have influenced their strategy in recruiting forest owners and providing technical advice services.

CONCLUSIONS

This study has highlighted some important questions about the success of FOOs in Portugal. Even though this study covered a small number of cases and there are gaps in the data collected it seems possible that the capacity to maintain the staff and to give technical advice that satisfy the members are the most important features of the success of FOOs in organizing forest collective action in North and Central Portugal.

It is recommended that a second study is undertaken with more cases and supported by better data in order to assess empirically the hypotheses explored here. For this to be possible there is the need, however, for an improvement in data recording on the FOOs activities, as for example the number of technical advice meetings between the staff and the FOOs' members. With more activities covered and more information recorded, it is likely that a better comparison between indicators of FOOs' success can be made, new indicators can be proposed and more reliable conclusions can be taken.

The assessment of the success of FOOs in Portugal and in other countries where they are highly dependent of public funds is a delicate, but very important matter that may be essential for the survival of the best. In Portugal, FOOs still struggle to subsist essen-

tially because most of the services they provide have the characteristic of public goods, such as, for example, the reduction of the risk of forest fires. In addition, small- scale forest owners, who are the main type of forest owners in the North and Central Portugal do not own large forest areas from which they could make profit and be able to pay for highly priced forest services. These reasons contribute to the FOOs dependence of public funds which are scarce and rarely paid on time. Since State funding does not differentiate between the FOOs that are successful in increasing the membership and the quantity and quality services provided and those that are not, they all struggle to get their bills paid in the end of the month. If there wasa mechanism of competition that could recognize and reward the most successful FOOs, they would certainly improve the services they provide and concentrate more efforts in recruiting more members which consequently would make them to become stronger at organising forest collective action. This would be a major step when it comes to their contribution to the sustainable forest management and development of forest innovative projects in the region where they are implemented.

The results of this study expose some big differences in some indicators of FOOs success but so far, there is no recognition of this fact by government entities. Since there is a strong element of public good provision in the operation of FOOs, it is recommended that the distribution of public support becomes much more closely linked to success than is currently the case.

ACKNOWLEDGMENTS

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Analyses of the Competitiveness of Forest Industry in the Republic of Macedonia

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Abstract

Background and purpose: This paper gives a thorough picture of the competitiveness characteristics of the Macedonian forest based industry for the period 1993 to 2006, from its independence to present times. The main purpose of this study is to analyze competitiveness of Macedonian forest industry and the factors that influences the creation and development of competitive advantages.

Material and methods: The study is based on theoretical tool of the Porter`s ''diamond'' model of the national competitiveness using four linked factors like: factor conditions, demand factor, firm's strategy, rivalry and structure and the forth one, related and supported industries. The method used is case study which includes collection of quantitative data, gathered through documentation, archival records, academic literature, publications, journals and websites.

Results and Conclusion: The analyzes has shown that the main strengths of Macedonian forest based industry are due to the existence of favorable factor conditions, as a cheap labor and energy cost-compared with region, good geographic location and relatively decent transport infrastructure. Weaknesses come from the lack of infrastructural investments (lack of capital), inappropriate management strategies, outdated machinery, low productivity and low value added products. To achieve better results industry should be organised in a better way and further investments in modern technologies and human resources are necessary.

Key words: forest industry, competitiveness, demand, firm condition, national market

INTRODUCTION

The competitiveness issue is a crucial element of interest for all governments, industries and economies that work under the principles of market economy. To be competitive and to stay at that position requires constant adjustments to market conditions, following the competitors and trends, but first of all, there is a need for restructuring the main production characteristics as quality, standard and prices according to the demand of the domestic and the international market. This study is one of the first attempts in Macedonia to present accumulated statistical material and analyze them with modern methods and approaches used in leading countries for assessing economic and industrial development.

It is important to know what are the main characteristics that can hold the sectors to be competitive, and what are the problematic areas that have to be taken into consideration to keep the sectors' competitive position. All of these questions are included and observed by this analysis, through the application of specifically chosen quantitative methods.

The main purpose of this study is to analyze competitiveness of Macedonian forest industry and the factors that influences the creation and development of competitive advantages using Porter's Theory of Competitive Advantage of Nations [1]. To meet this aim, several objectives and research questions are answered:

- to gather information's about current situation of forest industry in Macedonia,
- to analyze wood products market and current status of forest industry and
- to achieve a deeper understanding of competitive position and appraise level of competitiveness of Macedonian forest industry.

The research questions of this paper are:

1. What factors affect the competitiveness of forest sector in Republic of Macedonia?
2. What are main competitive advantages and disadvantages of Macedonian forest industry?
3. What recommendations could be given to Macedonian policy makers or managers of companies to enhance forest industry competitiveness?

MATERIALS AND METHODS

This paper relies on quantitative methodology or applies extensive statistical data.

The materials used for a quantitative research were gathered from documentation, archival records, academic literature, publications, journals and websites.

Analyses of collected data was carried out in the framework of the Michael Porters ''diamond'' model of competitiveness [1].

The determinants were listed and collected data were categorized in 5 categories under positive and negative factors, in order to analyze the competitiveness of forest industry.

According to Porter [1], competitive advantage of nations is the outcome of 4 interlinked factors and activities in and between companies (Figure 1):
• **Factor conditions.** This category includes production factors such as natural resources and geographical location, as well as created factors inherited from preceding stages.
• **Demand conditions.** The demand is formed by two constituents: local (domestic) market, as a starting source, and export to the international markets, and shows the nature of demand for the industry's product or service.
• **The Strategy, structure and rivalry of firms.** Direct competition impels firms to work for increases in productivity and innovation, and motivate leading companies to invest in the product, management and marketing. The competitive pressure also motivates higher organizational efficiency and training. Firms have a variety of structures and strategies to use, and that some will be more effective than others.
• **Related and supporting industries.** Spatial proximity of upstream or downstream industries facilitates the exchange of information and promotes a continuous exchange of ideas and innovations.

M. Porter model offers two additional areas from which companies can draw competitive advantages: chance which reflect rapid changes on world financial markets, unexpected growth in local orinternational growth, wars etc; and influence of Government through its policies as a catalyst and challenger; it's role is to encourage - or even push - companies to raise their aspirations and move to higher levels of competitive performance (Figure 1).

Namely, the ''diamond'' model is a mutually reinforcing system in which the role of any determinant cannot be isolated and the effect of one determinant is closely dependent with the others. Advantage in every determinant is not prerequisite for competitive advantage, but the interplay of advantage in many determinants reinforces benefits that are extremely hard for rivals to nullify or replicate.

RESULTS AND DISCUSSION

The Republic of Macedonia is situated in the central part of the Balkan Peninsula. It covers an area of 25 713 km^2 and has a population of 2 050 000. Forestry in Macedonia is an economy branch with minor participation in national Gross Domestic Product with 0.3-0.5 %, but if the multifunctional uses are valorized, the contribution will be much bigger. The contribution of the forest industry (primary and secondary wood processing, furniture, paper and celluloses...) in GDP is 2.5-3 % [2] and the share in total labor is 0.8 % [3]. Total wooded land is 988 000 ha or 39 %; forest area is 905 653 ha or 36 % of total area and other wooded land is around 78 500 ha. According the forms of management, high forest are 262 790 ha or 29 %, coppice 642 863 or 71 %. The most abundant species are oak (*Quercus* spp.) and beech (*Fagus* spp.). Forest distribution by purpose is: Economic forests are 834 347 ha (92 %), Protective 17 617 ha (2 %) and National Parks 54 036 ha (6 %). Growing stock is 74.3 million m^3 or 70 m^3/ha (in 2006) (Table 1).

88 % of all forest in country are state owned, and are managed by Public Enterprise (PE) ''Macedonian forests'' and national parks are managed by separate public institutions. The remaining 12 % of forest area are owned by private owners. Privately owned forests are scattered, fragmented and small in size. There are approximate 220 000 plots of an average size of 0.4 ha owned by approximate 65 000 households [2].

Macedonia is relatively small country with limited forest area, which demand careful planning, reforestation and harvesting procedures. Clear cutting is allowed, mainly in coppice forests. The certification of the forests does not exists yet. Illegal logging is a big problem; the approximate 8 630 m^3 in 2006 or 10 % of total harvesting in the country is from illegal activities [5], but some sources [6] states that this percentage reaches 20-25 %.

Fuelwood accounts for approximately 82-85 % of produced roundwood, industrial roundwood accounted for remaining 15-18 % respectively. Fuelwood consumption is around 700 000-750 000 m^3 annually, and mainly are covered by the domestic sources.
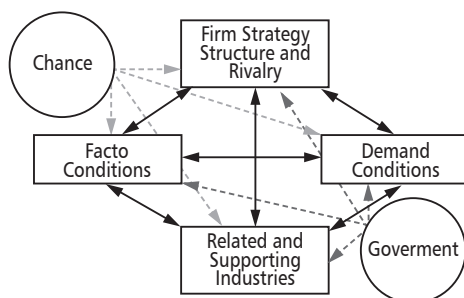

FIGURE 1
The Porter's Diamond system (source [1])

TABLE 1 Forest resources: area, growing stock and annual growth in 2006 (source [4])

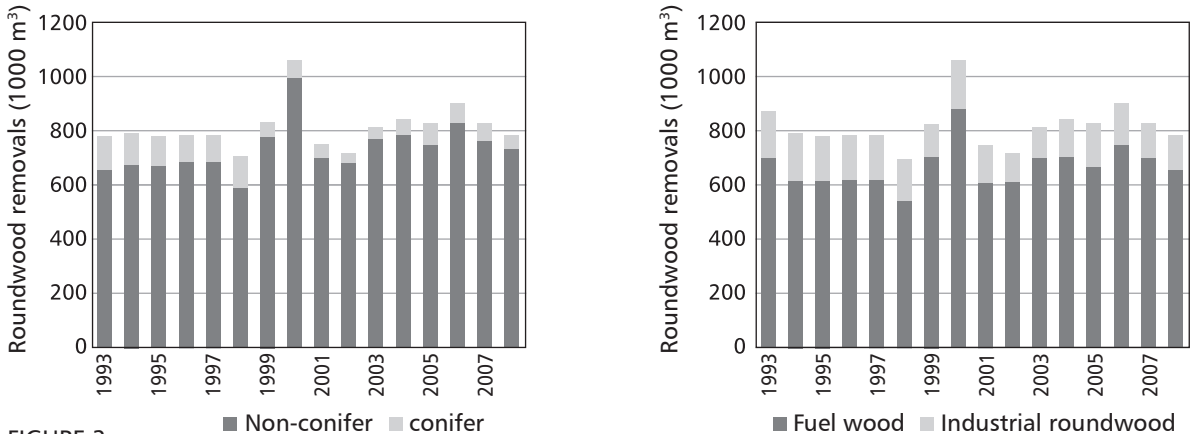|	Forest area	Volume of growing stock (m³)	Total annual growth (m³)	Annual increment (m³/ha)
Coppice	642 863	27 000 000	923 860	1.44
High forests	262 790	46 000 000	906 140	3.45
Total	905 653	74 000 000	1 830 000	2.02

FIGURE 2
Roundwood removals by: a) species and b) category (1993-2008) (source [7, 8])

The basis raw material – unprocessed round wood is supplied from domestic production i.e. from PE ''Macedonian forests'' [6]. Broadleaves (mostly beech) sawn wood is the main category produced; the conifer sawnwood is imported. The biggest percentage of industrial roundwood is used for sawnwood and veneer logs (more then 90 %), and smaller quantities of pulpwood and for other industrial uses (Figure 3).

The production of plywood and veneer is symbolic, and production of chip-board and fibreboard does not exist at all, so that the furniture industry imports them.

The main characteristic of the Macedonian labour market is high percentage of unemployment and comparing to the European labour market relatively cheap labour force [9] (Figure 4).

Forestry and forest industry plays an important role in the national economy especially in the rural areas because it provides employments for the rural population. According to statistics about 7 000 people are directly employed by the forestry and forest industry sector. Indirectly the sector provides job opportunities (part-time jobs) to additional 35 000 - 40 000 people through multiplier effects. Tens of thousands of people rely on the forest industry for a living. As 40 % of the population lives in rural areas and since a high proportion of these people are unemployed, forestry is likely to be of particular importance in raising living standards in rural areas [4].
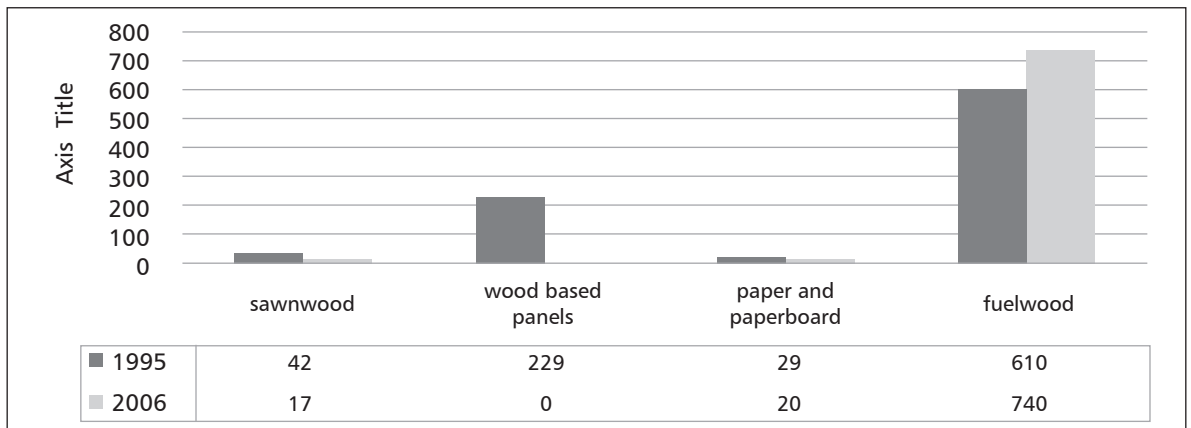

	sawnwood	wood based panels	paper and paperboard	fuelwood
1995	42	229	29	610
2006	17	0	20	740

FIGURE 3
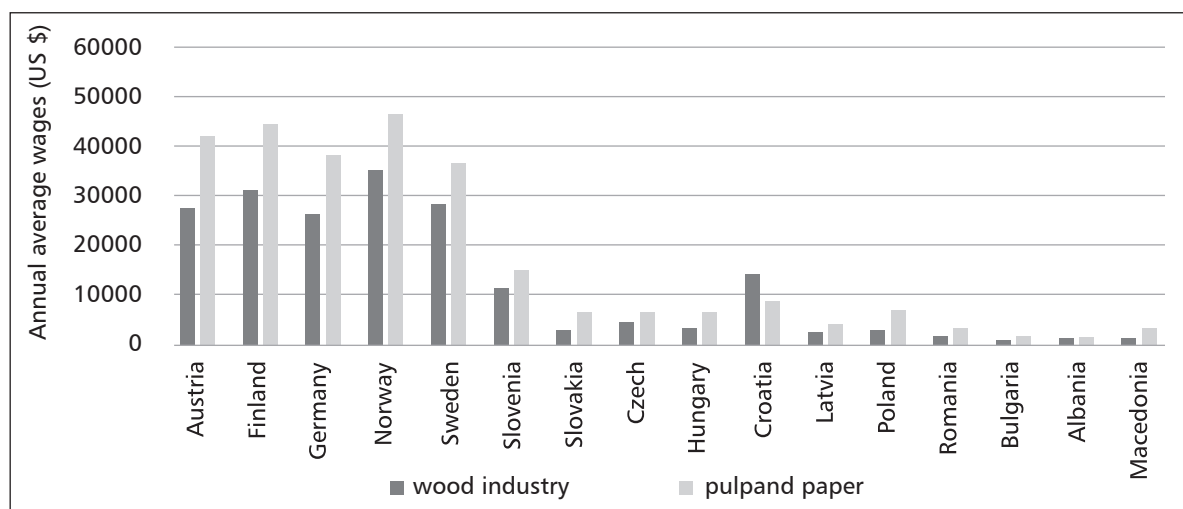*Production of wood products by sector in 1995 and 2006 (1000 m³) (source [7])*

FIGURE 4
Annual average wages in forest industry in selected European countries in 2005 (US dollars) (source [9])

TABLE 2
Employment in forest sector in Macedonia (1994-2006) (source [4])

number of workers	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Forestry	3592	3385	3767	3528	3401	3375	3000	2980	2830	2553	2940	2549	2517
Wood industry	1456	1463	1079	1232	1957	1633	1224	1348	1076	1348	2634	2861	3199
Pulp and paper industry	1694	1750	1208	1200	1265	1344	1337	1312	1235	1248	1766	1438	1734
Total	6742	6598	6054	5960	6623	6352	5561	5640	5141	5149	7340	6848	7450

Macedonia is mainly import oriented country with huge and growing trade deficit and relies on import of high value added wood products.

The external trade balance in the exchange of wood products is negative. The import value is several times bigger than the value of realized export. According

TABLE 3
Wood products net trade in Macedonia in 1000 US $ (1996-2006) (source [7, 8])

Years	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
ROUND-WOOD Agg	-24	-24	299	37	-979	185	104	829	65	104	1222
Fuelwood	-21	-21	-21	-21,5	-910	-234	-245	-25	90	137	171
Ind round-wood	-3	-3	319	58	-69	419	349	854	-25	-23	1051
SAWN-WOOD	13673	13673	-7772	-9275	-10860	-4814	-9416	-9957	-10868	-9952	-7755
WOOD-BASED PANELS	1285	554	-8231	-10947	-10569	-9384	-12887	-14784	-19971	-21526	-24193
WOOD PULP	-2657	-190	-1437	-635	-1631	-1171	-415	-373	-204	-372	-960
PAPER AND PAPER-BOARD	-24300	-46462	-25926	-42678	-22434	-22430	-22428	-33135	-19850	-19925	-42400
TOTAL	-12047	-32473	-42769	-63461,5	-47452	-37429	-44938	-56591	-50763	-51557	-72864

Macedonian State Statistical Office [4] in 2006 wood industry's export was 10 million dollars, and import $ 83 million.

Subject who dominated the forestry in the country is PE "Macedonian forests" responsible for planning and executing forest operations, and is the largest supplier of raw material to forest industry. It also used to operate with seven sawmills with an annual capacity of 20 000 m³ which are in process of privatization at the moment. In addition there is a great number (more then 500) of small and medium companies, mostly sawmills that operates on and off when saw logs can be acquired at affordable prices. Approximations are that more the 1000 firms existed in grey economy, but are impossible to establish the real number and assess their production results [10] (Table 4).

TABLE 4
Structure of enterprises in Republic of Macedonia in 2003 (source [10])

	Size of enterprise	Gross output in Euros	Number of enterprises
Saw mills	Small	13556	549
	Medium	969	3
Wood based panels	Small	477	10
	Medium		
Paper and paper-board	Small	15298	189
	Medium	3303	2
	big	10171	1

Using Porter's diamond model, the factors affecting competitiveness of forest sector can be categorized as production factors, demand factors, firm strategy and industry structure, related and supporting industries and government related factors.

Factors condition

Macedonia has geographic location on the Central part of Balkan Peninsula, relatively close to the transport corridors (rail and roads) and access to big and lucrative markets in neighbourhood and Europe. (Italy, Greece, Austria, Germany, Serbia…). This good position which avail forest companies themselves to the low transport costs.

The country is relatively small in harvesting of forests. The use of forests and wood for industrial processes in Macedonia is at a modest level. As a consequence there is shortage of industrial timber and producers bear high costs and have low productivity. The high percent of low quality coppice forests, mainly beech and oak, (70 % of total forest area), many of which are highly degraded, together with the small quantity of conifers (around 10 % of total growing stock), results in relatively low timber reserves, low timber mass, low and low annual growth per unit of land. Macedonia has only 160 000 m³ of annual harvest of industrial round wood. Quality of timber suffers because of low-yielding species, poor forest stands, and poor harvesting practices with limited access to the stands. Timber supply to local industry is inconsistent and uncertain especially to the small and medium size sawmills who are dependent of continuous supply and cannot afford delays in production.

Forest industry in Macedonia for the power mainly uses electrical energy. Regarding prices of electrical energy that industry is paying, compared from other countries in the region and EU is obvious that price of 4 Eurocents per kWh is relatively low and still very competitive.

Most of the equipment in use has been inhered from socialist era and dated from 90's. Machinery and equipment are outdated and inefficient (equipment in small sawmill companies is consist mainly of 1 or two band or circular saws, debarker, board lumber is dried on open air, very rarely in kiln), productivity is low, and there is lack of production process automation systems. Only a few individual small and private (furniture and sawn mills) companies have introduce some improvements in technology (as an automatic lathe's and laser guided saw), which does little to change the overall situation. As a consequences forest companies are faced with disadvantages as a wasteful use of raw materials and energy, high production losses, high power and raw material consumption, high pollution. Low investments in aging facilities leads toward low productivity and energy efficiency. All needed equipment and machinery have to be imported, because there aren't domestic producers in the country. The import is burdened with high prices on the international markets and transportation costs.

FIGURE 5
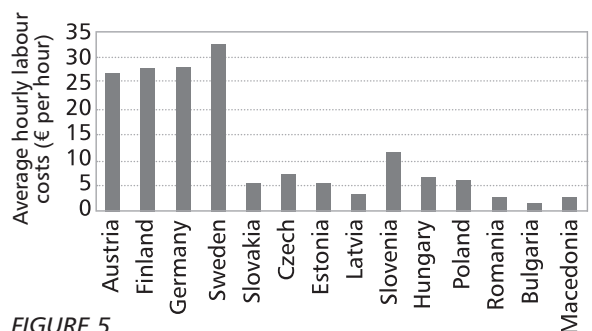*Average hourly labour costs in selected European countries in 2006 (in € per hour) (source [11, 4])*

With average hourly labour costs of 2.63 Euro, wages in forest sector are well below average wages in EU countries [11, 4], and this low cost of labor can bring comparative advantage (Figure 5).

Although basic factor conditions (forest resources abundance, geographical position, human resources)

are on the modest level compared with other countries in the region, they still offer opportunities which should be further developed by improving the advanced factors (knowledge, capital availability, and infrastructure). Under M. Porter's theory [1] the important factor behind competitiveness of any industry is its human potential, skills and qualifications.

Impeding factors are: low quality of local raw materials and shortage of industrial timber. State property of forest resources is also impeding factor. PE ''Macedonian forests'' has unregulated and monopolistic position in supplying forest industry with raw materials, which supply is inconsistent and uncertain.

Forest industry is faced with shortage of modern equipment and automation systems which are not produced in the country. Level of investments is very low, especially in foreign direct investments (According Central Bank of Macedonia [12], FDI in wood industry in 2006 was only 4759000 $US). Companies mainly finance themselves from their own and limited sources or from short term bank loans with high interest rate, which is insufficient to reach competitiveness needed for international markets. Numbers of innovations are very low, and collaborations with Forest faculty and other research institutions are negligible.

With investments in innovations, training, education, research and development, and in establishing the good relations with Forest faculty in Skopje (as a leading education institution in forestry), the situation can be improved. Managers and engineers needed more practical knowledge in modern technologies, communication technologies, international standards and marketing as a precondition to overcome present situation of low motivation and bad work mentality of local labour force, disrupted relationships and lack of cooperation between companies and R&D institutions.

Demand factors

Demand is formed by two constituents: domestic (local) and international (export) demand.

Nations gain competitive advantage in industries or in industry segments where the home demand gives local firms a clearer or earlier picture of buyer needs than foreign rivals can have. Local customers not only provide firms with a source of income, but they educate firms about customer needs and perceptions, so the local customer has much more influence over how products are designed, supported, and sold.

Macedonia with its relatively small population and small domestic market cannot offer possibilities to develop economy of scale. A major increase of the domestic market capacity would be impossible in the absence of the general growth of national economy, accompanied by a substantial increase of the per capita GDP. A major influence on demand relates to the non-industri-

al demands on forests, particularly for fuelwood. Non-industrial uses of timber, including fuelwood is reached 2/3 of entire consumption in the country (Figure 6).
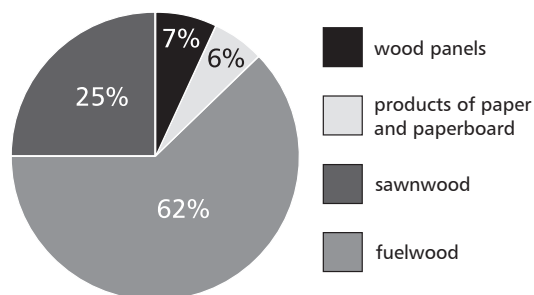

FIGURE 6
Structure of consumption of wood products (source [7, 8])

Development of exports is burdened by low quality and low values added products, the underdeveloped infrastructure as well as the weak networks and almost non-existing cooperation between the companies. The firms in the wood industry do not have the technological capabilities, design and marketing skills, financial and business management, or related human resource capabilities, required to compete in the global market.

But despite this gloomy situation, international market offers a lot of opportunities, and wood industry in Macedonia can benefit and improve its competitiveness through export, and exploited lower labour cost compared with other countries.

Firm's strategy, rivalry and structure

As argued by Porter [1], domestic rivalry, like any rivalry, creates pressure on firms to improve and innovate. Local rivals push each other to lower costs, improve quality and service, develop new products and have role in innovation and the prospects for international success. Firms have a variety of structures and strategies to use, and that some will be more effective than others. Porter [1] asserts that national culture plays a significant role, in which structures and strategies are selected by management and relative success of these business models varies with each industry.

Regarding the structure, industry is dominated by the PE ''Macedonian forests'' who has monopolistic position on the market and is exclusive supplier to wood industry and large number of small sized private owned companies, with mainly domestic capital, although some of them have foreign capital, which main activity is sawnwood production. The existence of great numbers of sawmills is result of small starting capital needed and fast turnover of invested capital compared to production of other wood products. The private-operated firm developed fast, but because most of them have old fashion household management further development is limited. These companies are focused on

the domestic market, and fierce rivalry exists among them. There is lack of horizontal and vertical integration, and concentration and cooperation is needed in order to increase size of companies and their ability to invest in new, modern facilities and development of competitive export oriented production.

The managers adopt flexible strategy oriented mainly on domestic market, where they can change production lines according with external conditions in the market.

This strategy enables them to adopt new product, or to change design and produce small series in relatively rapid response to the changed market demand. There are also many companies operating illegally in the environment of "grey economy", which does not fulfill their financial obligation.

This structure does not contribute to the development of wood industry and do not bring competitive advantage. There is absence of cluster organization, companies are too weak, without vertical and horizontal integration, with production which is not complaint with international standards, without export potential and orientation, and, therefore, limited possibilities to integrate into global manufacturing and supply networks. Still their flexible strategy and specialty enable them to make quick response to the changes of the external environment.

Related and supporting industries

Adequate related and supporting sector is able to provide the producers with extra competitive advantages, and opportunities to use the products or services offered by the companies within the related and supporting sectors. Existence of developed network of subcontractors and suppliers in a given region or country, makes it possible to offer more complex products and after sale service systems and turn out primary products with a higher value-added.

The main related and supporting sectors with forest industry are: Logistics; Energy; Processing Equipment Manufacture; Chemicals; Auxiliaries Manufacture; IT; Banking and Finance; Insurance; Business Consulting and Environmental Services.

Machinery and processing equipment, materials from chemical and auxiliaries needed for production such as ironwork, furniture cloth, varnish and paints for the Macedonian wood industry is mostly imported.

Information technologies which are necessity in modern production are just getting a foothold in the wood processing companies. One of the main reasons for slow IT implementation is lack of educated and training personal and limited capital for purchasing new hardware and software. Regarding bank and finance sector, very limited capital loans are allocated to the wood industry.

Companies faced difficulties to secure their working capital through bank loans, their assets are often not accepted as a collateral, and interest are very high. One must also note that a company's chances of securing a loan are hinged on the private connections of its managers, rather than on the company's financial situation.

Macedonian forest industry is not organized in clusters, and cannot benefit from related and supporting sectors as a source of competitive advantage, and explore possibility of early access to high quality and reliable supplies of essential components and materials, and from the cost advantages gained from the competitive local supplies.

Influence of Government

The role of government is above all to act as a catalyst and challenger; to encourage - or even push - companies to raise their aspirations and move to higher levels of competitive performance. Porter [1] asserts that the government can have a role in all determinants of national competitiveness, but that the role can be negative as well as positive and that its role will always be partial – not sufficient in itself to make a national industry competitive.

The government of Macedonia has not yet established an attractive business environment, very important for foreign direct investments. Government policies and activities in Macedonia do not seem to be addressing these problems effective. In the past wood industry (as other industries too) had the role of social service.

After the independence, Macedonia began a process of trade liberalization, which intensified during the second half of the 1990's. Republic of Macedonia concluded a series of Free Trade Agreements with the neighbouring countries and other traditional partners: Turkey, Serbia and Montenegro, Bulgaria, Croatia, Bosnia and Herzegovina, Ukraine, Albania, Moldova and Romania.

In 2007, Macedonia sign Central European Free Trade Agreement (CEFTA), for its further trade liberalization. Another agreement that Macedonian has ratified is the Agreement for stabilization and Association with EU, signed in 2001. It regulates trade aspects focused on increased trade liberalization between Macedonia and European Union. The country is also member WTO from 2003.

But aside these positive steps, the government role in the forest sector during the past period was insignificant, and not supportive, bureaucratic obstacles in the State ministries and institutions are still high. State institutions (Inspections) are not deeply involved in activities toward solving the problem with illegal companies which does not fulfill their financial obligation toward

State, and have market advantage. Experience of developed countries shows that long-term and clearly stated policy helps to achieve impressive results on the world market. The results are summarized into the following table 5, according to the applied conceptual framework.

CONCLUSIONS

The study reveals that the Macedonian forest industry is virtually lacking any obvious competitive advantages to be developed without major investments in infrastructure, technology upgrading, R&D, and professional training of personnel. To achieve competitive success, firms from the industry must possess a competitive advantage in the form of either lower costs or differentiated products that command premium prices.

To sustain advantage, firms must achieve more sophisticated competitive advantages over time, through providing higher-quality products and services or producing more efficiently.

It is important and necessary for the State to abandon its sporadic interference, concentrating on creating a favorable investment environment and on introducing regulations promoting conscientious and rational use of natural resources (especially since forests are one of the few renewable resources).

Table 5
Diamond model of competitiveness of Macedonian forest industry - summary

FACTOR CONDITIONS	Geographic position	Strengths	• Good geographic location close to the main transport corridors • Short distance to main export markets (EU, Balkan countries)
		Weakness	• Regional instability
	Human resources (labour force)	Strengths	• Tradition and experience • Cheap labour cost which lead toward lowest producer prices in the region • High social importance, employment and existence of large part of rural population
		Weaknesses	• Mentality and absence of willingness to accept changes and modern way of production • Senior managers and owners are not familiar with modern ways of doing business
	Natural resources	Strengths	• Wood as a renewable resource
		Weakness	• Low quality of forest resources (high percents of hardwood coppice stands) • State property of forest resources (90%) • Shortage of industrial timber • Inconsistent and uncertain supply with raw materials • Poor harvesting practice • Illegal logging
	Innovations	Weaknesses	• Low investments in innovation • Small firms have week ability to develop innovations
	Infrastructure	Strengths	• Good transport infrastructure of road network
		Weaknesses	• Low efficiency and out-of-date railway coaches • Country do not have sea access, the closest port is Thessalonici in Greece
	Equipment	Weaknesses	• Outdated and inefficient machinery leads toward high production losses • High consumption of energy per product • Pollution
	Energy supply	Strengths	• Low price of energy (compare with the region)
		Weaknesses	• Absence of long-term contracts with energy suppliers
DEMAND CONDITIONS	Domestic demands	Strengths	• Flourishing furniture and construction industry as driving force increase demand of forest products
		Weaknesses	• Small size of domestic market • GDP per capita is among the lowest in the region, so it is difficult to have demanding and sophisticated home demand • Bad relations between producers and buyers
	International demands	Strengths	• Trade liberalization agreements (CEFTA, Free Trade Agreements), opportunity for further market expansion and export
		Weaknesses	• Low quality of products and absence of certification of forest stands limits export potentials • Few high value-added products • Production is not standardized • At the same time trade liberalization -threat for domestic market from new developing countries (China, India…)

FIRM STRATEGY, STRUCTURE AND RIVALRY	Structure	Weaknesses	• Monopolistic position of PE as a largest supplier of raw material to forest industry • Large number of private SME focused on domestic market • Absence of cluster organization and lack of horizontal and vertical integration
	Strategy	Strengths	• SME adopt flexible strategy regarding production of small series of new products
		Weaknesses	• Fragmented and loosely connected companies with modest attempts to cooperation in order to reach economy of scale • Lack of modern business strategies, marketing and products design
	Rivalry	Strengths	• Fierce domestic competition creates pressure on firms to improve and innovate
		Weaknesses	• Disloyal competition of the unregistered firms (more then 1000 estimated) • The focus on the domestic market harm the competitiveness forest industry on international markets
RELATED AND SUPPORTING INDUSTRIES	Machinery supply	Weaknesses	• All machinery and equipment have to be import
	Chemicals and Auxiliaries supply	Weaknesses	• Products such as ironwork, furniture cloth, varnish and paints are also mainly from import.
	Relations with educational and R&D centers	Weaknesses	• Weak cooperation with forest faculty and other research institutions
	Information technologies	Weaknesses	• Very low implementation of IT technologies partly for the reason of lack of capital, educated and training Personal
	Bank and financial sector	Weaknesses	• Rigid and unstable bank credits (SME cannot obtain loans due to high risk and high interest rates) • Lack of investments (particularly foreign direct investments)
	Associations	Weaknesses	• Lack of business association concerning forest industry
GOVERNMENT		Weaknesses	• Lack of state policy which influence domestic forest sector • Lack of subsidies and appropriate tax policy. • Government is reluctant to provide financial assistance to export-oriented companies • State institutions does not penalize illegal companies • Bureaucracy

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The Attitude Towards Hunting of the Local Population from Two Settlements in Suburb of Skopje, Macedonia

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Abstract

Background and purpose: _The object of this paper is to investigate what kinds of perception towards hunting the local non-hunters population from settlements of Dolno Lisice and Dracevo have, their attitudes towards hunting activities and moreover of hunting as an economic activity._

Material and methods: _Based on a survey method with using a questionnaire, the research is conducted between February 21st and 23rd, 2010 on the area of suburb of Skopje, the capital city of Macedonia. The analysis reveals public opinion, obtained from 67 interviewees, as a representing part of the investigated area. For this purpose a questionnaire with 11 questions is prepared and in order to be included biggest possible number of residents and to access bigger response, except door to door mail approach is used also. The gathered data are processed with manual recording obtaining quantitative data on the attitude of interviewees._

Results and Conclusion: _Results reveal that most of the male population are going on hunting for benefit, unlike most women who hunt for sport and recreation. This analysis shows that hunting is quite widespread in this region and almost all respondents reported they know someone who is a hunter. Moreover in this case it is interesting that despite the big number of males of this region and female inhabitants as well have expressed desire to go on hunting._

Key words: _hunting, public opinion, public attitude towards hunting_

INTRODUCTION

''The attitude construct continues to be a major focus of theory and research in the social and behavioural sciences, as evidenced by the proliferation of articles, chapters, and books on attitude-related topics published between 1996 and 1999. To the relief of authors, the Annual Review of Psychology now divides this burgeoning field into two separate chapters, one surveying attitude change, persuasion, and social influence'' [1, 2].

''Attitudes toward hunting depend on what the altitude is about and hunting alone is too broad as an object and needs to be more precisely defined to give a meaningful understanding of anti-hunting altitudes'' [3].

The beginnings of hunting, in particular hunt as a form of human activity can be found from the time of human kind origins. As man evolved through history, also developed and hunting as an economic branch.

At the beginning, hunting was individual and not with high intensity, but somewhat later become to develop into organized joint activities with which people are involved as primary occupation.

From the time of old century, when people began to rely on agriculture and animal breeding, hunting is losing its initial meaning for the existence of humans and is no longer the main source of existential needs. It is considered that during this period of development of mankind are the beginnings of hunting as a sport and entertainment, in which participants prove its durability and dexterity. During this period, people go on hunting more for recreation than for material benefit. As a consequence to this, hunting was losing its original function.

''Over the past 25 years, research has furnished a great deal of descriptive information about the advantages of hunting and other wildlife-related activities. It has become clear that hunting is not merely a means to harvest game; it also affords opportunities to actualize a variety of social, psychological, emotional, and physical benefits'' [4].

Nowadays hunting is treated as a sport, recreation, hobby and entertainment, but also a way of environmental management and specific relationship to the animal part of nature called game. The economy of many countries hunting takes prominent place and is subject to a separate, permanent and systematic attention to relevant organizations in terms of promoting and developing not only domestic but also international tourism. The life of modern man more in need of rest, recreation and refreshment in nature, and hunting has proved to be very desirable and appropriate for that kind of vacation.

''From the research done in the past, more than nine out of ten people support at least some form of hunting. This was true in 1978 in the United States and is true in both the U. S. and Sweden today. This shows that blanket statements that the public opposes hunting are not accurate'' [3].

Concerning Macedonia, hunting activities enjoy special attention nowadays. Each adult person and active population (workable) citizens who fulfil conditions provided by law can become a hunter, to carry weapon and to hunt. It is estimated that there are about 34,000 hunters, members of some of the many in number hunting associations.

There are 256 hunting areas in total on the territory of the Republic of Macedonia, proclaimed as such with a Governmental decision [5]. These hunting areas are divided into 5 hunting regions, of which on hunting big game pertain 112 smaller parts of area and for hunting small game 144 hunting areas within these five regions. The hunting areas are given on concession to companies registered for hunting activities, where besides the right to hunt game, they are obliged to breed, store and protect wild life.

Although on the territory of our country there are a number of different game species, the main types of corporate hunting game are wild boar, roe deer and chamois, and also the small game as rabbit, partridge, etc. Certain types of game such as bear and lynx, because of its reduced numerical condition are declared permanently protected species and its hunting is prohibited.

Besides the richness of indigenous game species in certain hunting areas introduction and reintroduction of some non-indigenous game species of several types of deer, muflons, pheasant and other game is done. These activities contribute to wildlife enrichment in our country with game species that are not naturally present on this area or some new species that could adapt to existing living conditions.

Concerning the great nature beauty, unpolluted environment, the richness and game quality in our country, hunting has great potential to grow into important branch and as part of the national tourism.

The object of this paper is to reveal what kind of attitude the local population from Dolno Lisice and Dracevo settlements have towards hunting, hunting activities and moreover hunting as an economic activity. Surveyed settlements are located east of Skopje and are considered as sub-urban neighbourhoods. Surrounded by large complex of farmland with mountain Jakupica in their close surrounding, there are excellent conditions for hunting. The main objective is analysis of what kinds of attitude the local people have towards hunting and moreover the attitude of ordinary citizens who are not hunters. This is even more significant if taking into consideration the fact that in this region were not done similar studies so far. Therefore, this can serve as a base for further similar studies based on public opinion.Through obtained responses and quantitative analysis made afterwards, we would like to get a clear picture of their attitude towards hunting in order to detect specific problems and offer possible solutions to resolve them.

These kinds of surveys are good tool to learn more about attitude of the people towards hunting and the level of public awareness of opportunities, goals and meaning of hunting in general. Taking into account that public opinion is not considered as an important one in Macedonia, in almost all forest activities, this study will be the base of further investigations in this area, and also it will be the base for the Association of hunters for their improvement in their behaviour towards sustainable hunting.

THEORETICAL FRAMEWORK

''Recognizing the diversity of opinions about wildlife, researchers have emphasized segmenting the public into homogeneous meaningful groups in order to understand potential responses to wildlife management strategies. Much of this research has focused on differences among known interest groups (e.g. hunters) or people with different demographic characteristics such as sex and age [6, 7, 8]. Other research has segmented the public using psychological indicators such as motivations [9], attitudes [10], and normative beliefs [11]. These segmentation studies have enhanced our understanding of the differences between interest groups with different demographics, past experiences and psychological profiles'' [12].

''Attitudes are positive or negative evaluations of an object, and can be measured at both general and specific levels'' [13, 12].

''A schematic representation of the theory is shown in Figure 1. Briefly, according to the theory of planned behaviour, human action is guided by three kinds of considerations: beliefs about the likely consequences of the behaviour (behavioural beliefs), beliefs about the normative expectations of others (normative beliefs), and beliefs about the presence of factors that may further or hinder performance of the behaviour

(control beliefs). In their respective aggregates, behavioural beliefs produce a favourable or unfavourable attitude toward the behaviour; normative beliefs result in perceived social pressure or subjective norm; and control beliefs give rise to perceived behavioural control, the perceived ease or difficulty of performing the behaviour. In combination, attitude toward the behaviour, subjective norm, and perception of behavioural control lead to the formation of a behavioural intention. As a general rule, the more favourable the attitude and subjective norm, and the greater the perceived control, the stronger should be the person's intention to perform the behaviour in question'' [4].

MATERIALS AND METHODS

For the purpose of this paper, examination of local population's attitude from the settlements of Dolno Lisice and Dracevo towards hunting, with random choice of statistical examination of public opinion was made. Each area for collecting data is determined within administrative boundaries of Dolno Lisice and Dracevo, as suburban neighbourhoods with mixed population composition. They count about 30 000 inhabitants, with predominantly Macedonian Orthodox population. The survey was conducted with questionnaire given to the local people. The questionnaire was made of 11 questions, where most of them offer few possible answers.

For the manner of obtaining data, by the given slow movement of the statistical sample frame, the attitude of the locals who do not change in a short period of time, we conclude that the survey can be conducted at any time of the year without affecting the outcome of the analysis. An inquiry between February 21st and 23rd, on 67 respondents, by going from house by house and correspondent obtaining data was carried out.

In order to be included biggest possible number of residents in survey and access to bigger response obtained, the questionnaire was also sent by mail to the some respondents.

The data are processed with manual recording according to the given answers, obtaining quantitative data on attitude of the local population. Appropriate conclusions, based on which we can offer suggestions for improvement of certain views and understanding of the local population to hunting are pulled out.

The results obtained from the examination of the local population attitude within the settlements of Dolno Lisice and Dracevo to hunting will be explained further.

RESULTS

For the purpose of this paper, research on public opinion on a representing part of statistical sample frame by random choice in the settlements of Dolno Lisice and Dracevo was carried out. The survey is conducted and obtained interesting results will be explained in continuation of this paper. Therefore each of the questions and the result obtained will be analysed separately and presented graphically.

Q1: How old are you? – On the first question of respondents' age the answers were divided into 6 age classes, presented within the Graph 1. First class includes all respondents younger than 20 years, the second is between ages of 21 and 30 years, third is from 31 to 40 years, fourth class is 41 up to age of 50, the fifth takes from 51 to 60 years and all respondents older than 61 are in age class six. The most respondents as it can be seeing from the Graph 1 are on age between 31-40 years old with 34.3 % share and most of rest of the respondents are under the age of 20-30 years with 20.9 %.
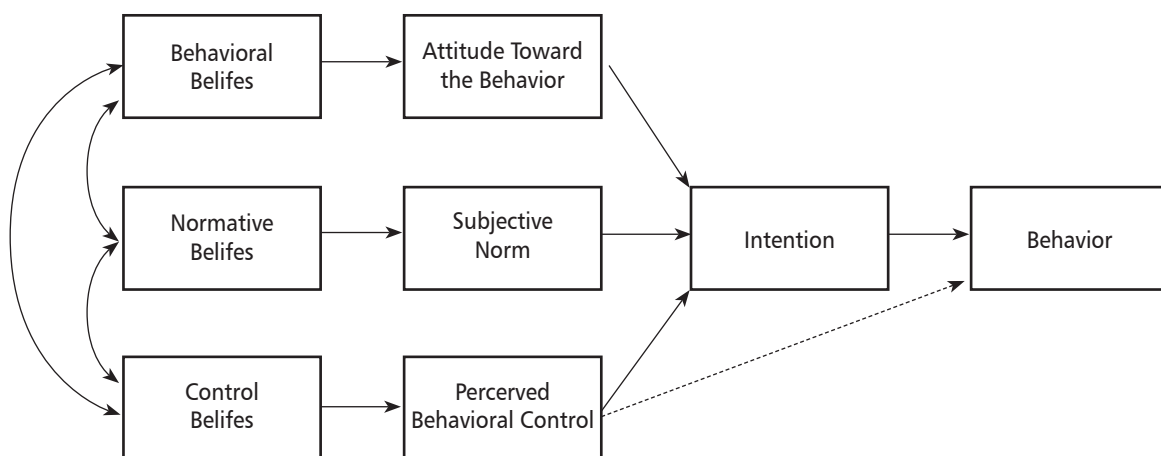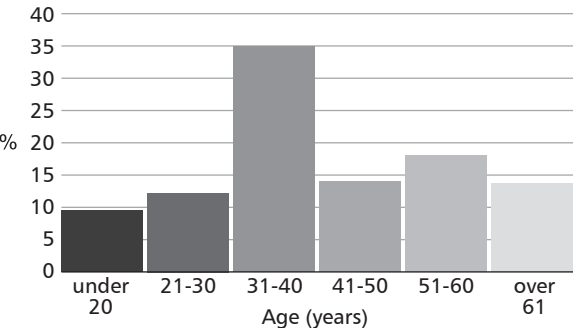

FIGURE 1
The theory of planned behaviour (source [4])

GRAPH 1
Question 1: How old are you?

Q2: What gender are you? – With the second question and further quantitative analysis of obtained answers we got a good picture of gender respondents' structure. Within Graph 2 representation regarding relationship between genders as almost identical with a small predominance of the female participating with 53.7 %, and compared to men with participation of 46.3 % is visible.
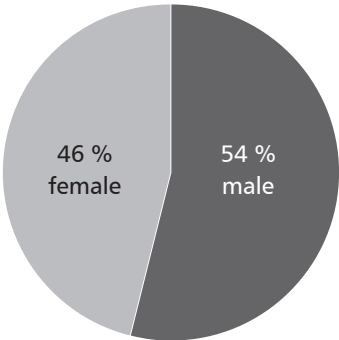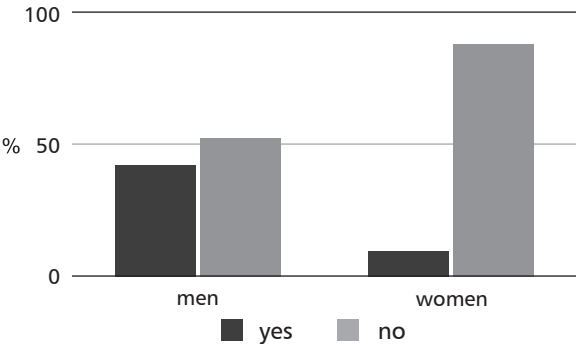

GRAPH 2
Question 2: What gender are you?

Q3: Have you ever have chance to hunt? – The obtained responses indicate that 74.6 % of respondents had no single opportunity to participate in hunting, as opposed to only 25.4 % of residents who have participated in hunting (Graph 3a).
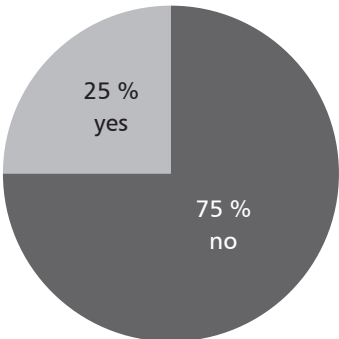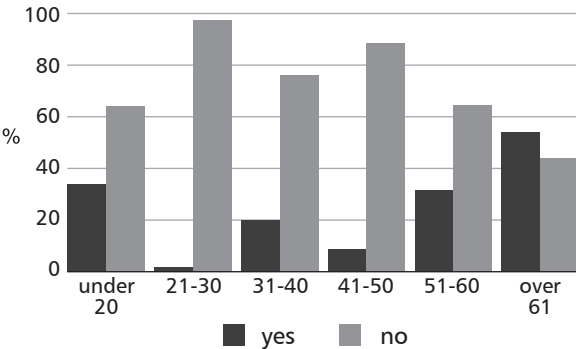

GRAPH 3a
Question 3: Have you ever have chance to hunt?

If you look at percentages' difference between those men who have participated only once in hunting and those who have never been on hunting, you will see that their ratio is almost identical (Graph 3b). Largest percentage of male respondents which had no opportunity to hunt is 54.8 %, as opposed to 45.2 % respondents, who were only once on hunting. Concerning female respondents, the situation is quite different and the percentages difference is very outstanding. Even 91.7 % of the respondents have never had the opportunity to hunt, as opposed to only 8.3 % which sometimes went on hunt.

GRAPH 3b
Question 3: Have you ever have chance to hunt?

If you take the percentage of residents within age classes that had only once opportunity to hunt (Graph 3c), you will notice that with exception of age class of residents older than 61 in all other age classes' residents who had no opportunity to hunt, dominate.

GRAPH 3c
Question 3: Have you ever have chance to hunt?

From the Graphs 3b and 3c you can see that biggest difference between those who had opportunity to hunt and those who had no such opportunity is for class of people aged from 21 to 30 years old, where all respondents declare they had no chance to hunt. Followed and opposite to that, residents older than 61 years, 55.6 % of the surveyed people had the opportunity to hunt (Graph 3c).

Q4: Would you go on hunting? – From following graphs (Graphs 4a, 4b, 4c) we can notice that more than half of respondents would like to go on hunting. Than 55.2 % of respondents said they would like to go on hunting, 20.9 % respondents reported that have no such desire, while 23.9 % of them said they might go on hunting in future if they got an opportunity (Graphs 4a).
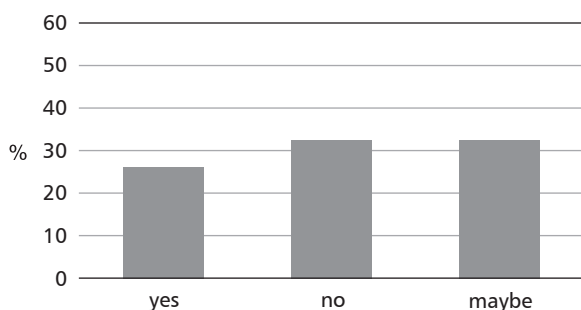
GRAPH 4a
Question 4: Would you go on hunting?

For better representation of the results of answers to this question depending on gender and age of the participants, they are presented in Graphs 4b and 4c.

Respondents asked if would go hunting, 64.5 % of men said they would to hunt, other 19.4 % said they would not go hunting, and 16.1 % of the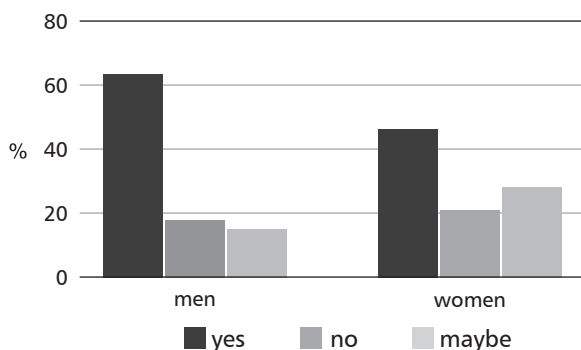 respondents said if they will got an opportunity they might go on hunting. The same question posed to the female respondents had received many responses with not so different percentages, where 47.2 % of them stated if there is a chance they would go hunting, 22.2 % female respondents would not go to hunt and 30.6 % of them hesitate and said they might went (Graphs 4b).

GRAPH 4b
Question 4: Would you go on hunting?

From quantitative analysis of responses to this question, it is notable as between male and female respondents as well dominate those who would like to go on hunting. Yet, desire is greater among male respondents where difference is more remarkable, so

we get a respondent who does not want to go on hunting opposite to three people who would like to go. Unlike males, with female respondents difference is not that notable so on one female respondent who wants to go hunting comes two with desire to go.

But, if we look at the results from the peoples' declares per adult classes, the most of them interested to go on hunt are older respondents, compared to younger people who did not expressed such a desire. Thus, the percentage is 91.7 % of residents who are aged between 50 and 60 years with 33.3 % of residents under the age of 20 years (Graph 4c).
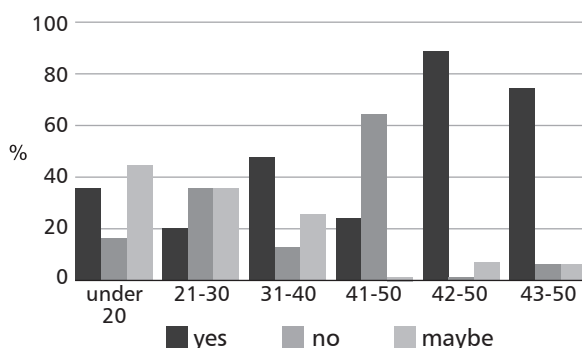
GRAPH 4c
Question 4: Would you go on hunting?

Q5: Do you have any relatives or friends hunters? – As we can see from Graph 5, vast majority or 95.5 % of population have relatives or friends hunters, compared to only 4.5 % respondents who do not have relatives nor hunters acquaintances.
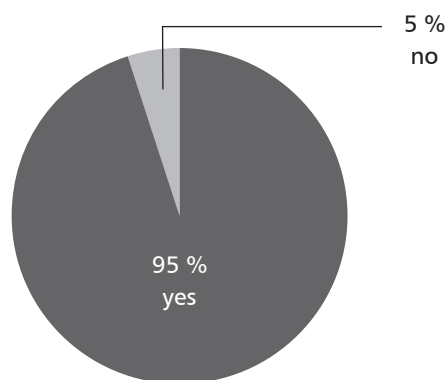
GRAPH 5
Question 5: Do you have any relatives or friends who are hunters?

The largest percentage of respondents of both genders asked whether they have friends or relatives hunters, are given positive response. All male respondents reported they have a friend or relative who is a hunter, unlike women with 91.7 % of respondents answered affirmatively to this question.

If we look at the results according to age class, we will notice two features. First is extremely large majority of respondents who gave answer upon this issue in all age classes. And the second is that all residents aged from 21 to 30 years, from 51 to 60 and over 61 years give affirmative answer to this issue. If we look at negative responses, we can notice most of the negative responses with 16.7 % are given by the youngest respondents, or respondents younger than 20 years old.

Q6: Does the stories of your relatives or friends hunters about hunting have positive effect on you? – Going through these answers we can see according to responses of 77.6 % the hunters' stories left positive impression to the respondents, unlike 22.4 % of respondents that have acquired negative impressions about hunting through such stories and discussions (Graph 6a).
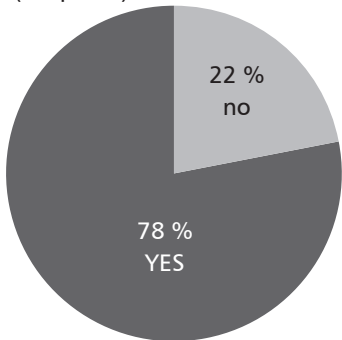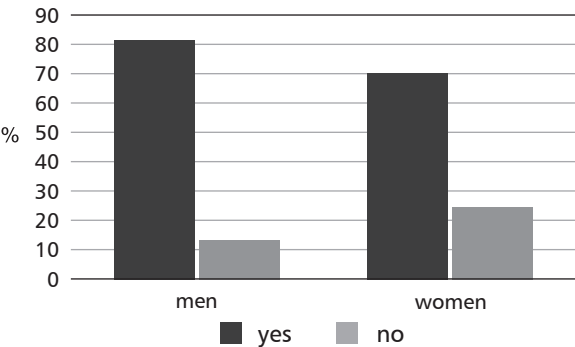

GRAPH 6a
Question 6: Does stories of your relatives/friends hunters have positive effect on you?

The results are presented for responses by gender (Graph 6b) and by age classes (Graph 6c). Here the highest percentage of respondents of both sexes, on this issue has responded affirmatively. Moreover friends or relatives with their hunting tales made positive affection to even 83.9 % of male respondents and to 72.2 % of female respondents, compared to 16.1 % male and 27.8 % females those stories have no positive affection on the respondents towards hunting.

GRAPH 6b
Question 6: Does stories of your relatives/friends hunters have positive effect on you?

We can see that in all age classes respondents with positive impressions dominate. With the most outstanding percentage are the answers from residents aged from 31 to 40 years old with 82.6 %, from 51 to 60 years old class with 91.7 % and those over 61 with 88.9 % participation.

If we compare these results with question number 4 answers, with dominant positive answers on: "Would you go on hunting?" it is obvious that these two issues are in mutual dependence and among them is positive correlation (proportional depending).
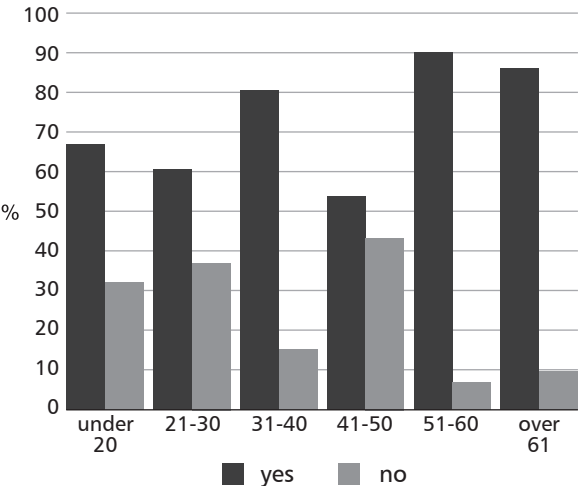
GRAPH 6c Question 6: Does stories of your relatives/ friends hunters have positive effect on you?

Q7: Are you familiar with the situation of game population density in Macedonia? – From the answers given to this question from the locals it shows that 58.2 % of respondents think game population density in Macedonia is a small, while only 13.4 % consider numerous state of the game number in our country is great (Graph 7a).
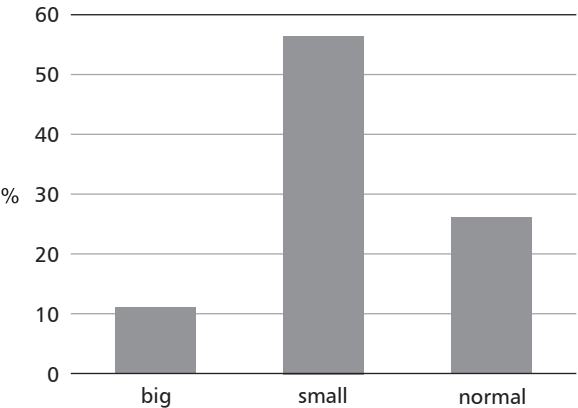
GRAPH 7a
Question 7: Are you familiar with the situation of game population density in Macedonia?

The most of both male and female respondents consider low game population density. However from female gender the share is 66.7 % responses, compared to male respondents with 48.4% of them who think game population density is low (Graph 7b).
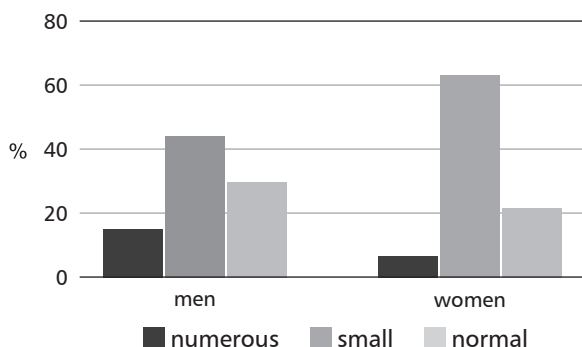
GRAPH 7b
Question 7: Are you familiar with the situation of game population density in Macedonia?

If we consider answers from different age classes' respondents, we can see that with the exception of youngest respondents who are with age under 20 years (of whom 50.0 % reported that number of game in our country is normal) in all other adult classes dominate attitude that game population is small. The largest percentages of those who think game population density is low with 87.5 % are aged 21 to 30 years, followed by people aged between 51 and 60 years with 77.8 % share. It is interesting that none of respondents aged 21 to 30 years and over 60 years do not think that game population density in Macedonia is great (Graph 7c).
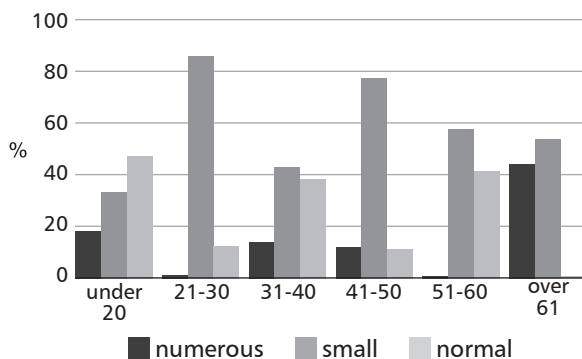
GRAPH 7c Question 7: Are you familiar with the situation of game population density in Macedonia?

If a comparation is done between answers to this question to results of question number 10 which states: "Are there any poachers in the area of your place of living?" we can see that they are positively correlated with claims of respondents answered positively to this question. In comparison, these two questions indicated that percentage of those who

think game population density is low (58.2 %), is very close to those considering there are poachers in the area of their place of living with (61.2 %). This leads to a conclusion that number of poachers is inversely proportional to the game population density, or as bigger the number of poachers the less the game is.

Q8: Do you think hunters hunt for recreation or sport or for obtaining benefit (ex. meat)? – This question provide perception that local people attitude towards motif of hunters to hunt is divided. It is almost equal percentage of those residents who think hunters hunt for sport and recreation to those who think they hunt for the benefit. As we can see from Graph 8, 50.7 % of respondents gave affirmative answer to this issue and negative answer gave 49.3 % of respondents.
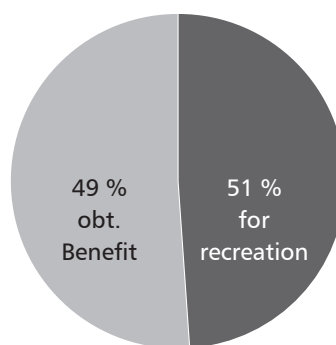
GRAPH 8
Question 8: Do you think hunters hunt for recreation or sport or for obtaining benefit (ex. meat)?

If we go through results of responses from both gender classes separately, we can see that there is almost equal percentage of respondents who believe that hunters hunt for sport and recreation to those who think that hunting is for benefit. From the results of the quantitative analysis, the responses given by male respondents, 51.6 % of them believe the hunters hunt for the benefit, while 48.4 % believe they hunted for recreation and sport . Unlike males, female respondents' position is reversed so that 52.8 % of them believe the hunters hunt for sport and recreation versus 47.2 % who thought that they hunted for the benefit.

From the answers to this question, we can conclude that the most of the despondences look on hunting as an activity for providing benefit, where the most common motive is the meat.

Q9: Do you think hunters are with different ethnic, political and religious background? – Results show that 64.2 % of local population believe hunters are with different ethnic, political and religious background, while 13.4 % believe they are not with different background. Of these, 22.4 % were not sure and they gave answers as maybe or I am not sure (Graph 9a).
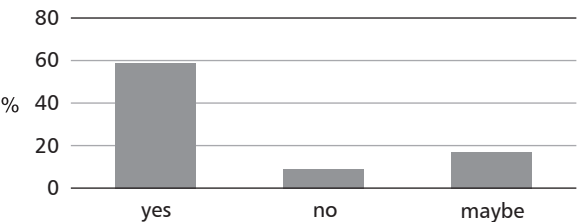
GRAPH 9a
Question 9: Do you think hunters are with different ethnic, political and religious background?

If we made quantitative analysis to this question according to the respondents by gender, we will see that in both sexes percentage ratio of given results is almost identical (Graph 9b). With members from both genders confirmative answer dominate, and even two thirds of them on this issue gave positive response or rather 64.5 % males with 63.9 % of females. Unlike them, the issue gave a negative answer with 16.1 % of males and 11.1 % female respondents, while 19.4 % male and 25.0 % female respondents said that hunters might be with different ethnic, political and religious background.
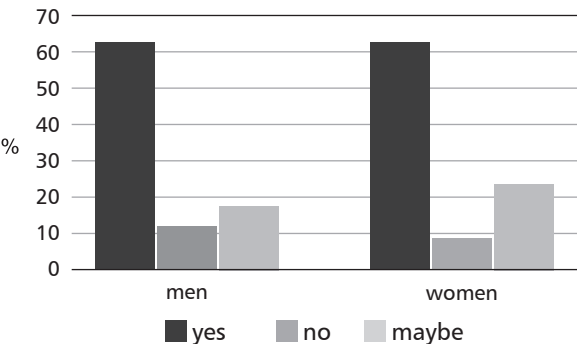
GRAPH 9b
Question 9: Do you think hunters are with different ethnic, political and religious background?
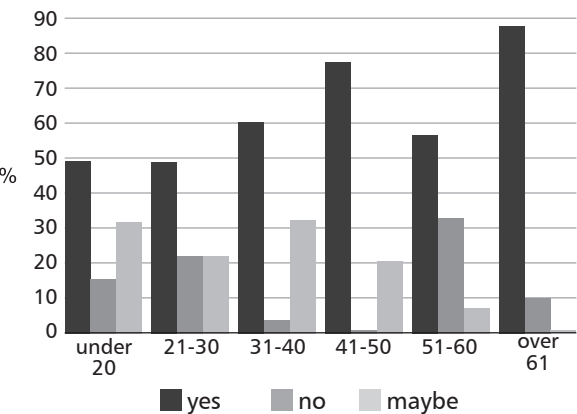
GRAPH 9c
Question 9: Do you think hunters are with different ethnic, political and religious background?

From the Graph 9c we can see that with age increasing, increases the percentage of residents who think hunters are with different ethnic, political and religious background. But at the same time with increasing of ages decreases the percentage of undecided residents who answered to this question with "maybe".

Q10: Are there any poachers regarding your place of living? – From results of the two possible answers to this question, you'll learn about the attitude of locals from villages Dolno Dracevo, Lisice and whether there is and to what extent poaching in their place of residence. The result shows that almost two thirds or more accurately with 61.2 % of population, respondents claim their settlement has poachers, unlike of 38.8 % think their settlement do not have poachers (Graph 10a).
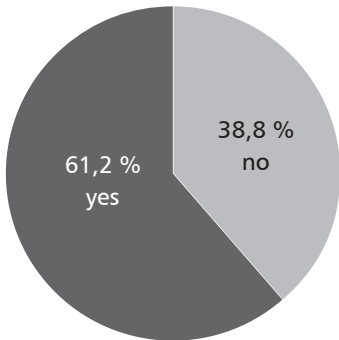
GRAPH 10a
Question 10: Are there any poachers regarding your place of living?

According to answers to this question of male and female respondents, it is noticeable that almost identical percentage of inhabitants of both sexes believes that their place of residence has poachers (Graph 10b). Only 61.3 % of males and 61.1 % of females believe that their place of residence has poachers, versus 38.7 % of males and 38.9 % of female respondents who believe that their place of residence has no poachers.

If you look at the responses from inhabitants of different age classes, we can notice that in all age classes dominate number of positive responses with exception of youngest people age class.

The Graph 10b gives clear difference in attitudes among male and female residents, between those who believe that their place of residence has poachers versus those who consider the opposite.

Analysis of responses to this question indicates on very high percentage of unplanned and illegal hunting, which adversely affects to game population density. For this reason there is a need for greater controls against poaching, which certainly will have positive impact on the number, sex ratio and genetic resources in the catchments areas of game.
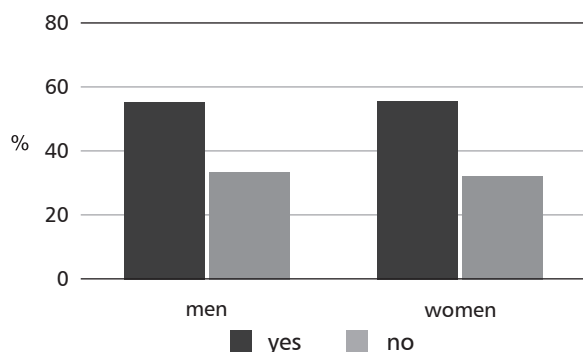
GRAPH 10b
Question 10: Are there any poachers regarding your place of living?

Q11: Do you think hunting could be a part of tourist offer in the state? – Almost two thirds of respondents answered affirmatively to this question, or 64.2 % of them think hunting has potential to be part of touristic offer of our country. In contrast, 13.4 % of respondents believe the opposite, while 22.4 % of the population were not sure if hunting could possibly be part of our tourism offer (Graph 11).

GRAPH 11
Question 11: Do you think hunting could be a part of tourist offer in the state?

The answers are almost identical in both sexes of respondents. The largest percentage of males is with 67.7 % and even 61.1 % of female respondents believe hunting could be part of tourism in the country.

The interviewees from different age classes with exception of residents who are aged 21 to 30 years dominated by negative responses, in all classes the old age classes dominate confirmative response. Positive answer to this question gave the oldest inh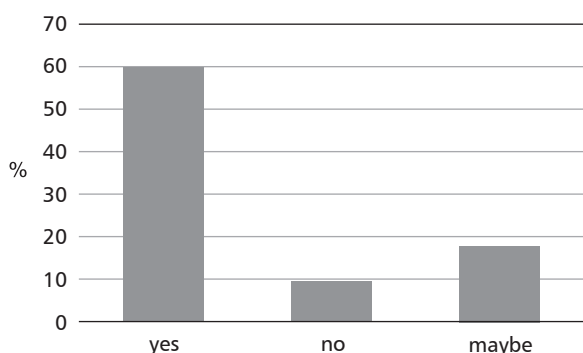abitants. On this issue all respondents older than 61 answered affirmatively. Most negative answers to this question were given by the residents aged 21 to 30 years of which 50.0 % and 33.3 % aged from 41 to 50 years reported they did not consider hunting could be a part of touristic offer of our country. It is interesting that on this issue none of the residents under the age of 20 years and over 51 did not give negative answer.

DISCUSSION AND CONCLUSIONS

The attitudes towards hunting of males and females inhabitants from the surveyed settlements are identical with exception of some questions where there is slight difference between responses.

Therefore, as for instance in position of the motive hunters to hunt, most of the male population stated they hunt for benefit, unlike most women who think they hunt for sport and recreation.

This analysis shows that hunting is quite widespread in this region and almost all respondents reported having an acquaintance or relative who is a hunter. In most of the cases the stories have strong positive impression on the residents. Thus for majority of the respondents this had big influence and initiating desire to try out this kind of experience. In this case it is interesting that despite the big number of males and female inhabitants of this region as well have expressed desire to go hunting. Proof that their acquaintances with the stories have great influence on this desire for going to hunt is the high percentage of affirmative answers to three questions and their positive correlation.

Certain correlation can be noticed between the numerous of respondents with dominant position who think their region has in big part poachers with they who think the game population density is low. According to official data given we can conclude that majority of locals have proper perception regarding these phenomena. By analyzing the answers to these questions it is obvious that the respondents that claim the game population density is low and those who answered that within their place there are poachers, have approximately the same percentage of responses, showing negative correlation between them.

Considering this, we can conclude that a reducing of one occurrence will occur increasing of some other. Therefore, if we want to increase the game population density it is necessary reducing of poaching and unplanned hunting.

In conclusion one could draw that we should pay more attention to younger inhabitants of these settlements, to explain the potential hunting has to attract tourists - hunters in our state.

Hunting as tourist activities at the moment is not consider and treat properly regarding the fact that in Macedonia there are around 30.000 hunters and 256 hunting areas, and hunting areas are populated with diverse game species indicate that on hunting should be look on more different way than the current one.

This research is the first one on this issue in Macedonia. It will be good to be improved and spread in other parts of the country, in order to get a whole picture.

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Forestry and Environment Legislation in Collision – Case Study Serbia

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Abstract

Background and purpose: Conflicts in the Serbian forestry sector have not been very often used as a research topic in our country. This paper presents the results from a case study conducted in the National park 'Fruška gora'. The aim of the study was to explore the collision between forestry and environmental legislation and related institutions and organizations.

Material and Methods: Data were collected from primary and secondary sources. Primary data were collected through in-depth interviews. Interviews were conducted with the managers of the National park and the representatives of the scientific communities, private forest owners as well representatives from the relevant Ministry. The theoretical framework is a combination of the main conflict elements embedded in the structure of the main aspects like culture, conflict management and policy development.

Results and conclusion: According to the interviewees` opinions the roots of the conflict can be found in overlapping jurisdictions of the institutions and organizations in the forestry sector as well as in the implementation of the legislative and management plans. Conflict management strategy is based on sustainable management of protected areas and better implementation of laws.

Keywords: conflict management, National Park Fruška gora, legislative, protected areas

INTRODUCTION

The Countries of South East Europe (SEE) are currently in process of joining the European Union (EU) and strive to become full member states. The process to join the EU requires SEE Countries to integrate updated policy concerning environmental protection [1] and related legislation into the countries' legislative frameworks.

Protected areas are refuges of tranquility and peace, yet they are also places where conflict occurs.

In a world in which the bio-physical environment and socio-cultural systems are changing rapidly, conflicts involving protected areas are inevitable.

There is no single definition of conflict. According to FAO [2], natural resource conflicts can be seen as disagreement and disputes over access to, control or use of, natural resources. Conflict is also defined as a process in which two or more parties attempt to frustrate the other's goal attainment. The factors underlying conflict are threefold: interdependent, differences in goals, and differences in perceptions [3].

According to Hellström and Reunala [4] main conflicts can be caused by: (I) intensification of forestry operations; (II) increased societal needs like recreation, and (III) growing importance of the environmental movements.

Conflict can represent the productive interaction of competing interests and values, an ever-present function in a dynamic society. Conflicts that are properly addressed can be opportunities for problems to be identified and solved, and progress achieved [5]. Many conflicts, when not managed become counterproductive and destructive, leading to detrimental results and hostile relationships.

Protected area staffs are challenged to respond to conflicts so that unproductive consequences can be avoided while human well being and the natural environment are protected. Conflict will always exist to some degree in every community, but it can often be managed and resolved [6, 7].

It is important to emphasize that conflict when managed have the positive impact on relations and even policy development [8, 9]. If conflicts – even intense ones – raise important political concerns, help to keep the administration alert, motivate creative planning and problem-solving and make sure everyone's opinions are heard, they can work as important catalysts for positive social change and development [10].

As the previous research on forest conflicts is limited or non-existent in the SEE region and on the other hand the forest policies in each of the countries are in stages of development, the issue of conflicts can be very significant in identifying the range of interests and related conflicts of different broad stakeholder groups.

MATERIALS AND METHODS

Fruška Gora is an isolated, narrow, low island mountain in Pannonia plain. The area in which is situated is 80 km long. Its location, specific geological history and different microclimatic conditions make it very interesting and important to science. In 1948 the government of Pupils Republic of Serbia founded state enterprise called Pupils excursion-place centered in Sremska Kamenica. The aim of this company was establishment, usage and forest complex management for mass picnics and tours of people, together with other tasks for which the forest management unit is competent. In 1952 the first forest management unit basic document has been done, by terrain section of Ministry of forestry. In that time, localization of excursion places has been done, together with landscape architecture, building of roads, footpaths, drink fountains, desks and benches. In 1960, a law proclaiming the Fruska Gora a National Park (NP) was passed. The borders have largely remained the same till today and mark a territory of 25 520.00 hectares [11].

NP "Fruška gora" was chosen deliberately, because in this type of protected areas overlapping jurisdiction with regard to forest management between sectors of forestry and nature protection is present.

NP "Fruška gora" is obliged to respect several lows, regarding National parks, forestry, environmental protection, water, fishing, hunting, tourism, cultural heritage, planning and construction, geological researching and mining.

Managing of NP is under the several Laws and regulations, such as:
a. Law on National Parks (Official Gazette Republic of Serbia No 39 from 31st May 1993);
b. Environmental protection law (Official Gazette Republic of Serbia No 66/91 and 135/04);
c. Law on Forestry (Official Gazette Republic of Serbia No 30/10);
d. Spatial Plan of National Park Fruška Gora (Official Gazette of Province Vojvodina 16/04 from 27th August 2004)
e. Management Plan (Faculty of Forestry, Belgrade 2006.)

The objectives of this research were to identify the most important conflicts and to deduce are identified conflicts managed properly? This research was conducted at NP "Fruška gora" in Serbia as well parallel similar protected areas in the five countries in SEE region: Albania, Bosnia and Herzegovina, Croatia, and Macedonia. Each country has one or two case studies.

For that reason the specific open questionnaire was designed and executed in all cases [12]. Questionnaire was designed to capture all four important elements of the conflicts (content, procedure, relations and culture) in targeted group of actors involved in management of protected areas (PA), in government and in related conflicts as well. The data collected through face to face interviews was our primary data. Interviewees were employees in institutions directly or indirectly involved management of PAs Target groups were: employees from the governmental institution related to forestry and nature conservation; public enterprises for forestry; local administration; private

TABLE 1
List of the interviewees in the case study NP Fruška gora

No	Organisation	Education
1.	National Park "Fruška gora"	Graduate Forest Engineer
2.	National Park "Fruška gora"	Graduate Forest Engineer
3.	National Park "Fruška gora"	Graduate Forest Engineer
4.	University of Novi Sad, Faculty of Science, Department of Ecology	BSc Ecology
5.	Ministry of Agriculture, Forestry and Water Management, Republic Forest Inspection	Graduate Forest Engineer
6.	Ministry of Agriculture, Forestry and Water Management	BSc Economics
7.	Forest community "Beočin"	Graduate Forest Engineer
8.	Forest community "Beočin"	Vocational school
9.	Forest community "Beočin"	BSc Lawyer
10.	Institute for forest protection, Novi Sad	Graduate Forest Engineer

forest owners association; protected area administration; scientific institutions.

Since this is the qualitative research there is no strict rule defining the number of interviewees. Researchers take account of the saturation and repetition of the same data and answers and based on that define the number of interviews. Number of case study interviews is presented in the Table 1.

The respondents were asked main questions: are there any conflicts in forestry sector, how the conflicts are managed, how should an organization react to the conflict and did conflicts initiate any changes in your organization and policy process [12]?

Beside the data collected from the interviews all additional data related to the specific case study were collected. Additional data included: documentation, archival records, text analysis, interviews and surveys, direct observations, participant observation and physical artifacts. Main source of information about: behavior, opinion and, values were answers to the open questions which were analyzed qualitatively. This was supported with information on knowledge, educational background and demographics characteristic of the interviewees.
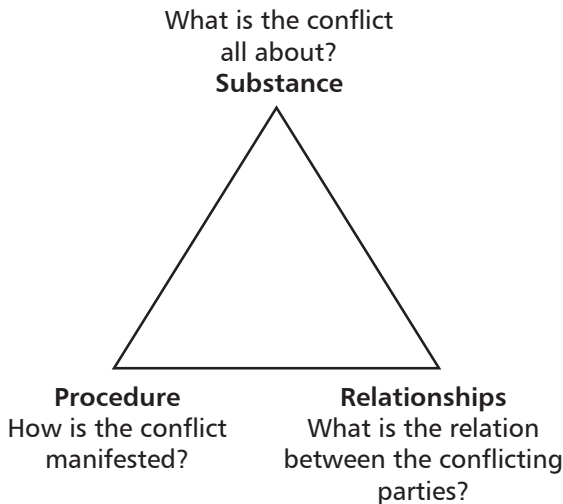
FIGURE 1
Progressive triangle

THEORETICAL FRAMEWORK

Theory defines the conflict in the different ways, using the different terms to explain the word "conflict". The terms such as: struggle, pressure, opposition, aspirations, interaction, cooperation, rivalry, competition are frequently used in the defining of the conflict situation. The theory conflict management framework created by Walker and Daniels [3] includes three elements: substance, process and relations (Figure 1).
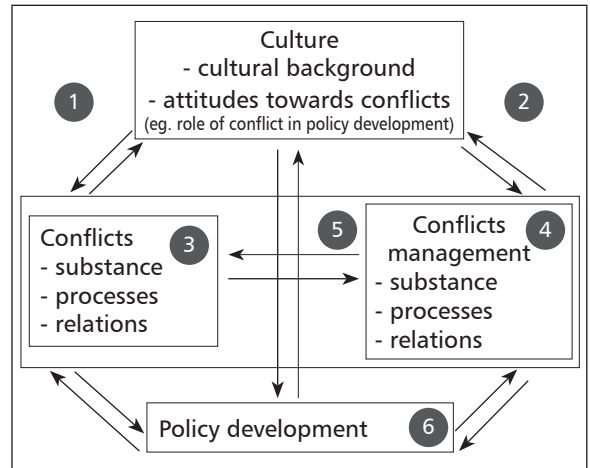
FIGURE 2
Theoretical framework

Three elements of conflict also named Progressive triangle and also occurs during the management of conflict. The substance and process are tangible elements of conflict where the relations are based on the personal way of the understanding things. Theoretical framework used is Walker and Daniels [3] is embedded into theoretical framework of Eeva Hellström [10] adding to the theoretical framework fourth important cultural element (Figure 2).

By recognizing major forestry/environmental conflicts in the country, with its themes, actors and intensity, defining its tangibility, it is possible to portrait also conflict management in a triangle of three interrelated dimensions - substance, procedure and relationships - and it will illustrate a number of things regarding various stakeholder's attitudes toward their view on impact on policy development, in order to allow stakeholders meaningful voice in the process.

Since the factor of the "ideal culture" plays an important role for each stakeholder in recognizing self-interests, it can be applied towards an in-depth analysis of interests.

Upon the basis of improved information a process of "rethinking" is to take place, serving to alleviate the conflict [13].

Conflict management strategies must account for the particular situation in which a conflict occurs. But, complex conflict situations can never be resolved, but they can be managed well, so that the conflict situations do not become destructive. So, the term management is a broad notion that includes, but does not require resolution. It is the way of situation improvement [3].

The role of conflict in actor identity and problem definition: Missing from the discussion so far is the

recognition of the importance and contribution of social conflict in political discussion. Often conflict is viewed as a destructive force that should be reduced or eliminated. However, without conflict actors cannot define themselves. Actors define themselves in relation to others and "other" is recognized through recognition of difference. Thus, the recognition of difference leads to the establishment of boundaries between "self" and "other" [14].

RESULTS

The results are divided into groups of elements determining conflict, conflict management elements as well as cultural background and policy development, issues directly affecting or affected by the conflicts.

1. Conflict and conflict determinants

Regarding theoretical dividing upon conflict elements, the analyses is set in order according to the gathered data and therefore the substance determining issues, the process indicators as well as the relations defining the conflict.

Substance as a conflict element
From the data gathered with the interviews, can be concluded that majority of conflicts arise between public and private sector. Some data regarding conflict elements results and therefore for this case study more data besides substance, as well as conflict stage, its beginning and lifespan, main actors involved within conflict, the jurisdiction over the conflicting issue and the powerfulness of the main actors, presented below within the Table 2.

From the data (Table 2), we can see that conflict have appeared years ago and are still existing. For most of them the causes of appearance are as a result of the new ongoing ecological/environmental initiatives.

positive answer and NP offer a service of the maintenance of the meadow. The price of the service was much higher than the financial solvency of the forest community. Therefore the limit of the right to use the private property was imposed, and in turn the expensive service of the maintained was offered.

Overlapping legislation, struggle for competencies, different interests, values and attitudes of forestry and nature conservation sector is likely source of this conflict.

Common denominators
In NP ''Fruška Gora''case study differing management objectives are the key issue. Therefore, these can refer to the values of the conflicting issues (forestry-nature conservation) and interests of the opposed parties [15].

There are several lows, regarding National parks, forestry, environmental protection, water, fishing, hunting, tourism, cultural heritage, planning and construction, geological researching and mining, to be respected. Beside that the restitution process is about to start and will open new possible areas of conflicts where about 50 % of forest areas should be given back to the old owners. The overlapping of several laws consequently lead to poor law enforcement, which could result with new problems sousing new conflicts. This puts parties on the field in more complex situation that before, without proper tools to manage it.

2. Process

Ministries responsible for protected areas has jurisdiction over the substance of the conflict. National parks are good examples of areas where various and mutually interdependent stakeholders with differing interests and attitudes struggle to achieve their goals.

TABLE 2
Conflict element data

Case study	Conflict substance	Beginning / Duration of conflict	Main actors (stakeholders)	Stage of conflict	Jurisdiction over conflict	More powerful actor
SER-Fruska Gora	meadow maintenance between PFOs and NP Fruska gora	NP proclamation (1960) / Ongoing	NP Fruška gora, PFOA ''Sumska zajednica''	latent stage	Institute for Nature Protection	Institute for Nature Protection

The substance is disagreement about the management of the meadow. The meadow is privately owned by Forest community ''Beočin''. The meadow is favorite picnic place of the citizens of town Novi Sad. On the other hand it is the site of numerous protected and rare herbaceous species. The owners intend to fulfill the tourist offer by proper open-air equipment and other serviceable for tourists. This requirement was sent to the Institute of Nature Protection and to the administration of NP ''Fruška Gora''. There are no

There are significant changes in management of privately owned forests and forest land. The new management plan for Management unit of Forest community ''Beočin'' was made in year 2007.

3. Relations

The main conflict in this case study is between public forestry and environmental sector, public and private sector. The level of trust between the primary

TABLE 3
Conflict management elements data outlined per case studies

Case study	Conflict substance	CM strategy	Primary actors	Power is on the side of	Professional background	Organizational culture	Actor attitudes towards conflict
SER-FRU	meadow maintenance, different management objectives	Avoidance / Competitiveness	NP Fruška Gora, PFOA	NP Fruška gora	NP-foresters PFOA-various	NP –traditional, PFOA-various	NP perceives no conflict. PFOA-traditional

parties in these cases varies from distrust or very low level of trust, and that can be seen from answers of the interviewees in all countries.

Primary parties in conflict are: NP ''Fruska gora'', Institute for Nature Protection and Forest community ''Beočin''. Secondary parties are: Ministry of Agriculture, Forestry and Water Management, Ministry of Spatial Planning.

The conflict is, according to interviewees, in the latent phase hidden from public view. Relations consist of dialogue, cooperation and participation of all parties in management of protected area.

4. Conflict management and conflict management determinants

At the time when the conflict is determined usually subsequently follow up activities towards solving or mitigating the appeared situation. There is variety of activities that can be undertaken in that direction and usually depends on the actor's choices and more or less of the conflict environment attitude and the given situation. Within the Table 3 the conflict management components and the analyzed elements are present.

'The management and solution of the collision between forestry and environmental sector legislation depends to inter-sectoral cooperation. There is obviously lack of collaboration as different view of nature protected area maintenance, process through which parties who see different aspects of a problem can constructively explore their difference and search for solutions that go beyond their own limited vision of what is possible.

4.1. Substance
Evidently there are great number of laws and regulations related to the same area. By interpreting and judging them as such, each of the sectors can in theory justify its activity. In practice, it causes misunderstanding, disagreements and even the open conflict between interests of the Association of Private Forest Owners and nature protection requirements.

4.2. Process
Although the development of transparent and participatory structures for governing natural resources is an essential step, the process side of conflict management is advance stage. The cooperation between administration of NP and Forest Community result in extraction unique forest management unit, privately owned. Management of this specific Unit differs from management of NP as a whole.

4.3. Relations
Conflict management was carried out by Secretariat for Environmental Protection and Sustainable Development who are in the same time stakeholders in the protected areas.

Constructing an environment in which conflicts over natural resources can be dealt with productively will also require new structures and processes for governing natural resources management decisions. Changes to national policies and legal frameworks are needed to accommodate the development of relations between institutions and organizations at various levels. The critical problem is incapacity of stakeholders to provide transparency and accountability to community-based organizations.

5. Cultural background

Employees in PFEs with different professional background as conflict parties show differing attitudes to conflicts. Some of them deny the very existence of the conflict some do find conflicts neither negative, nor completely positive.

Traditional values are reflected in the attitudes of the management of the NP as well as in the attitudes of the members of the Forest community. The interviewees from NP use the phrases about "necessity and superiority of the forestry profession in the management of the protected area" since "only foresters have the sufficient scope of knowledge and skills" which can be appropriately used in the management of the NP. The members of the Forest community emphasize the long tradition in management of same forests.

6. Policy development

In case study there have been no policy changes made, during or after the conflict management. Some improvement with regard to communication is

evident. Application of the forestry legislation often presents a problem for employees in forest sector. The employees in the public institutions, public enterprises, and owners of the private forests, as well as experts from the forestry sector and the domain of environment consider that the forestry legislation is not adapted to the needs of the forestry sector. Also there are opposite opinion that the forestry legislation promotes and supports the sustainable forest management in the appropriate way. More than 70 % of the interviewees emphasized that there are difficulties regarding harmonizing the legal regulation of the environmental protection law with the forestry legislation, or think that the harmonisation is not good enough.

DISCUSSION AND CONCLUSIONS

Origin of the conflicts were related to overlapping or not harmonized law regulative; different way of management of PAs or different property rights. It means that the majorities of conflicts belong to substance part, but in some case studies procedure and relation part were also stressed as components which can improve the substance issue. There was not proper conflict management.

It is evident that there is a great number of laws and sub-legal act which are related with the same area. By interpreting and judging them as such, each of the sectors can in theory justify its activity. In practice, it causes misunderstanding, disagreements and even the open conflict between the forestry and environmental protection legislation, since they are simply used double and impartially as the legal remedy. The views of the people which are in touch with these laws also confirm the theory.

The management and solution of the collision between the forestry sector and legislation which is related to the protected natural resources to a great extent depends upon the inter-sector cooperation, investment in the sectors, as well as monitoring and appraisal of the sectors. The international and regional cooperation becomes a key to the improvement of the legislation and contributes to the investment in the sectors, which is reflected in the connecting of the legal regulations.

IF conflicts are managed, THEN the management of natural resources can become more participative, equative and efficient, rendering benefits to a larger group of stakeholders. Conflicts are actually good, they provide an opportunity to discuss, differ and find common solutions and improve things. If they are not managed then this potential is lost.

Policy processes can be more successful, when they recognize the potential influences of conflicting issues and interests [12].

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Some Indicators of Beech Forests Vitality in the Republic of Serbia in Period 2004-2009

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Abstract

<u>Background and purpose:</u> *Forests monitoring is one of the largest forest bio-monitoring systems that is carried out in order to record changes by using the most important environmental parameters. The National Focal Centre for forest monitoring in the Republic of Serbia, within the Institute of Forestry of the Republic of Serbia has been taking an active part in an international program of ICP Forest, with a view to improving its working activities and harmonizing them with other approaches to monitoring forests and forest ecosystems.*

<u>Material and methods:</u> *In order to determine forest ecosystem processes, it is necessary to carry out detailed research of ecological and socio-economic consequences of forest deterioration and to study the impacts of regional climate changes on forest communities. In the period from 2004 to 2009, observations were performed on 130 sample plots and data necessary for further analysis were collected. These plots are systematically arranged in either a 16x16 km or a 4x4 km grid system. The main parameters assessed on the sample plots are the degree of defoliation and discolouration as well as the extent of damage. A comparative analysis of the data obtained in this period will provide a better insight into the present state of beech forests in Serbia as well the effects of defoliation and discolouration trends.*

<u>Results and conclusion:</u> *Beech is the most common broadleaved tree species on the Level I sample plots. Its health state is the result of adverse effects of complex factors of abiotic and biotic origin (i.e. effects of both living organisms and complex natural processes within the beech forests habitats). This paper presents some indicators of beech forest vitality whose occurrence show certain regularity and which can be interpreted as a trend. The annual values of the health state elements and the fluctuations of these parameters from year to year present important indicators of vitality of beech forests in Serbia.*

<u>Key words:</u> *health state, pollution, crown, beech*

INTRODUCTION

The Level I forest monitoring has been continuously carried out in accordance with the ICP Programme and Manual on the established sample plots – study areas – on the territory of the Republic of Serbia since 2002 [1]. The main objective of ICP Forests is monitoring the effects of anthropogenic and natural stress factors (in particular air pollution) on the present condition and development of forest ecosystems [2]. The Level I forest condition monitoring of this programme mainly refers to observation and assessment of tree crown defoliation and discolouration on certain lots of the sample plots. The main parameters to be assessed are defoliation (percentage of leaf or needle loss), discolouration and damage visible on the trees, caused by many biotic (fungi, insect pests etc.) and abiotic factors [3].

Since the system of forest condition monitoring was integrated into the state forestry environment, under the coordination of the Forest Directorate and

National Focal Centre (NFC) for the forest condition monitoring of the Institute of Forestry, several relevant institutions together with their associates have taken part in the International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests operating under the UNECE Convention on Long-range Transboundary Air Pollution (CLRTAP[1]). The data are collected on more than 6000 sample plots established in more than 40 participating countries, which make the Level I network of forest condition monitoring, systemically arranged in 16×16 km and 4×4 km grid systems across Europe [4].

Forests monitoring is one of the largest forest biomonitoring systems that is carried out in order to record changes by using the most important environmental parameters. The collected data can be used to determine both the spatial and the temporal trends of the forest condition as well as the tree species and the condition of their crown in different regions. A wider context can include the correlation between the crown condition data and the relevant sample plot data or the external data on natural and anthropogenic stress factors, which can tell us a lot about the mutual relationship between the stress factors and forest vitality.

Beech is the most widely distributed tree species in the hilly and mountainous regions of our country (particularly large beech forests occur in South East and East Serbia). It grows individually or within forest ecosystems at the altitude range from 100 to 2100 m. Pure beech forests (both high and coppice) account for 28 % of the growing stock in Serbia, and 16.4 % when mixed with other species.

MATERIAL AND METHODS

In the period from 2004 to 2009, observations and assessment of tree crowns were carried out on 130 sample plots which were established on the territory of the Republic of Serbia, in the grid system of either 16×16 km or 4×4 km. The number of trees per species slightly varied from year to year because some trees were felled and replaced with new ones, while some sample plots were clear-felled, so that in 2009 the total number sample plots was 122. In the final year of the research, the assessment of the tree crown defoliation and discolouration as well as the damage caused by biotic and abiotic factors was carried out on 2765 trees. Beech was the most common species with 841 trees (Table 1).

The researchers from the Institute of Forestry regularly perform field checks of the sample plots within the forest management units in the presence of other forestry experts - forest inspectors, forest engineers

1 CLRTAP Convention on Long-Range Transboundary Air Pollution

TABLE 1
Percentage of broadleaved trees on sample plots in 2009

Species of broadleaves	Number	%
Fagus moesiaca	841	34
Quercus cerris	505	21
Quercus frainetto	362	15
Quercus petraea	168	7
Other species	446	18
Total Broadleaves	2434	100

TABLE 2
Classes of defoliation according to ICP Forests classification

Class	Degree of defoliation	Needle / leaf loss (%)
0	none	0–10
1	slight (warning)	>10–25
2	moderate	>25–60
3	severe	>60–100
4	dead	100

TABLE 3
Classes of discolouration according to ICP Forests classification

Classes od discolouration – chlorosis	Degree of discolouration	Percentage od leaf chlorosis (%)
0	none	0–10
1	slight (warning)	>10–25
2	moderate	>25–60
3	severe	>60–100
4	dead	100

and technicians responsible for particular districts in which sample plots have been established. Within the frame of the national and transnational research (Level I), the crown condition is expressed by the classes of defoliation, discolouration and combined classes of damage. Defoliation is estimated in 5 % steps and grouped into 5 classes of uneven scope width (Table 2). Discolouration is an important diagnostic indicator of the crown condition and can be assessed by the classes presented in Table 3. The combined classes of damage are shown in Table 4. Discolouration is an important diagnostic indicator of the crown condition and can be estimated according to the classes stated in the Table 3. The combined assessment of the defoliation and discolouration of the leaves/ needles is shown in the Table 4.

TABLE 4
Combined assessment of damage according to ICP Forests classification

Class of defoliation - dying	Class of discolouration-colour loss, chlorosis			
	0	1	2	3
0	Resulting class of damage			
	0	0	1	2
1	0	1	2	2
2	1	2	3	3
3	2	3	3	3

RESULTS

Although six years is a relatively short period for a complete statistical data processing in the form of a comparative analysis, the processed data and the values obtained for the classes of defoliation and discolouration can be used to make some conclusions. Therefore, any conclusions made should be interpreted only as conditionally reliable trend.

Deterioration of beech forests, either acute or chronic, has been a problem in a great number of European countries, including Serbia, but also on the North American continent. In our country, a significant deterioration of beech forests was recorded for the first time in 1956-1957 in the eastern parts of the country. There are numerous abiotic and biotic factors which cause forest deterioration. The most critical are certainly anthropogenic impacts (excessive tree cutting and exploitation disturb the natural balance in the forest ecosystems), which has been confirmed in numerous studies [5].

As with defoliation, six years of monitoring and assessing discolouration is a period too short to form a reliable trend in the variation of this phenomenon. However, it can be concluded that in this period of time, beech forests on the analyzed sample plots had a consistent percentage of trees unaffected by discolouration.

The data that represent damage are in function of the first two parameters of health state (defoliation and discolouration). Defoliation and discolouration depend on damage and the three parameters are interdependent.

The trend extrapolated after processing the data on the damage inflicted in this period of time was reliable (a regular pattern of development). In other words, beech forests showed a decreasing frequency of damage in the period of observation and monitoring. The influence of damaging agents is presented in Table 5.

Beech forests showed a slightly more pronounced defoliation in 2008 (84.0 % of trees showed no signs of defoliation in comparison with 2009 when 96.7 % of trees were not affected by defoliation) [6]. The percentage of trees with no signs of discolouration was constantly high at the time of observation. Discolouration was not registered in more than 90 % of trees. The frequency of damage was steadily decreasing in this period and the values ranged approximate as is the case for defoliation and discolouration. The frequency of damage on beech trees in this period was quite uniform.

DISCUSSION AND CONCLUSIONS

Pathogenic fungi and destructive insects are organisms that accompany certain natural ecosystems.

TABLE 5
Causes of damage on beech trees in Serbia in the period 2004-2009

Year	Agent						
	Insects	Fungi	Abiotic	Human	Fire	No damage	Other damage
	(%)						
2004	20.3	3.9	1.3	1.2	0	84.0	1.5
2005	27.4	2.8	0	0.1	0	87.8	0
2006	30.2	16.2	11.1	3.4	0	93.4	1.2
2007	24.7	11.5	6.6	2.4	0	90.2	0.1
2008	11.4	9.2	3.3	1.5	0.5	92.8	2.7
2009	7.2	8.7	0	0	0	96.3	8.0

Because of their destructive activities, one of the objectives of forest management is to control insect populations and to reduce their status to a tolerable level or to a number which cannot cause extensive damage [7].

Collecting these data over a longer period of time and relating them with the stand characteristics will give us a deeper insight into the reasons for forest deterioration both in time and in space.

The sample beech trees were the most vital in the final year of research (2009), which can be both in the case of defoliation and in the case of discolouration explained by favourable hydro-meteorological conditions (temperature and precipitation within the boundaries, without extremes).

FIGURE 1
Galls caused by Mikiola fagi

The present condition of beech forests, both coppice and high, in Serbia is unfavourable. They are degraded, their quality is unsatisfactory, as well as their health condition. It is well known that despite its good technical properties, beech wood is vulnerable and susceptible to the attack of various parasitic and saprophytic organisms. Their activities make physiologically weakened and diseased trees an easy target for the attack of various primary and secondary harmful insect species, which can ultimately lead to deterioration of both individual trees and groups of trees [7].

Approximately 150 species of insects were found and registered on beech trees. They live, grow and feed on different parts of beech trees [8]. Only a small number of them is characteristic only of beech, while the majority can live on other tree species. There are three main groups of insects, depending on the tree part they feed on: I) the insects that suck up plant sap from the foliage and branches, II) the insects that feed on foliage tissue, either on the surface or hidden in the tunnels and galls and III) the insects that live and feed on wood [8]. The first group is represented by the widely-spread *Phyllaphis fagi* L..

FIGURE 2
Damage - Orchestes fagi

The damage to beech leaves caused by insects is mainly by mining and gall making insects. *Mikiola fagi* (Htg.), (Figure 1) makes galls on beech leaves which then become deformed while their assimilation capacity becomes reduced. *Rhynchaenus fagi* L. (Syn. *Orchestes fagi* L.), (Figure 2) or the beech weevil causes damage only in mature beech trees. It reduces the assimilation leaf area and causes physiological weakness of the attacked trees. Furthermore, trees on sample plot 87 suffered considerable damage caused by beech aphids *Phyllaphis fagi* L. (Figure 3), at the time of their swarming.

FIGURE 3
Beech aphids Phyllaphis fagi

Fruiting bodies of the wood-rotting fungus *Laetiporus sulphureus* (Fr.) Murrill (Figure 6) occur on some beech tree trunks. There are some canker-infested areas on the bark and the tree butts are slightly affected by the presence of several different wood-rotting fungi, but only to a smaller extent.

A great number of fruiting bodies of *Fomes fomentarius* (L.: Fr.), (Syn. *Ungulina fomentaria*/Linn./Pat) (Figure 4) was found on the branch litter as well as a small number of Nectria sp.

FIGURE 4
Fomes fomentarius *on beech trunk*

There is also a great number of decayed trees attacked by wood-rotting fungus *Trametes versicolor* (Fr.) Pil. (Syn. *Coriolus versicolor* L. Et Fr.) Quel.) in the vicinity of beech sample plots [9].

Gnarls of non-parasitic origin are the most common type of abiotically caused damage. They appear on the bark of the beech tree trunks and their size can be from a few millimeters up to three centimeters in diameter. They are present in large numbers on individual trees. The greatest extent of mechanically caused damage to young beech trees in this period was done by hail. Frost injured young leaves are a very frequent occurrence too (Figure 5).

FIGURE 5
Frost damage

As the most common tree species in our country, beech is still in a good state of health. However, the above stated damaging agents have threatened its existence in certain localities and made it predisposed to future outbreaks of harmful pests and diseases [10]. Dying or deterioration of beech forests is the result of adverse effects of different abiotic and biotic factors on trees as living organisms and on complex natural processes within forest ecosystems. The agents that belong to one of these two groups (biotic and abiotic) can act either simultaneously or in succession. In order to determine the processes of forest ecosystems decaying, it is necessary to do detailed research of ecological and socio-economic consequences of forest deterioration and to analyze the impact of regional climate changes on beech forest communities.

The assessment of the crown condition, through defoliation and discolouration, as well as the estimation of the damage inflicted to trees by various diseases and pests on the established sample plots in the period from 2004 to 2009 make a notable contribution towards reaching final conclusions about the adverse effects of different biotic and abiotic factors on the vitality of beech forests in Serbia, in the region and throughout Europe [10].

FIGURE 6
Laetiporus sulphureus *on marked beech*

The impact of pollution and climate change on the forest vitality is an apparent phenomenon in Serbia, in the whole region and throughout Europe. It poses pressing issue which has to be addressed both in our country and worldwide.

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Conversion Coefficients for Distilling Wood in Running Standards and Everyday Practice

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Abstract

<u>Background and purpose:</u> *Need for distilling wood is rather significant on the wood market in Republic of Srpska. Delivering of distilling wood is done according JUS standard. Purpose of this research was to explore how much this standard is appropriate for present assortment of wood which deliver and use as distilling wood, and what are main problems.*

<u>Material and methods:</u> *Research was conducted at the premises of the company "Destilacija" a.d. Teslic. It was selected samples of distillation wood in a random manner, so as to check accuracy of conversion factors stated in the delivery note. Subject of interest were loads with one-meter log wood for distillation. Conversion coefficients are determined by using xylometry method and dendrometric method.*

<u>Results and conclusions:</u> *Conversion factor based on xylometry varies considerably between 0.45-58. Results lead to the conclusion that appliance of officially prescribed conversion factor leads to over estimation of delivered distillation wood. Also results of dendrometric measurements and calculating of volume show that conversions factors are significantly lower than those one obtain with the xylometry 0.36-0.52. Main reason for that may laying in the fact that measurements was done according to JUS which prescribes measurement with rounding down for diameter (round centimeters) and length (round decimeters). Dendrometric measurement according JUS is not appropriate for assortments from the category of staked wood. Conversion coefficients must be determined for different moisture content. One solution for described gap may be shift to weight scaling. In that case mistakes caused by measurement could be avoided but it must be considered moisture of wood also. Wood for distilling should be as dry as much as possible before use, around 20 % moisture content.*

<u>Key words:</u> *distilling wood, conversion coefficients, xylometry method.*

INTRODUCTION

Distillation of wood in industrial scale had begun in Bosnia and Herzegovina in 1896. That year had been established Bosnian joint stock company for wood processing (Bosnische Holzvewertungs – Aktiengesellshaft) situated in the town Teslic [1]. Main task of this company was to process 120 000 stacked cubic meters per year of beech distillation wood in charcoal crucible, and to deliver all of produced quantities (around 130 000 metric tons) to the Steel industry in the town of Vares. At that time, industrial plant in Teslic had been among the biggest of it`s kind in Europe, with daily capacity of 400 stacked cubic meters. Apart of charcoal crucible, factory had produced coarse wood vinegar, methyl alcohol and acetone, as well as number of other derivates with provided placement on the world market.

Industrial plant in Teslic sustain to this days, under the name Chemical Industry ''Destilacija'' a.d. Teslic [2]. Annual quantity of processed wood amounted 80 000 solid cubic meters. From this raw material the following items are produced: charcoal crucible, shell (nut) charcoal, acetic acid, powder for hardening steel, acetates, antifreeze, diluents, solvents and other products.

Greater part of raw material comes as round wood between 2 m and 6 m in length. Smaller part comes as one-meter firewood (log wood, billets) in round and split pieces. Round wood is calculated in a solid cubic meter. Single pieces volume under bark is determined according to Huber's Cubic Volume formula. Log wood processed in stump area or by the road-side, is being ordered in stacks of prismatic shape. Log wood is calculated in a stacked cubic meter or stere (stére) which describes a cube with an edge length of 1 m x 1 m x 1 m, including air gaps between

TABLE 1

Review of volume conversion factors for various typed of stocked round wood, used in former Yugoslavia (source [9, 10])

	Types of stacked round wood	JUS D.B0.022 (1984)	Horvat & Krpan (1967)	Gornik-Bučar & Merzelj (1988)
1	Billets (split logs) over bark	0.80	0.70-0.75	
2	Billets (split logs) under bark			0.80
3	Logs (rounds) over bark	0.75	0.65-0.70	
4	Logs (rounds) under bark			0.75
5	Pulpwood debarked			0.80
6	Rough puplpwood (with bark)	0.70		0.70
7	Fire wood	0.69		0.69
8	Small round billets	0.55	0.40-0.50	
9	Stump wood	0.45	0.45-0.50	0.30
10	Forest residues	0.40		
11	Chips	0.37		
12	Bur (burr)		0.50-0.65	
13	Bark			0.30

the woodblocks. Conversion of volume of stacked cubic meters into appromaximate volume of solid cubic meters is conducted by using appropriate conversion factors. According to existing national standard (JUS D.B5.023) [3] distillation wood is equalized with firewood of hardwoods including small round billets (with mid. diameter under bark 3-7 cm), but the share of the later assortment is not prescribed. For these assortments, national standard (JUS D.B0.022) [4] requires conversion factor equal to 0.69 for firewood and 0.55 for small round billets. According to the principle „take it or live it", public forest company calculated common (average) conversion factor equal to 0.65 on delivery.

Considering that Chemical industry ''Destilacija''

a.d. Teslic consumes rather big amount of raw material, there is necessity for an accurate estimation of wood consumption in industrial processes, particularly when it comes to one-meter firewood.

Conversion factors that exists in literature or are in the practical use in other countries differs from conversion factors prescribed by national standard, and as such are not applicable to the local conditions [5, 6, 7, 8]. With that regard, this paper deals with detail analyze of the real volume of distilled wood (i.e. firewood) at unloading ramp, applying dendrometric and xylometric methods. On the basis of such research, authors have come to the novel conversion factors which are more accurate with the real situation. Therefore, the aim of this research was to revise

TABLE 2

Review of volume conversion factors for various shapes of stocked round wood, used in foreign countries (source [11, 12, 13])

	Shapes of stacked round wood	Pirinen (1996)	Kofman (2006)	Jennings (1965)
1	Round wood measuring 2 m in length		0.65	
2	Round wood measuring 3 m in length		0.55	
3	One-meter firewood, neatly stacked	0.62		
4	One-meter firewood, loosely packed	0.40		
5	Firewood in ready-to-burn logs, in round and split pieces, 33 cm long, neatly stacked	0.67	0.75-0.80	
6	Firewood in ready-to-burn logs, in round and split pieces, 33 cm long, loosely packed	0.40	0.45-0.50	
7	Pulpwood debarked			0.75
8	Rough pulpwood (with bark)			0.65

accuracy of conversion factors in use, and to recommend ones that are more appropriate to the field conditions.

MATERIALS AND METHODS

Research was conducted at the premises of the company ''Destilacija'' a.d. Teslic. There we selected 16 samples of distillation wood in a random manner, so as to check accuracy of conversion factors stated in the delivery note. Subject of our interest were only loads with one-meter log wood for distillation.

Survey of standards relevant to distillation wood
There are two national standards dealing with distillation wood: Classification and measuring of unworked and worked timber (JUS D.B0.022) and Heatwood and distillation (JUS D.B5.023); (JUS was an acronym for Jugoslav standards, later renamed with an acronym SRPS for Serbian standards).

According to JUS D.B5.023 (i.e. SRPS D.B5.023) distillation wood is equalized with firewood of hardwoods including small round billets with mid. diameter under bark 3-7 cm, where under hardwoods are considered: beech, hornbeam, oak, locust, maple, ash, elm, field maple wood and fruit trees.

According to the moisture or time after cutting, this wood is classified as a dry (seasoned) if cut at least 6 months before delivery, in winter or in summer, or as a raw (green) if cut less than 4 month before delivery.

According to the shape of pieces, standard differs:
a. Billets: pieces of wood 1m in length, obtained by splitting of round wood at least 15 cm in diameter, with both ends cut by saw. Chord of arc or flat side of billet ought to be 10-25 cm wide. Tolerances of length are +/- 5 cm.
b. Logs: pieces of wood obtained by sawing of round wood, one meter long, with diameter 7-25 cm. Tolerances of length are +/- 5 cm.
c. Small round billets, obtained by cutting with axe or saw, 90-120 cm in length, with diameter 3-7 cm.
d. Bur: gnarled, easy or hard to split pieces of wood, length 0.5-1.2 m, with diameter 25-40 cm.
e. Stump wood: pieces of wood obtained by breaking or splitting stumps, 15-40 cm thick.
f. Wood remains: pieces of wood remain after cutting, sawing, splitting and debarking of wood in forest or at sawmills. Dimensions of pieces vary between 0.5-25 cm in thickness, 2-25 cm in wideness and 15-120 cm in length.

According to the quality, wood is assorted in two classes, the first and the second. In the 1st class the following defects of wood are acceptable: knots of all sizes and types; partially decayed pieces, up to 10 % of shipment; incipient rottenness of wood, up to 30 % of shipment; up to 15 cm distance between the rounded concave longitudinal surface and a straight line joining the innermost points of the surface, spiral grain with no limit.

Acceptable defects for the   2nd class are slightly higher than for the 1st class, as follows: knots, of all sizes and types; sweep and spiral grain with no limits; partially decayed pieces, up to 20 % of shipment; incipient rottenness of wood, up to 50 % of shipment; short pieces, up to 10 % of shipment.

Distillation wood comes in prismatic piles, which volume is expressed in a stacked cubic meter. Conversion of this volume into approximate volume of solid cubic meter is conducted by using appropriate conversion factor (JUS D.B5.023), given in Table 1. For the sake of comparison, in Tables 2 and 3 are given

TABLE 3
Volume conversion factors in dependence of diameter, length and shape of stocked round wood pieces according to Flann (source [14])

Mid. diameter (cm)	15		20		30	
Length (m)	1.2	2.4	1.2	2.4	1.2	2.4
Shape of pieces	V O L U M E C O N V E R S I O N F A C T O R S (m³/stere)					
S O F T W O O D S						
Straight and smooth	0.70	0.69	0.74	0.73	0.78	0.77
Straight, slightly rough and knotty	0.66	0.63	0.71	0.69	0.75	0.73
Slightly crooked and rough	0.63	0.59	0.69	0.66	0.73	0.71
Crooked, rough and knotty	0.55	0.51	0.62	0.59	0.65	0.63
H A R D W O O D S						
Straight and smooth	0.66	0.64	0.71	0.69	0.77	0.74
Straight, slightly rough and knotty	0.61	0.57	0.66	0.64	0.72	0.70
Slightly crooked and rough	0.59	0.55	0.64	0.62	0.70	0.67
Crooked, rough and knotty	0.52	0.47	0.59	0.55	0.61	0.59

(Photo by Dane M.)

FIGURE 1
Wood stacked and prepared for sinking

conversion factors that exist in literature or are in the practical use in other countries.

Upon unloading at the receiving site, each shipment was stacked into prismatic pile. From each load we took three stacked cubic meters of wood as a sample, positioned at the beginning, in the middle and at the end of the pile. Each and every piece of wood was measured in dendrometric sense using traditional formulas of Huber, Smalian and Riecke in order to estimate it`s volume and the volume of one stacked cubic meter of wood. Diameter was measured over bark with manual calliper. One measurement was made for pieces thinner than 20 cm, and two for the others. Diameter was expressed in centimeters, rounded down. Length was measured as the shortest distance between two parallel sides, using meter tape. Length was expressed in meters to one decimal place rounded down (JUS D.B0.022, EN 1309-2) [15]. At the same time, water displacement (xylometry) was used to determine true volumes of observed pieces of wood.

(Photo by Dane M.)

FIGURE 2
Vessel with remaining water

Xylometry is well known in science and in practice. It is based on the simple principle that volume of a body is equal to water mass displaced by it body. There are various methods used with xylometry, measuring the increase in water level, the increase in weight of the xylometer or the decrease in weight of the object, and converting weight change to change

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TABLE 4
General review of collected data

Sample No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Number of pieces in one stacked (m^3)	130	124	114	112	132	127	124	148	80	82	67	63	84	68	54	79
Aver. diameter (cm)	5.7	6.1	6.2	6.5	5.4	5.7	5.8	5.1	8.1	8.0	8.8	9.4	8.0	9.0	9.5	7.9
Percentage of pieces with mid. diameter < 7cm (%)	76	71	72	62	77	68	71	84	37	35	26	29	35	16	13	24
Perc. of pieces with mid. diameter 7-25 cm (%)	24	29	28	38	23	32	29	16	63	65	74	71	65	82	87	76

in water volume [16]. In our case, sampling pieces of wood were neatly stacked into an empty vessel (box) of 1,000 liters, with inner dimensions of 100 cm x 100 cm x 100 cm (Figure 1). Then water was poured into the vessel to the upper level of 100 cm (1,000 l = 1 m^3). After that we took out all the wood from the vessel and measured water level (Figure 2). In fact we determined amount of water that remains in the vessel. This amount of water actually represents air gaps between pieces of wood within one stacked cubic meter. True wood volume was determined as a difference between 1.000 l (1 m^3) and the remaining volume of water. Conversion ratios were calculated as a quotient of 1 m^3 solid and of 1 m^3 stacked.

On the basis of described procedure, we have collected data from 16 samples with 814 pieces of wood in all. General review of collected data is given in Table 4.

RESULTS AND DISCUSSION

Overall results of the experiment are shown in Table 5. As we can see all shipments were assumed as distilling wood of 2nd class to with corresponding conversion factor 0.65 (JUS D.B0.022).

Conversion factor based on xylometry varies considerably between 0.45-0.58, and always is lower than stated in delivery note. This result leads to the conclusion that appliance of officially prescribed conversion factor leads to over estimation of delivered distillation wood. With that regard, there is a need for improvement of existing conversion factor on the basis of reliable data. Also results of dendrometric measurements and calculating of volume show that conversions factors are significantly lower than those one obtain with the xylometry 0.36-0.52. Main rea-

TABLE 5
Results of experiment

Sample Nr.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Conv. factor stated in the delivery note	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Conv. factor calculated byxylometry	0.46	0.48	0.49	0.49	0.45	0.47	0.47	0.45	0.56	0.54	0.56	0.56	0.54	0.54	0.58	0.55
Conv. factor calculated by Huber's formula	0.37	0.39	0.40	0.40	0.33	0.38	0.38	0.33	0.49	0.48	0.49	0.50	0.48	0.50	0.51	0.48
Conv. factor calculated by Smalian's formula	0.37	0.39	0.40	0.40	0.33	0.38	0.38	0.32	0.49	0.47	0.50	0.50	0.48	0.50	0.52	0.48
Conv. factor calculated by Rieckes's formula	0.36	0.38	0.41	0.40	0.33	0.39	0.38	0.33	0.49	0.48	0.50	0.50	0.48	0.51	0.52	0.49

son for that may laying in the fact that measurements was done according to JUS which prescribes measurement with rounding down for diameter (round centimeters) and length (round decimeters). Thus, maximum error due to rounding is 9 mm in measuring diameter and 9 cm in measuring length. Relative impact of these errors on error of volume is as higher as the wood assortment is less voluminous, and vice versa. This simple rule is particularly noticeable with very small assortments such as small round billets.

There are no significant differences between different methods (formulas) of calculating volume. So we can conclude that measurement according JUS is not appropriate for assortments from the category of staked wood. Another important fact which has to be considered is moisture of wood. Volume of wood depends on moisture content. For example row wood (after cut) of beech has 14 % higher volume than dry, wood of oak 11 % etc. That means that conversion coefficients must be determined for different moisture content.

One solution for described gap may be shift to weight scaling. In that case mistakes caused by measurement could be avoided but it must be considered moisture of wood also. Wood for distilling should be as dry as much as possible before use, around 20 % moisture content.

There are a significant number of pieces with diameter below 7 cm (13-84 %) that according to JUS standard are not allowed in the 2nd class distilling wood with conversion coefficient 0.65.

We determined dependence between conversion coefficients and number of pieces, as well as between conversion coefficients and average diameter of pieces. We used correlation and regression analysis.

Examination of relationship between number of pieces in stacked meter and conversion coefficients obtained by xylometry we can say that with increasing of number of pieces conversion coefficients are decreasing. There is very strong dependence represented with coefficient of correlation of R=0.98, and coefficient of determination of R^2=0.96. Dependence is shown graphically (Figure 3) and represent with linear function (1).

$$y = 0,6601 - 0,0015x \quad (1)$$

Examination of relationship between average diameter of pieces in stacked meter and conversion coefficients obtained by xylometry we can say that with increasing of average diameter of pieces conversion coefficients are increasing also. There is very strong dependence represented with coefficient of correlation of R=0.96, and coefficient of determination of R^2=0.93. Dependence is shown graphically (Figure 4) and represent with linear function (2).
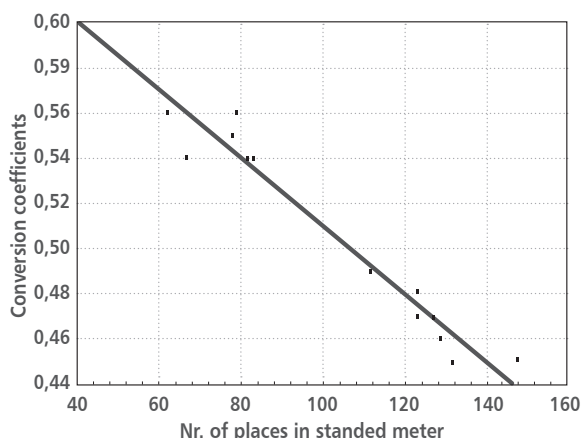
$$y = 0,3044 + 0,0288x \quad (2)$$

FIGURE 3
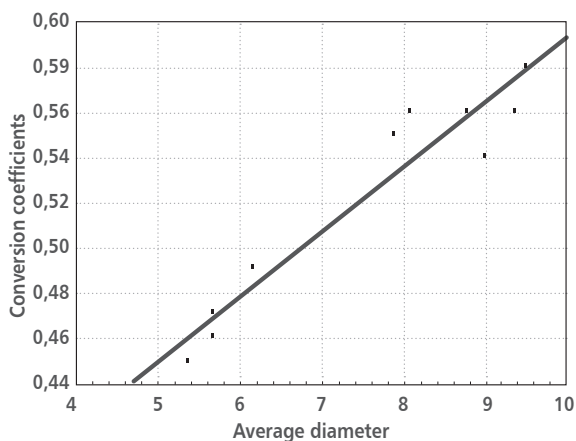*Dependence between number of pieces and conversion coefficients*

FIGURE 4
Dependence between average diameter of pieces and conversion coefficients

CONCLUSIONS

Conversion coefficients are defined in JUS standard and depend on dimensions and shapes of pieces of wood. Results of research show that conversion coefficients by JUS are not appropriate for the wood which appears as a raw material for distilling. Xylometry method show that coefficients should be significantly lower than those one prescribe in JUS standard and used in delivery notes and should be revised. We can conclude that dendrometric measurement is not adequate method for measure of stacked wood. Volume of wood depends on moisture content. For example row wood (after cut) of beech has 14 % higher volume than dry, wood of oak 11 % etc. Conversion coefficients must be determined for different moisture content. Solution could be shipment of distilling wood by weight scaling. In that case wood for distilling should be as dry as much as possible, around 20 % moisture content.

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