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NORWAY SPRUCE PLANTATIONS IN CROATIA: INVESTMENT ANALYSYS AND ALTERNATIVES

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Abstract: *Spruce plantations in Croatia were established mainly during the second half of the 20th century. Reasons were karst afforestation and increase of short term profit. As skiofit species it tolerates high planting density and thus provides high timber volume at the end of rotation. Planting density, spatial distribution, thinning intervals and intensity are key elements of economical management. End of rotation has the most influence on economic result because it is the time of highest net profit. The comparison of one long or several short rotations in the same time period represents different opportunity costs. This paper presents investment analysis in spruce plantations. Revenues and costs are estimated for each tree separately in particular plantation. Using forest growth simulator MOSES version 3.0 optimal rotations have been evaluated based on silvicultural and economic criteria. The results show the most profitable management scenario for growing spruce trees in a defined time period.*

Keywords: capital budgeting, plantations, management scenario, rotation length, NPV, LEV

INTRODUCTION

In Central Europe, Norway spruce has had a long history of cultivation since the middle of the 19th century. This species has been planted intensely thus has changed natural forest into artificial forests and has led to the introduction far outside its natural range. But in many European countries, the choice of tree species is changing. Norway spruce for example has been shifted to be mixed with broadleaves. According to Spiecker (2002), mixed stands have been found to be more resistant against various forms of damage, more diverse in their fauna and flora composition than pure, single-species stands.

Forest management has had a long tradition in the Republic of Croatia, and it is traditionally oriented to the so called close to nature forest management. Major establishment of forest cultures began in the last century with sanation of water torrents, afforestation of lower karst areas (pinus), higher karst areas (spruce) and low land areas with populous plantation. Coniferous cultures cover 1.44% of Croatian forests area, which is 28680 ha in surface (Čavlović 2010). Norway spruce is a species which dominates Croatian forest cultures. Spruce cultures are established on different terrains, from lowland to the mountain areas (Matić 2011). Fast growth wood production from artificial coniferous plantations, became more attractive as a consequence of higher demand for the woody biomass. Forestry as an economic branch has specific tasks in management plans and financial accounting. It is not always possible to respect principles of current profitability, as omission of certain forest interventions can impact the future woody biomass increment and reduce forest value, which can have long term negative consequences on profitability (Posavec 2002).

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Capital budgeting or investment analysis is a decision making procedure about long term investment in a company's business assets, as a long term investment project.

Capital budgeting techniques have been the principal means of analysis of timber investments. These techniques discount the values of costs and returns to calculate present values, land expectation value, cost/benefit ratios or internal rate of return (Zinkhan 2003). It is the process of making a decision about the financial desirability of a project (Dow 2009, Klemperer 2003, Sheffin 2003). Planting density, spatial distribution, thinning intervals and intensity are key elements of economical forest management. End of rotation has the most influence on economic result because it is the time of highest net profit. The comparison of one long or several short rotations in the same time period represents different opportunity costs (Yin 1997). The basic characteristic of an investment is that the benefit is not immediate but postponed in time. Investments are in fact prolonged present expenditures, because of higher expenditures in the future (Orsag 2002, Ravenšćak 2012). Currently prescribed rotation period for natural spruce forests is 80 years, irrespective of stand quality (productivity options), while rotation period for cultures is defined through forest management plan (Annon 2006). There are two main aims of spruce stands establishment: first, ecological aim is habitat development and enabling recovery of natural indigenous forest vegetation; second, economic aim is the highest possible woody biomass production. These goals can be reached through two or more culture generations depending on degree of forest stand quality damage.

Business results and set goals depend directly on the length of rotation period and therefore the aim of this paper is to research possibilities of implementing prescribed natural forest rotation period for use on cultures and defining the most profitable rotation scenario within the 80 year period. The comparison of one long or several short rotations in the same time period represents different financial result. The paper compares profitability of one 80 year long rotation to combined rotations of different lengths whose total is also 80 years (for example, profitability of one 80 year rotation vs. two 40 year rotations).

1 MATERIAL

Spruce is one of the most common and economically important coniferous species in Europe. Its good yield and quality performance on very different site conditions favored this species over a long period (Tjajadi 2010). The center of common spruce distribution are higher mountains of central and northern Europe. Therefore it does not establish important forest zone in Croatia as it is the case with beech or sessile oak for example (Alegro 2000). Norway spruce in Croatia is a species that naturally grows in valleys and frost spots of high mountains in which it does not have serious competition of other tree species (Matić 2011). In total growing stock of Croatian forests, spruce makes 2 380 578.00 m^3, that is 273 m^3/ha. There are 8 363.72 ha of spruce plantations in the Republic of Croatia which makes 30% of total surface of coniferous plantations (Čavlović 2010). Average growing stock in plantations is 109.2 m^3/ha. Object of the research is situated in central Croatia, in the area of largest formation of pure spruce cultures during 1950's and 1960's. Experimental plot is located in the area of Forest district of Karlovac, forest office Duga Resa within a stand (surface 8,73ha) of young spruce culture with other indigenous broadleaved species (common hornbeam, sessile oak) whose growing stock is negligible in comparison to spruce. The trees are healthy, of good quality and uniform dimensions. The terrain is mildly hilly and partly rocky, with altitude oscilating between 165-185 m. An experimental plot of 1 hectare (100x100m) was allocated within the stand. The culture was established 20 years ago by planting four year old seedlings at a distance of 3x3.5 m that allows for later start of thinning. The growing stock measured on experimental plot is 122.79 m^3/ha, and current annual increment 6.5m^3/ha. Mean tree size is 15.5 cm in diameter and 13.2 m in height (crown height is 7.1m). For calculation of mean tree size volume Schumacher–Hall function was used (Schumacher 1933). The researched culture is managed with the 80-year rotation period prescribed for natural spruce forests. In the past, cultures were managed with different rotation period lengths, mostly between 40 and 100 years, depending on stand quality of habitat and defined management aim. Cycle thinning does not depend on rotation period and it amounts 10 years, with first thinning done at 30 years of age.

2 METHODS

Stand value grows over time. To estimate current value of forest stands the method of the present cut value is used (Figurić 1996). Using data of growing stock with assortment tables and price lists for the year 2012, classification by age and worth is made. Price list is available at http://portal.hrsume.hr/. Labor and culture establishment costs in forest exploitation were also taken into account (Anon 2008). The estimated economic value of the existing growing stock and economic value of assortments harvested in thinning is presented in Results. The economic value of forest can be calculated from the selling prices of timber assortments. In this method of determining the economic value, forest is considered as a final product that can be cut and sold immediately. Consequently, this method is often recognized in literature (Figurić 1996) as value of forest stand which is cut and sold at any age. To calculate stand value it is necessary to establish its growing stock and proportion of individual assortments. By using the method of current cutting value, stand value for each 10 year period was calculated. Current condition at 20 years of age was measured on site.

Current growing stock, height, crown height, breast height diameter (BHD) and spatial distribution for each tree were measured on experimental plot (size of 1 hectare) and imported in Forest Growth Simulator MOSES ver. 3.0. (Hasenauer 2000). Models of height and diameter increment used in simulator were constructed for Austrian conditions (BOKU). Its outputs were used as basis for investment analysis in the research. MOSES represents the diversity of age and species in that it is possible to assess consequences of treatment strategies depending on the position of each individual tree within all-aged pure and mixed stands (Hasenauer 1994, Pretzch et al. 2002). It consists of different sub-models (diameter increment, height increment, crown, mortality). The current annual height and diameter increment are calculated depending on the potential height, potential diameter increment and a dynamic growth reduction function (crown ratio) representing changing growth conditions and competition. Potential diameter increment is defined by functions of open growth trees (Hasenauer 1997). In this research, each simulation was done by using the same increment models; therefore the comparison of scenarios between themselves is justified. Prescribed management of spruce cultures instigates thinnings every 10 years which was also done in the simulator. The projection implies establishing next generation in the same year in which the previous culture was cut. The 80 year time frame represents duration time of investment project within which 8 scenarios were defined for research purposes. Simulations comprise 8 different scenarios of culture management over 80 year period. Wood exploitation revenue and expenses were calculated for each thinning and cutting. The shortest used rotation period is 20 years, and the longest 80 years, while 40 year and 60 year rotation was also used (Table 1). The growth scenarios with different rotation periods use projected development from the basic first scenario and are combinations of its elements. The common point to all scenarios are thinnings every 10 years, starting from 30 years of age, meaning that rotation period of 20 years implies 20 years of management without thinning.

Tab. 1 Management scenarios

Scenario No.		1	2	3	4	5	6	7	8
Rotation period combination	[years]	80	40 40	20 20 20 20	40 20 20	20 40 20	20 20 40	60 20	20 60

For each individual tree, assortment structure was established and wood value calculated. Cutting, processing and transportation costs were taken from the company price list of Hrvatske šume Ltd. (Annon 2008). Thinning intensity was determined according to the book of regulations of forest management (Annon 2006) according to which the thinning annual cut of intermediate profit is determined by formula 1 (Klepac 1963).

$$E_m = M \cdot \left(1 - \frac{1}{1{,}0p^l}\right) \cdot \frac{1}{q} \qquad [1]$$

E_m – cut [m^3]
M –growing stock [m^3]
P –current annual increment [%]
l – interval of thinning [year]
q – realization factor

Realization factor (q) is determined by the growing stock and stand age, referring to the proportion of cut against accumulated increment. In case when q=3 there will be cut 1/3 of volume increment in t;he stand from the last management period (m^3). In a stand of normal growing stock, realization factor is directly connected to stand age. In young stand (30-40 years of age) realization factor 2 was used, in middle aged stand (50 years) factor 3, and in ready-to-cut stands (60-70 years) factor 4. First thinning was done at 30 years of age and the last at 70 after which clear cut followed at 80 years of age.The experimental plot is situated at the first site index, which is in direct connection with potential tree height taken from the yield tables for pure spruce cultures of first stand quality (Meštrović 1995). Potential stand quality height is 33m, used as an entry data, and it represents maximum height that a tree can obtain in competition free conditions. This variable is of crucial importance in the work of simulator because it influences the annual net increment.

The basic criteria for evaluating scenarios are Net Present Value and Land Expectation Value where forestry interest rate of 1.5% was used. In economics, the Net Present Value or net present worth (NPW) of a time series of cash flows, both incoming and outgoing, is defined as the sum of the present values (PVs) of the individual cash flows of the same entity (Lin 2000, Klemperer 2003). If the NPV of a prospective project is positive, it should be accepted. NPV is a central tool in discounted cash flow (DCF) analysis and is a standard method for using the time value of money to appraise long-term projects. This method will be used as a major tool in scenario ranking. The Land Expectation Value is the maximum an investor can invest in the land asset and still earn the minimum acceptable rate of return on the invested capital. The decision criterion is to accept the investment if the LEV is positive. LEV is sometimes also called the Faustmann formula. It is the present value, per unit area, of the projected costs and revenues from an infinite series of identical even-aged forest rotations (Klemperer 2003).

4 RESULTS

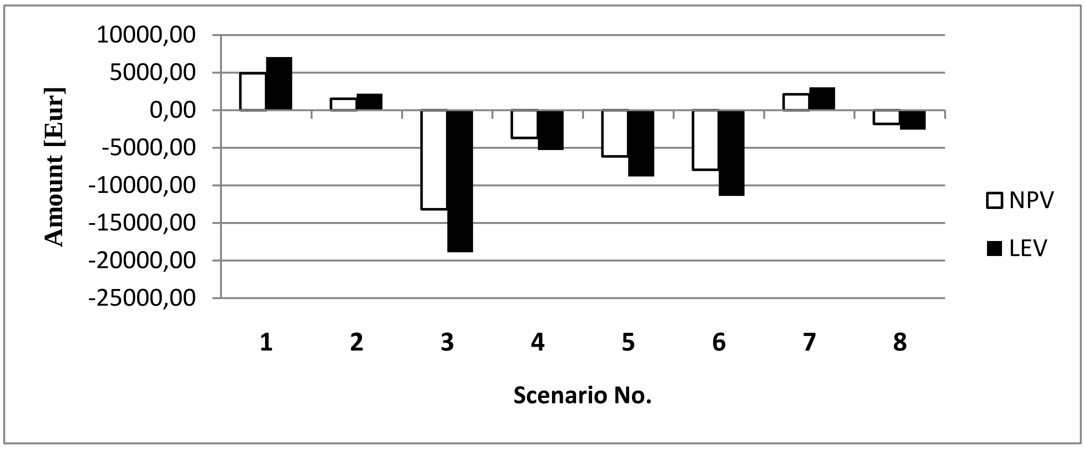
Stand development is projected from 20 years of age until the end of rotation period (80 years). A stand at 80 years of age would have 332 trees per hectare, a basal area of 44 m^2/ha and 622.6 m^3/ha of growing stock (Table 2). Elements of stand structure projected according to scenarios are the result of stand development at a particular age of the first scenario (Tables 1 and 2).

Tab. 2 Stand growth dynamics

age [year]	20	30	40	50	60	70	80
N [pcs/ha]	986.00	904.00	631.00	527.00	435.00	371.00	332.00
G [m^2/ha]	18.60	30.99	33.36	38.19	40.32	41.93	44.24
V [m^3/ha]	125.63	255.63	323.02	420.18	490.59	553.21	622.60
CAI [m^3/ha/year]		13.00	6.74	9.72	7.04	6.26	6.94

Costs of establishing a spruce culture are equal for each scenario and amount to 6492.53 €. Cost-revenue ratio is different in relation to individual scenarios (Table 3). Establishing cost implies the cost of seedlings and the price of labor during afforestation according to sales prices of Hrvatske šume Ltd. (Annon 2008). At the end of the observed period, the highest profit is seen in the first scenario. All scenarios except first include starting costs twice or more (Table 1 and 3). The basic criteria for accepting projects are the positive results value of NPV and LEV methods.

Figure 1 Investment analysis using NPV and LEV



The results indicate that scenarios 1, 2 and 7 are economically acceptable for managing spruce cultures in the future. Economic effects of scenario 3 application would, as expected, be the least satisfactory, owing to short rotation periods and resulting in frequent artificial rejuvenation and negative revenue-cost ratio. It is interesting to note that scenarios 4 and 8 obtain very similar financial results although they differ greatly in the length of chosen rotation periods (Figure 1). The Net Present Value refers to the time duration of an 80 year project, while the Land Expectation Value implies the infinite number of identical projects. Management through application of scenarios referring to combination of short rotation periods (scenarios 3,4, 5 and 6) result in production of assortments of small dimensions and thus of small realizable value. Quantitatively speaking, a larger amount of less valuable assortments is produced in a short time period, but the time preference variable does not have substantial influence on the business result (Figure 1).

Tab. 3 Scenario analyses

		Project age [year]								
Scenario No.	[Euro]	0	10	20	30	40	50	60	70	80
	Net Revenue				1988.82	1253.31	1900.29	1489.38	1420.31	24520.03
1	Afforestation costs	6492.53								
	Net Revenue				1988.82	11272.74			1988.82	11272.74
2	Afforestation costs	6492.53				6492.53				
	Net Revenue			2187.31		2187.31		2187.31		2187.31
3	Afforestation costs	6492.53		6492.53		6492.53		6492.53		
	Net Revenue				1988.82	11272.74		2187.31		2187.31
4	Afforestation costs	6492.53				6492.53		6492.53		
	Net Revenue			2187.31			1988.82	11272.74		2187.31
5	Afforestation costs	6492.53		6492.53				6492.53		
	Net Revenue			2187.31		2187.31			1988.82	11272.74
6	Afforestation costs	6492.53		6492.53		6492.53				
	Net Revenue				1988.82	1253.31	1900.29	18948.54		2187.31
7	Afforestation costs	6492.53						6492.53		
	Net Revenue			2187.31			1988.82	1253.31	1900.29	18948.54
8	Afforestation costs	6492.53		6492.53						

The negative result is due to the fact that short rotation periods do not allow for culmination of volume increment. In Norwegian spruce stands, the culmination of volume increment, or the absolute maturity is reached at 90 years of age (Delač 2012). The third scenario uses the combination of the shortest, 20 year rotation period, at which a stand has not even reached culmination of height increment (Table 1). The first scenario is the most profitable, while the third is the least profitable (Figure 1). The prescribed 80 year rotation period that is practiced in Croatian forestry for natural spruce forests, in this paper described as scenario 1, justifies its use in culture management due to its profitability. All other scenarios that are combinations of short rotation periods are financially less favorable as stands do not reach the age of absolute maturity.

5 CONCLUSION AND DISCUSSION

Investment in spruce culture with its cultivation characteristics is financially justified. Cultures of short rotation periods offer possibility of higher turnover in shorter time period, increasing cost effectiveness of an investment. It is particularly useful in conditions of small contribution of cultures in total forest surfaces, with the aim of reviving of indigenous forest vegetation to degraded stands and afforestation of abandoned agricultural areas.

Investment analysis suggests forest management by using the first scenario. Other scenarios that use rotation periods closer to the absolute stand maturity are more profitable as a result of maximum average increment in the analyzed 80 year period. Average log diameter also has a significant influence on wood value, i.e. the average diameter that increases profitability of longer rotation periods because they are closer to the economic maturity or maximum growing stock value.

Besides the current woody biomass production potential in state forests (2.6 mil m^3), there is an opportunity for production increase through establishment of new fast growing forest cultures at 180 000 ha on average. Forest biomass exploitation for energy purposes in Croatia could have multiple socio-economic benefits and represents a possibility for rural development. In this context, the evaluation of scenarios was done solely based on revenue from wood value, with assumption that ecological benefits are equal for all scenarios. But it is also a known fact that longer rotation periods benefit increase of biodiversity and non wood forest functions (Hartley 2002).

Further investment analysis is possible in direction of analyzing particular investments by forest management segments. It is possible to explore cost effectiveness of longer/shorter thinning rotation period application. Thinnings done on young stands are not cost effective, because labor and machinery costs overcome sales revenue of wood assortments, and they can be avoided by planting a smaller number of trees by surface unit. On the other hand, application of thinning on young stands, as well as investing in branch pruning, results in production of more valuable assortments at the end of rotation period. In this paper, investment analysis until 80 years of age was researched, but it is necessary to explore possibilities of cutting age prolongation for spruce cultures.

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MODELS OF FINANCING FOREST ECOSYSTEM SERVICES IN THE FEDERATION OF BOSNIA AND HERZEGOVINA, CROATIA AND SLOVENIA

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Abstract: *As renewable natural resource, forests are public good that provide various types of products and services for the society. From the products that can be market valorised, public forest enterprises and private forest owners generate revenues, participate in GDP, contribute to the employment and rural development. They are also obliged to pay a certain fees as a compensation for usage of forests in accordance with forest legislation.*
Apart of material benefits, forests continuously secure various immaterial benefits for society, in literature and practice known as forest ecosystem services. The countries, whose models for financing forest ecosystem services are analyzed in this paper, had been created as a result of dissolution of former Yugoslavian Federation. Along with the establishment of new socio-economic and political systems in these countries, different models for financing forest ecosystem functions have been created and continuously improved at the national level. This paper deals with comparative analysis of these financing models in order to identify good practices and analyze possibility of their application in specific national forest policies` context.

Keywords: forest ecosystem services, financing models, forest policy, Federation of Bosnia Herzegovina, Croatia and Slovenia.

1 INTRODUCTION

The forest is a renewable natural resource providing many benefits to the society (Mavsar *et al.*, 2008; Kengen, 1997). These benefits are twofold. The first group refers to the direct or manufacturing uses, i.e. material goods in the form of various timber products, and many of the non-wood forest products. Such benefits can be market-validated. The second group of forest benefits results from the usability of the forest as a natural phenomenon. The forest provides both material and intangible benefits which people can enjoy. The material benefits are reflected through the forest contribution to the development of other economic activities such as tourism, hunting, agriculture, water resource management, energy sector etc. (Delić and Bećirović, 2012). Intangible benefits are reflected through a positive impact on human health by ensuring a clean and fresh air, water, macro and microclimate factors regulation, providing an opportunity for recreation in order to improve the physical and mental state of man, land and settlements protection from various natural disasters, and to meet people's cultural and aesthetic needs. There is no market for these services, so paying for them is difficult to determine (Mavsar *et al.*, 2008; Willis *et al.*, 2000; Mayrand and Paquin, 2004). The complexity stems from different perceptions of forests in certain societies, cultures,

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traditions, thus the same functions have different values in different communities. The countries that are the subject of this analysis had been created as a result of dissolution of the former Socialist Federal Republic of Yugoslavia. In the early 1980s, there was an attempt to establish a system of financing the services of forest ecosystems by including other indirect beneficiaries. Such attempts did not give the best results but they were important for the development of subsequent models based on the law (Delić, 2006).

Through the analysis of forest ecosystem services financing mechanisms in the Federation of Bosnia and Herzegovina, Croatia and Slovenia, the evolution of the common model occurring in accordance with the socio-economic trends of individual states was considered. Up to now, the models have not been compared so the purpose of this research is to obtain information about the different possibilities of resolving this issue and identifying the best practices to improve one's own model. This paper presents a review of certain models and a brief overview of their functioning in practice.

2 MODELS OF FINANCING FOREST ECOSYSTEM SERVICES

2.1 Historical Overview

The issue of forestry-funding in the former Socialist Federal Republic of Yugoslavia was diverse and in accordance with the socio-economic trends. Originally, the administrative-budget form of financing forestry, with full powers of the state was effective and, withal, included the Fund for the promotion of forestry. Funds raised by the Fund were intentionally used for financing the basic forest cultivation work, especially when financing could not be done out of current operations (Šaković, 1980).

Later, the forestry enterprises, as forests users, made a shift to self-financing. In order to find ways of financing and investing in forestry, different economic and non-economic categories were defined (forest depreciation, depreciation for forest regeneration and means for forest reproduction). The 1980s brought an awareness of the economic, ecological and social significance of forests, thus involvement of the other beneficiaries in the process of forestry-funding in addition to forestry enterprises was promoted. Primarily, these were companies from the wood-processing industry, energy and water sector, as well as local communities and the State (Official Gazette SRBiH No. 6/75, 20/78; Forestry Program B-H, 1986). Consequently, new sources of funding were reached. The purpose of these funds was bare lands afforestation and improvement of degraded forests. Raising and using these funds did not give the expected results (Delić, 1991; Vuletić *et al.,* 2010). The absence of market elements and administrative pricing, political interference in the economy, and then the concept of organization, are just some of the problems having a negative impact upon the financial policy (Delić, 1991).

After the dissolution of Socialist Federal Republic of Yugoslavia, the former republics split-up into independent countries with the established political and economic systems building their own models of forestry funding.

2.2 Analysis of Financing Models in Federation of Bosnia and Herzegovina

Following the Dayton Peace Agreement and the administrative division of Bosnia and Herzegovina to the two entities, the Federation of Bosnia and Herzegovina (hereinafter Federation of B-H) and the Republic of Srpska, forests as natural resources are under the jurisdiction of the entities. Therefore, this field is regulated on the basis of the entities' forest laws[2]. Legislation of the both entities defines forest functions as the environmental, economic and social. The Ecological functions include the conservation of biodiversity, habitat and land protection, water protection, climate role, and the role of forests in carbon sequestration. The production of wood and non-wood forest products (NWFPs) comes under the economic functions. The social functions are defined as following: recreation, tourism, education, research, defense, infrastructure and buildings protection, etc. With the development of multifunctional forestry concept, a mechanism of financing the usage of products and services was defined.

According to the Law on forests (Official Gazette Federation of B-H, No. 23/02), as forest users, the forestry enterprises were obliged to allocate funds for the basic reproduction in the amount of 15% of their total revenues. These funds finance all the activities of forest-biological measures in order to ensure the sustainable management of forest resources (Article 26). Additionally, they allocated 3% of revenues for the extended reproduction in order to re-forest bare lands and improve the overall beneficial functions of forests (Article 27). This law established the obligation of paying the fee for using the beneficial functions of forests in the amount of 0.1% of the income, by all legal entities registered in the Federation of B-H, except the forestry enterprises (Article 60). The means of extended reproduction and the abovementioned fee could have been used for bare land afforestation, forest regeneration, scientific research, construction of forest roads, certain silviculture and forest-protection measures as well as nursery production.

The Forest Regulation changed the way of regulating this issue (Official Gazette Federation of B-H, No.83/09). According to the Article 47 of the abovementioned Regulation, forestry enterprises are obliged to pay a fee for using forests in the amount of 7% out of which 5% is for local-community development, 1% for the budget of the Federation and 1% for the budget of the cantons. Furthermore, this Regulation prescribes decreased value of fee for the beneficial forest functions in amount of 0.07%. Forestry enterprises, public institutions, humanitarian organizations, associations and foundations are relieved from paying the fee (Article 48). The accounting and payment is controlled by the forestry inspection. These funds can be used for making and revision of the National forest program, conducting forest inventory, preservation and protection of forests, the management of protective forests and special purpose forests, improving the production of forest reproductive material, preservation and enhancement of biodiversity, scientific research, etc. Adopting the new Law on Forests is in the process with the same proposal of paying fee for beneficial functions.

The total amount of collected funds raised on the basis of paying for beneficial functions increased slightly in the period between 2003 and 2011. However, funding for beneficial forest functions have not been collected to the amount that can be achieved. According to the estimates, 40% of the given amount was collected on average by 2008. Moreover, 61% of the collected funds under the Program of incentives for forestry (Delić *et al.*, 2011) were spent purposefully. Using the funds purposefully and transparently would significantly improve the state of the forests, built and rebuilt forest infrastructure and other activities improving the situation in the field of forestry (The information on forest management…, 2011). The financial police and forest inspection controlled payment for using beneficial forest functions. A positive step has been made by the issuing of the Forest Regulation which states that tax administration also controls the payment accounting in addition to forestry inspection. Neither the reasons for non-payment of these obligations or taxpayers' opinions on this issue which should be the subject of future research, have not yet been explored.

[2] Federation B-H is the subject of analysis in this paper

2.3 Analysis of Financing Models in Croatia

Croatian Forest Law from 1990 introduced system of paying for the use of beneficial forest functions by all legal entities registered in Croatia in the amount of 0.07% of their total revenue. Companies engaged in forest management were not required to pay this tax. The collected funds were paid into a special account of Croatian Forests, the public forest enterprise. In the meantime, this public forest company transformed into Limited Liability Company (Croatian Forests Ltd.) and a new Forest Law was enacted in 2005 (Official Gazette Croatia, No.140/05). This law clearly defined beneficial forest functions: soil protection from erosion caused by water or wind, water balance and prevention of floods and high water waves, water purification by filtration through forest soil and contributing to sources of potable water, positive impact on climate and agriculture, air purification, influence on landscape beauty, creating favorable conditions for human health, providing space for recreation, contribution to development of forest based tourism and hunting, secures gene fund of forest species, protection of diversity of species, ecosystems and landscapes, supporting general and special nature protection (national parks etc.) of forest landscape, mitigation of "greenhouse effect" by carbon sequestration and provision of oxygen, enhancement of human environment, protective function in a case of war operations and contribution for development of local communities (Article 3).

This law brought no changes regarding the payment for the usage of beneficial forest functions. The Financial Agency controlled the payment and accounting of all the funds based on the financial report and interim closing. If the taxpayer does not fulfill this obligation, the Financial Agency can collect payment from the taxpayers' funds deposited at commercial banks. The funds of the beneficial functions can be used for: financing of forest regeneration, forest protection, management of forests in karst areas, restoration of forests threatened by dieback and diseases, forest roads' construction, mine sweeping, protection of gene diversity, establishment of clone plantations, forestry-based scientific work, and forest management programs for private forest owners (Article 64). The Enterprise is obliged to send annual report on tax collection, its distribution, as well as a planned distribution for next year to the Croatian Parliament. As part of a government program supporting small enterprises, the amendment to the Forest Act from 2006 relieved small business owners from paying this fee. Significant changes occurred in 2010 when the Government reduced the amount of fee payment for the beneficial functions by 25%. The amount was reduced from 0.07% to 0.0525% of the total revenue. This measure is part of the economic program for recovery from the recession (Vuletić *et al.,* 2010). The final law changes referring to the additional decreasing of the beneficial forest functions fees for 50%, i.e. to 0.0265% of the total revenue, occurred in 2012.

Although the trend of raising funds was increasing, the lack of control resulted with insufficient collection, especially in the initial phase. The decision to reduce the percentage of allocation certainly affected the total amount of raised funds. The taxpayers have strongly criticized the introduction of the obligation of paying for the beneficial functions considering it as a purely political decision. Many taxpayers are not informed enough; do not know the purpose of the payment or how funds are distributed and hold it unnecessary to pay this tax (Vuletić *et al.,* 2010).

2.4 Analysis of Models of Financing in Slovenia

The current system of financing forestry and with forests connected fields was formulated in 1992 and 1993. In Slovenia, forest management is defined by the Law on Forests (Official Gazette of Slovenia, No.30/93, 13/98, 56/99, 67/02, 110/02, 115/06 and 110/07) and National Forest Program (NFP) (Nacionalni gozdni program, Official Gazette of Slovenia, No. 111/07) which is a fundamental strategic document, aimed to determine the national forest policy. Both, the Program and the Law provide the conditions for sustainable and multifunctional forest management in accordance with the principles of environmental protection and functioning of forests which includes environmental, social and economic aspects. Forest functions, by the Law on Forests, are as follows:

- Ecological: the protection of forest plots and stands, hydrological, biotope and climatic functions.
- Social: protective function (such as protection of infrastructure), protection of the natural and cultural heritage as well as the other aspects of the environment, recreational, touristic, educational, research, hygiene-health functions, defence and aesthetic functions.
- Productive: timber production, utilization of other forest resources and game management.

In order to maintain these functions, Republic of Slovenia allocates funds from the state budget for the following forestry-funding aspects: public forestry service, investments in forests, systematic maintenance and construction of forest roads, and improvement of knowledge related to forests. Mainly due to the ownership structure (predominance of small and fragmented privately-owned forest parcels), which is typical for Slovenia, state provides a permanent professional consulting and assistance for the owners. These activities contribute to the fulfilment of the expectations and demands both from the general public and owners, so that their interest can be achieved without permanent damage of the forest. Furthermore, it defines a set of measures that ensure ecological, social and productive functions. The Law on Forests defines a set of property rights and prohibitions (Articles 5, 17, 29 and 49), but it also provides a system of (co)financing (Article 46 and 48).

The (co)financing funds are provided in the budget of the Republic Slovenia according to the annual plan for forest investments, arranged by public forestry service on the basis of the NFP and silvicultural plans. With respect to the state forestry-funding, the Law on Forests (Article 48) defines that these funds should be provided for public forestry service, planned activities in protective forests and activities in privately owned forests that belong to the high-risk torrents areas. Onward, the same Article regulates financing of the measures whose implementation must be ensured by the Forest Service. In accordance with Article 46, Article 48 regulates compensation, re-compensation and the purchase of forests which Republic of Slovenia declares as protective or forests with special purposes, implementation of measures for the protection of forests against fires in karst and preventive-suppressive action. Furthermore, Article 48 defines that the co-financing funds should be provided for forest-environmental measures and measures within Natura 2000, silviculture and protective works and works for maintaining the wild animals habitat in the privately owned forests or in the forest land, preventive care measures for groups of forest trees or individual forest trees on the non-forest land outside the settlements, reforestation of burns and forests damaged by natural causes, forest nursery and plantation activities, research and development activities in forestry, reclamation and conversions in private forests, construction and maintaining of forest roads, investments for the improvement of conditions for obtaining and marketing forest products, initial activities of forest owners associations established on the basis of contractual obligations or Law, popularization of forests and forestry.

The management of these funds from the budget for (co)financing of forests is carried out in accordance with the Order on the financing and co-financing of investments in forests from the budget of the Republic of Slovenia (Official Gazette of Slovenia, No. 71/04, 95/04, 37/05, 87/05, 73/08, 63/10). The Order defines in more details the activities within the program of investment in forests that are (co)financed in the private and municipal forests (Article 12) and state forests (Article 13). Furthermore, the Order sets out ways of raising budget funds, share of (co)financing for each activity depending on the functions intensity level defined in the forest management plan and methods of calculating costs and the highest cost per unit.

Allocation of the budget for (co)financing of investment in the period between 2007 and 2011 had a downward trend (from € 3.176 million in 2007 to € 2.698 million in 2011). These funds were almost fully utilized - 98.4% of available funds were used in 2011. In 2011, the Public Forestry Service covered only 65% of the forest investments with the available budget sources which were planned in the program of work and investment in forests for 2011. In 2011 the total budget for forestry sector was 26.3 million €, out of which 81.76% was allocated for public forestry service, 10.05% for regeneration, tending and protection of forests, 4.68% for forest roads maintenance and construction and 3.49% for accompanying measures in forestry (Report on the state…, 2012).

3 DISCUSSION AND CONCLUSIONS

The analysis of the models of financing forest ecosystem services in different countries shows that in case of Croatia and Federation of B-H, the models based on the same principle are applied. The models differ only in the percentage of forest users' allocation. These models are based on political decisions without a proper economic analysis. Croatia has a longer tradition of applying this model (for over 20 years) but it has transformed over time with a tendency of decreasing the percentage of funds. Reasons for reducing the funds have not been explored. However, based on the taxpayers' opinions that this is an additional levy and an unnecessary burden to the economy, it presumably puts certain pressure on the government. It is believed that a more extensive research should be conducted on this issue in order to give arguments and justify the existence and application of this model (Vuletić *et al.*, 2010).

The model of financing forest ecosystem services in Federation of B-H was created after the Croatian model. The model had started with a higher percentage of allocation that, in the meanwhile, has been reduced. Still, this percentage is higher than in Croatia for about 2.5 times. The high amount of unpaid funds points to two problems: lack of control, and taxpayers' dissatisfaction over paying. When it comes to the control and supervision, a step forward has been made in collecting and spending of the beneficial forest functions funds because subsequent decisions introduced the mandatory payment. The research on taxpayers' opinion on this issue has not been conducted yet. However, based on the analysis of the collected funds, there is an obvious lack of the payments by the economic entities, especially large ones. The purposeful and transparent use of the funds would remove doubts about the correctness of the decision on the appropriate allocation of resources, especially in companies that indirectly benefit from the forest ecosystems (energy sector, water power management, tourism, hunting, etc.).

Forest financing system in Slovenia is completely different and is based on the budget which (co)finances all the activities planned by the Forest investment program. Hence, there is no special form of financing forest ecosystem services but the importance of ecological and social functions is taken into account when deciding on (co)financing. This model is well designed but due to the lack of budget funds it is not fully operational. On the other hand, the state should use legal instruments to oblige forest owners to fulfill the obligations according to the Law on forests. Obviously, it is possible to enforce forest owners to accomplish measures prescribed by administrative order in their forests but forest administration avoids using this tool. Models of financing in the analyzed countries are in accordance with the socio-political and economic systems of analyzed countries. Therefore, one can conclude that the higher the level of economic development is the more realistic possibility of forestry-funding through the state budget should be. On contrary, solutions are based on imposing the new taxes which leads to their higher percentage in economically weaker countries. This is logical, given the need to secure resources for the sustainable management of forests. A detailed analysis of the functioning of the individual models, problem-identification in their application, conducting a research of public opinion on the forest ecosystem services could significantly contribute to the identification of best practices and examples of their application in the concrete realities of national forest policies in line with the European and world trends. The future researches should be based on these grounds.

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Competitiveness of Forestry in the Czech Republic

Roman Dudík[1]

Abstract: *In this article competitiveness is viewed from the perspective of financial support for forestry in the Czech Republic. Attention was focused on financial support, in the form of direct subsidy payments, to land owners and managers. The main financial source considered is the Rural Development Programme of the Czech Republic for 2007-2013. This source of finance was designed and delivered in accordance with the European Commissions regulations for Rural Development and contains measure I.1.2 named Investments in Forests. The measure is targeted at supporting the purchase of forestry machinery, improving the technical utilities of forestry businesses and the improvement of forestry infrastructure under specified conditions. An analysis was made of the drawdown of funds under this measure in the period 2008-2011 with regard to the legal status of individual subsidy recipients and their geographic distribution.*

Keywords: subsidy, forestry, investments in forests, forest property, Czech Republic

The issues connected with the payment of subsidies, to forest owners and managers, from public sources are numerous and have already been dealt with, for example, by Klarer (1999), Niskanen (2007), Šišák (2007) or Dudík (2008, 2012).

This paper is limited to a consideration of the public subsidy support of competitiveness of forest properties and thus also the wider forestry sector. Financial support from public sources is taken into account as a form of aid. In the Czech Republic certain categories of owners and managers of forest properties can submit an application for project funding from the Rural Development Programme of the Czech Republic (in the following text referred to only as the Programme). The Programme, specifically measure I.1.2, is financed by a 75 % contribution from EU sources and by 25 % from national sources. Support of competitiveness of forestry in the Programme is supported within the measure *Investments in Forests*.

1 Ivestments in forests in the Czech Republic

Measure I.1.2 – Investments in Forests – of the Programme is limited to three areas of project activity: purchase of forest machinery, technical utilities of business establishments and improvement of forestry infrastructure. The following Mission and objectives for these three areas describes the Programme as it has been constructed for the specific needs of the Czech Republic.

Objectives of the measure I.1.2 (MA, 2008):

- Increased diversification, and widening of market opportunities.
- Improving the processing and marketing of raw materials.
- Improving the infrastructure.
- Using market opportunities thanks to innovations.
- Restructuring and development of technical potential and support for innovation processes.
- Increasing the competitiveness.

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Type and amount of support (MA, 2008):

- Type of support: direct non-repayable grant.
- Method of financing: co-financing
- Amount of support: The support shall be provided as a contribution to cover a part of the eligible expenditure incurred, at a maximum of 50 % of eligible expenditure for machinery and technical utilities. Forestry infrastructure – at most at 100 % of eligible expenditure.

Example of conditions for the granting of support – forest machinery (2007):

- The support shall only be provided for investments that are in compliance with forestry management plan.
- The support shall only be provided for forest holding of minimum area 3 ha.

Eligibility rules are very important for processing individual projects. These rules are published under individual calls for funding applications and they are explicit about which measure the call relevant to. It is interesting to note the extent to which eligibility rules for the first call were expanded by the time the final call was issued. Complex analysis of the changes in eligibility rules, and the justification for them, would exceed the scope of this article and therefore we will focus only on the expenditure that is deemed ineligible for subsidy payments.

Ineligible expenditure under the first call (October 2007):

- purchase of used machines and equipment.

Ineligible expenditure under the current call (September 2012):

- purchase of used machinery and equipment,
- training of the operator of the purchased machinery, spare parts for acquired machines and protective equipment,
- machinery and equipment for sawmill processing,
- wood harvesters and wood harvesters with forwarder,
- four-wheeled vehicles for personnel including, cars, trucks, pick-ups and double cab pick-ups,
- electrical power generators and also machinery and equipment, that must be connected to an electrical power source,
- applicants with cultivated forest lands equal to 15 hectares or less – are not eligible for support against expenditure, that can be supported by subsidies, code 003 (compact tractor),
- applicants with cultivated forest lands equal to 250 hectares or less – are not eligible for support against expenditure, that can be supported by subsidies, code 002 (universal wheeled tractor), code 014 (self-propelled loader) and select from codes 017 and 018 (backhoe, excavator, truck),
- applicants with cultivated forest lands equal to 500 hectares or less – are not eligible for support against expenditure, that can be supported by subsidies, code 001 (skidder, forwarder),
- applicants with timber harvesting less than 100 000 m^3 with the next 10 years – are not eligible for support against expenditure, that can be supported by subsidies, code 004 (log truck),
- activities related to regeneration after final felling,
- in some cases VAT - see rules.

From the above comparison of eligibility criteria in 2007 and 2011 we can see, that the conditions (in the areas of ineligible expenditure) for project funding were tightened up considerably over the period. This could be portrayed as being unreasonably restrictive for forest owners and other potential applicants for subsidies. However it is important to take into account, that in October 2007 the main eligibility requirement was, that the applicant had to manage a 3 ha minimum size of forest property. This undemanding eligibility requirement was taken advantage of by applicants for subsidy, who also operated in the market as suppliers of services to other forest owners. This led to a situation where harvesting machinery was being purchased with as much as 50% public subsidy and then hired out to other forest owners at rates which were able to under-cut the competition because of the abnormally low financing costs for the machinery. This relaxed approach to funding eligibility had the unintended consequence of undermining open competition in the forestry contracting sector in certain localities and a tightening of the rules was necessary.

2 DRAWING OF SUBSIDIES IN THE CZECH REPUBLIC IN 2008-2011

Although applications for funding only started in late 2007, because of delayed approval of the Rural Development Programme for the Czech Republic, money from public sources was in fact paid out in 2008. When evaluating the payment of subsidies in this period the legal status of applicants was also taken into account. Out of 25 possible different legal forms of applicant, 7 groups were created: natural persons (individual entrepreneurs), registered companies, cooperatives and associations, foreign persons (individual entrepreneurs – not Czech), state and related organizations, municipalities and funded institutions, others.

State subjects were excluded from funding, under the sub-measure Investments in Forests, from the opening of the Programme in 2007. The groups which did draw down funding from 2008 to 2011 were: natural persons, registered companies, cooperatives and associations, municipalities and funded institutions. It is important to say, that applicants had to confirm that the payments they received from the Programme would not aggregate to exceed the „de minimis“ funding threshold for State Aids in the European Union. In practice this means, that over a rolling four year period they cannot receive payments from public sources of more than 200 000 EUR (5 372 000 CZK). Exchange rate: 1 EUR = 26,86 CZK (SZIF, 2007). This should limit the maximum payment under measure I.1.2 to 200 000 EUR for an individual applicant.

Table no. 1 shows subsidies paid out to the forestry sector under measure I.1.2 Investments in Forests of the Rural Development Programme of the Czech Republic in 2008-2011 with regard to the legal form of individual applicants.

Tab. 1. Subsidies drawn under measure I.1.2 Investments in Forests in 2008-2011 (mil. CZK)

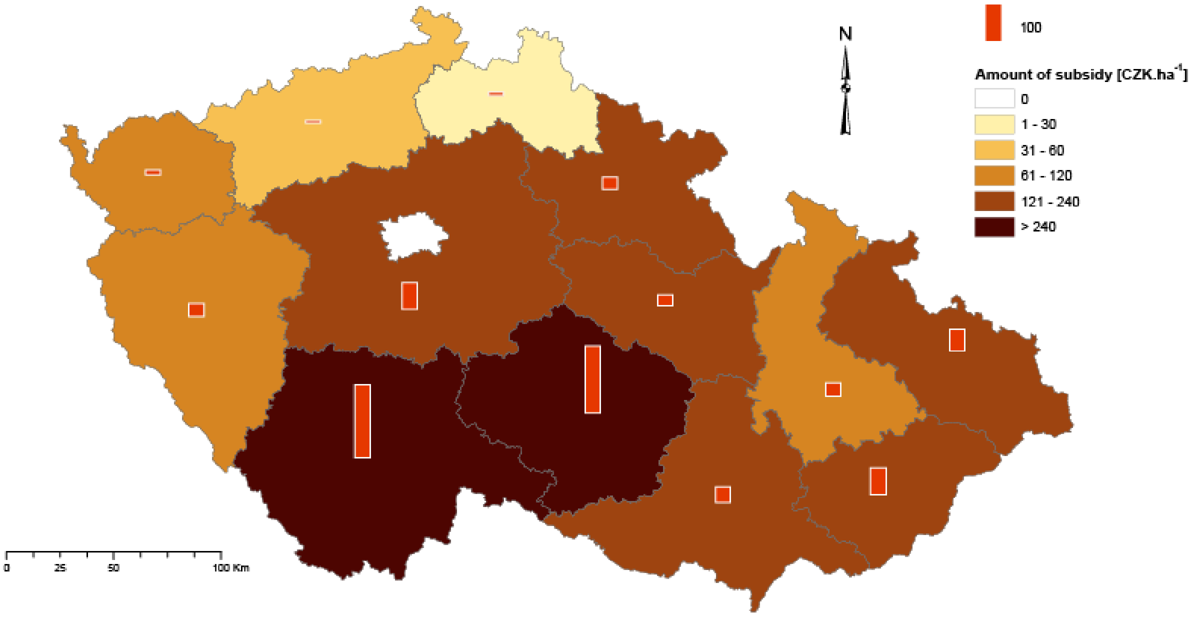
Legal forms	Measure I.1.2 Investments in Forests		
	Forest machinery (sub-measure I.1.2.1)	Technical utilities of business establishm. (sub-measure I.1.2.2)	Forestry infrastructure (sub-measure I.1.2.3)
Natural persons	126,7	40,4	102,6
Registered companies	164,5	13,7	139
Cooperatives and associations	16,2	0,0	20,6
Foreign person	0,0	0,0	0,0
State and related organizations	0,0	0,0	0,0
Municipalities and funded instit.	75,3	0,0	271,7
Others	0,0	0,0	0,0
Total	970,7		

Source: author's own processing, data from the State Agricultural Intervention Fund; Dudík, 2012.

The collection of maps (picture no. 1-3) gives information about payments made from the Rural Development Programme of the Czech Republic for 2007-2013 under sub-measure I.1.2.1 Forest Machinery, I.1.2.2 Technical Utilities of Business Establishments and I.1.2.3 Forestry Infrastructure according to regions in 2008-2011. The amount of subsidy is restated in CZK.ha^{-1} of forest land. The collection of maps also includes information about the quantity of paid out subsidy according to the region in which the project was implemented (Dudík, 2012).

Picture no. 1: Subsidies drawn for forest machinery purchases in 2008-2011 according to regions in CZK.ha^{-1} of forest land including the quantity of paid out requests

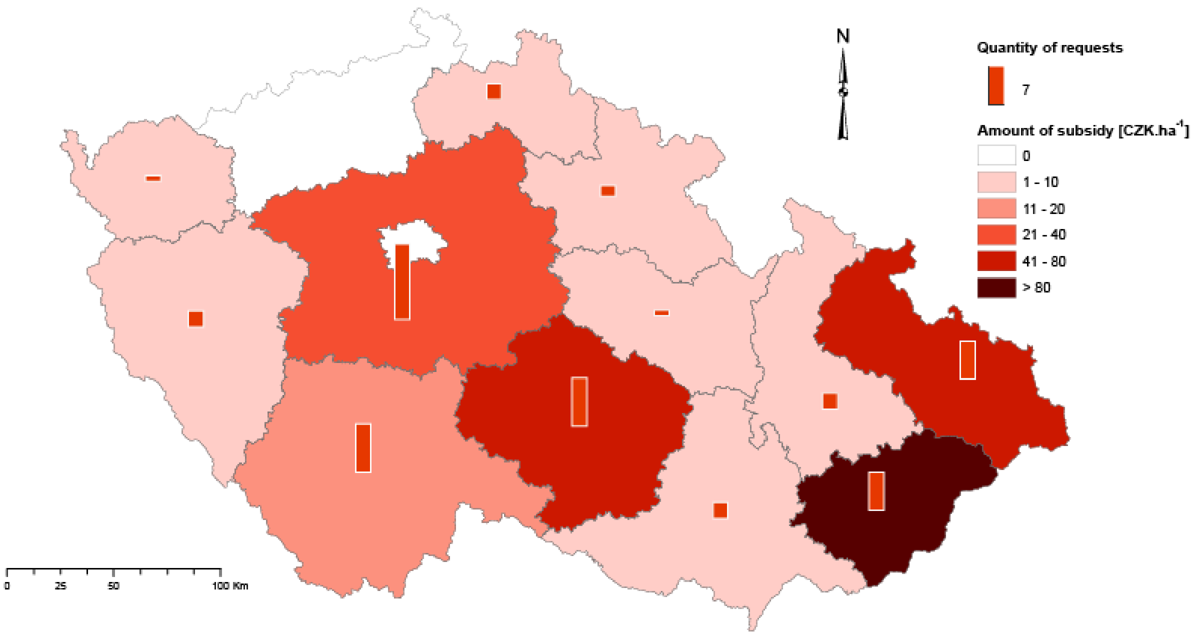
The Rural Development Programme of the Czech Republic for 2007-2013, sub-measure I.1.2.1 Forest Machinery



Source: author's own processing, data from the State Agricultural Intervention Fund; Dudík, 2012.

Picture no. 2: Subsidies drawn for technical utilities of business establishments in 2008-2011 according to regions in CZK.ha^{-1} of forest land including the quantity of paid out requests

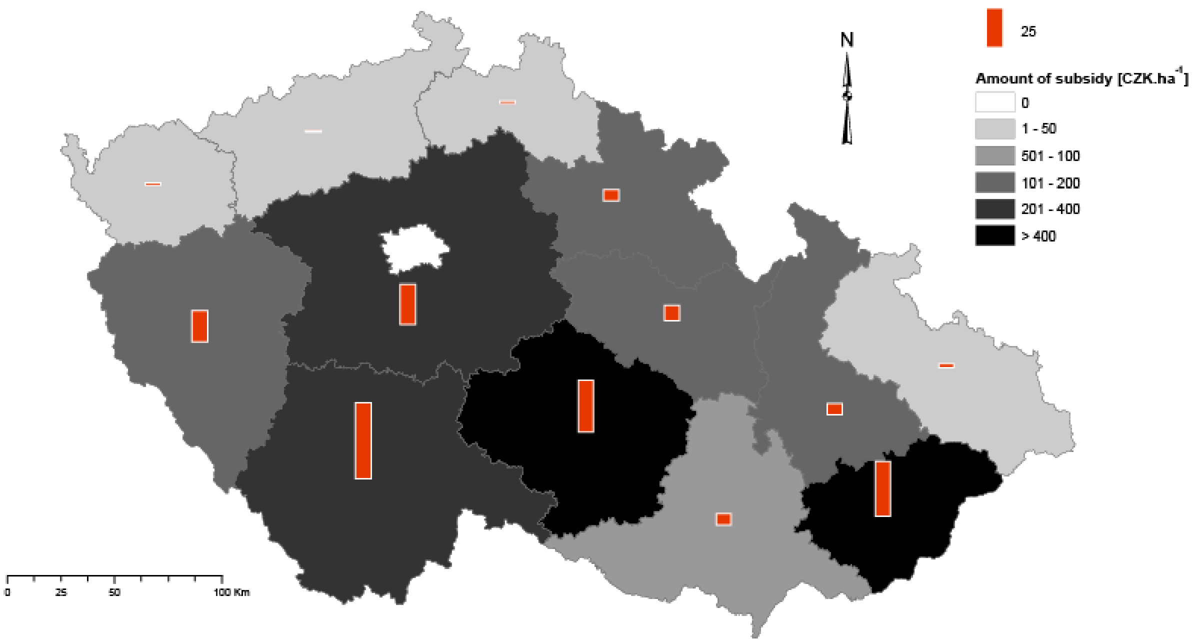
The Rural Development Programme of the Czech Republic for 2007-2013, sub-measure I.1.2.2 Technical Utilities of Business Establishments



Source: author's own processing, data from the State Agricultural Intervention Fund; Dudík, 2012.

Picture no. 3: Subsidies drawn for forestry infrastructure improvement in 2008-2011 according to regions in CZK.ha^{-1} of forest land including the quantity of paid out requests

The Rural Development Programme of the Czech Republic for 2007-2013, sub-measure I.1.2.3 Forestry Infrastructure



Source: author's own processing, data from the State Agricultural Intervention Fund; Dudík, 2012.

3 Conclusion

In general we observe that the limited range of activities eligible for subsidy appears to lead to poor arrangement and difficult orientation in possibilities of drawing subsidies from public sources. Forest owners and managers have to put a large amount of effort into working out how to get subsidies from public sources rather than applying this effort to managing their enterprise. This situation is further complicated by the eligibility rules that are frequently changed and that influence processing individual projects within each call for funding applications.

When we speak about subsidy payments to support the competitiveness of forest management, we can say, that the Rural Development Programme of the Czech Republic has played an important and positive role in stimulating investment. In 2008-2011 970,7 mil. CZK was paid out to forest owners and managers for investments in forests and out of this amount of money 382,7 mil CZK was used for purchase of forest machinery, 54,1 mil CZK was used for technical utilities of business establishments and 533,9 mil CZK was used for forestry infrastructure improvement. When speaking about legal forms of applicants the majority of support was paid out to municipalities and funded institutions for the improvement of forestry infrastructure (271,7 mil. CZK), followed by registered companies, that used this support for purchase of forest machinery (164,5 mil. CZK), and in third place registered companies, that used this support for improvement of forestry infrastructure (139 mil. CZK).

Although beyond the scope of this quantitative analysis, focused on the total amount of drawn down support, it is also important to pay attention to the efficiency of processes for paying support from public sources (of course with emphasis on making the most appropriate use of public funding). Of course for such an analysis it is much more difficult to obtain publicly accessible data and often the required data are apparently completely missing.

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ASH RECYCLING – A METHOD TO IMPROVE FOREST PRODUCTION OR TO RESTORE ACIDIFIED SURFACE WATERS?

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Abstract: *This cost–benefit analysis compared different strategies for ash recycling in southern Swedish forests, with a special emphasis on the potential to use ash recycling as a measure to ameliorate acidification of soils and surface waters caused by acid deposition. Benefits transfer was used to estimate use values for sport fishing and non-use values in terms of existence values. The results show that the optimal share of acidified forest land that should be treated with ash depends on how optimistic one is about the effect of using ash to restore lakes and streams from acidification. More optimistic assumptions imply that the ash to larger extent should be used to ameliorate acidification. Using the most realistic assumption, given the experiences of forest liming, shows that acidified forest land should not be treated with ash with the aim of restoring lakes and streams from acidification. From a socioeconomic point of view, ash simply does more good as fertilizer on forested organic soils.*

Keywords: Ash recycling, Acidification, Forest growth, Cost-benefit analysis
JEL Classification: D61, Q23

1 INTRODUCTION

Increased demand for bioenergy has created a market for use of all part of the tree, where logging residuals (tops and branches) are sold as biofuels. The supply of biofuels used for district heating has quintupled in Sweden since the 1990's of which wood fuels accounted for 32 TWh (46%) in 2010 (Swedish Energy Agency, 2011). Logging residuals (henceforth we will denoted by the common Swedish acronym GROT) contributed with 7.3 TWh in 2007 (Swedish Forest Agency, 2008). The large biomass removal causes an increased export of base cat ions (calcium, magnesium, potassium and sodium) and other nutrients bound to the plant tissues. The base cat ions originate to a large extent from weathering of soils and if this process cannot balance the base cat ion removal by harvest, the soils are acidified (Iwald *et al*., 2012). To ameliorate this effect, ash generated at combustion of biofuels can be returned to the forest to complete the cycle.

Currently, forestry contributes 30-70 % of the acidification of Swedish forest soils (Swedish Environmental Protection Agency 2007). Besides soil acidification, there is a growing concern in Sweden that the depletion in soil base cat ion pools would also lead to surface water acidification associated with lower base cat ion concentrations in runoff (Swedish EPA, 2007).

The aim of this study is to make a cost-benefit analysis of ash generated from bioenergy production most profitably for the society should be recycled and divided between mineral and organic forest soils in southwest Sweden. The economic net value of ash recycling on forest growth as well as on surface water acidification is evaluated.

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2 BACKGROUND

There are several options on how ash deriving from combustion of logging residuals can be utilized. A competition between different uses can easily arise, but in this study we focus only on the ash recycling part. This can be split into two main objectives of recycling (i) to increase the forest production at organic soils and (ii) to restore forest soils and surface waters from acidification. The question then becomes – which of these two objectives should guide where in the forest the ash is recycled?

The analysis distinguishes between mineral soils and organic soils. Since no single market price for ash exists we have in the following assumed that the price of ash is equal to the district heating plants' cost for transport and distribution of ash in the forest.

The simulations are based on two main scenarios:

Base scenario: Acidified lakes and waters will recover naturally and ash recycled to forest soils is primarily used to improve forest growth.

Alternative scenario: Ash is partly used to improve forest growth, but also distributed on mineral soils to reduce acidification in adjacent lakes and streams.

In the alternative scenario, the resulting reduction in acidification gives rise to non-market priced benefits due to improved environmental status. These benefits consist of an ecosystem value and a recreation value of improved fishing. The economic simulation will weigh these benefits against the cost in terms of less ash to improve forest growth as well as changes in transport costs.

Three cost/benefit components are considered in the simulations. The first component is the change in the Faustmann soil expectation value (Faustmann, 1849) between base and alternative scenarios. Note that when ash is used to increase the pH level in acidified waters there is less to improve the growth on organic forest soils. This means that if we have environmental ambitions with the ash, as in the base scenario, an opportunity cost arises in terms of reduced growth on some forest land with organic soils.

The second component is the difference in transport and management of ash between the base and alternative scenarios. The third component is the increased social benefit of improved water quality in the scenario where the ash is used to increase the pH level in lakes and streams. This social benefit consists of two parts, a recreation value of improved fishing in the acidified lakes and streams, and an existence value of the improved environment.

The problem with these environmental values is that they are non-market priced amenities, and hence no market priced exists. Several empirical methods exist to value non-market priced amenities, but an alternative to estimating a value directly is to use benefits transfer. Benefits transfer is not a valuation method per se, but rather a systematic way to transfer existing valuation estimates from earlier studies conducted elsewhere to the policy area the researcher is interested in (e.g. Brookshire & Neil, 1992). In this study we have for the recreational values used data material from Paulrud (2001), since this study is a travel cost study of recreational fishing in the county of Bohuslän, which is situated in southern Sweden.

The effects of acidification on terrestrial and aquatic ecosystems are valued as a benefit transfer derived from a political agreement on air pollution reduction programs in the EU. The WTP of European society for protecting one hectare of ecosystem from acidification and eutrophication was estimated using the standard price approach by Vermoote and De Nocker (2003). The standard price approach is based on the abatement costs of emission reductions as a proxy for revealed WTP for improvements in ecosystem health. In total the recreational and existence values sum to 1232 SEK[3]/hectare of surface water (Bostedt *et al*, 2010). The

[3] 1 SEK ≈ 0.14 USD (October 2012)

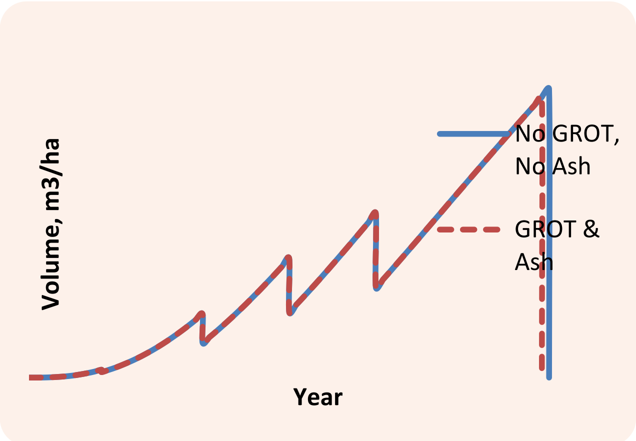
simulations in this study have been conducted using Plan33, a computer program for economic analysis for non-industrial forest owners (Ekvall, 2005; Ranius *et al.*, 2005). A discount rate of 3 percent is used in the simulations.

3 RESULTS

The results are presented for two spatial levels, the stand level and the regional level. The stand level analysis show results on different site indexes, and are a component in the calculations for the regional level. The regional level analysis is in fact a cost-benefit analysis of the two alternative uses of the ash – to reduce acidification in lakes and streams or to fertilize organic soils to improve timber production. The site index measures the height of the 100 tallest trees in meters after 100 years, i.e. for G30 the 100 tallest have a height of 30 meters after 100 years. G stands for Norwegian spruce dominated stand, while T stands for Scots pine dominated.

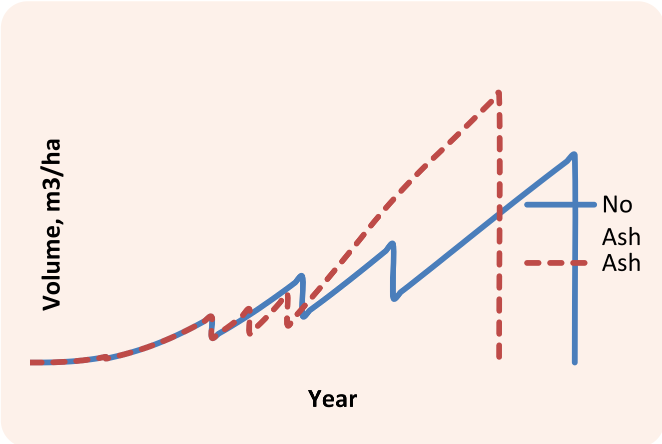
To illustrate the effects of harvest of logging residuals and ash recycling on different stands we use two typical stands for southern Sweden, one on mineral soil and one on organic soil. The mineral soil stand is assumed to be spruce dominated, with 67.8 % Norwegian spruce, 21.7 % broadleaves (mainly birch), and 10.5 % Scots pine. Figure 1 shows the volume development over the years for two alternatives: one where neither logging residuals is removed, nor ash added, the other alternative including both harvest of logging residuals and ash fertilization. The soil expectation value for the first alternative is 7 677 SEK per hectare, while the corresponding value for the second alternative is 9 343 SEK per hectare, i.e. an increase of 1 666 SEK per hectare. This is due to the income from the sale of logging residuals, since we have not assumed any fertilization effect of the ash. The logging residuals/ash alternative is associated with a slightly shorter rotation time, 70 years, compared with the base alternative, 71 years.

Figure 1. Difference in volume development for a spruce dominated, mineral soil stand between an alternative where GROT is removed and ash added (denoted GROT & Ash), and an alternative where neither of these actions are conducted (denoted No GROT, No Ash).



In the next example we study identical stands as mentioned above, but with the difference that they are located on organic soils. At one stand ash is added but logging residuals are not removed. This is compared with another identical stand where no ash is added and no logging residuals are removed. The ash gives a significant fertilization effect, resulting in a soil expectation value of 13 205 SEK per hectare, while the corresponding value for the non-ashed alternative is 8 272 SEK per hectare. This yields a substantial difference of 4 933 SEK per hectare. Additionally, the ash fertilization alternative is associated with a much shorter rotation time, 61 years compared with 71 years, since the faster growth makes it optimal to cut it at an earlier age, according to the Faustmann criterion. The present value will reach its maximum at the age of 61.

Figure 2. Difference in volume development for a spruce dominated, organic soil stand between the alternatives ash fertilization (denoted Ash) and no ash fertilization (denoted No Ash).



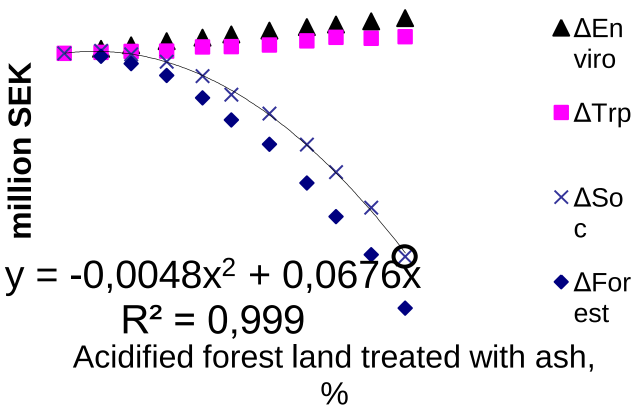
The regional level analysis is based on two scenarios. In the base scenario we assume that the nonmarket benefits of reducing acidification is zero, i.e. society has no ambition to use measures in forestry to improve acidified lakes and streams. Ash is only used to improve timber growth. In the alternative scenario, ash is used in varying intensity to improve acidified lakes and streams, since it generates a positive non-market benefit. The difference between the alternative and the base scenario is the net social gain (or loss) of using ash recycling to reduce acidification in lakes and streams. As mentioned earlier three economic terms form this net social gain, denoted ΔSoc: ΔForest, the difference in soil expectation value between the alternative and the base scenario, ΔTrp, the difference in transport costs between the alternative and the base scenario, and ΔEnviro, the difference in the benefits produced by an improved environment in lakes and streams between the alternative and the base scenario. All scenarios are evaluated over a 50 year time period.

Distributing ash on acidified forest land can have different effect on surrounding acidified lakes and streams. We call this effect ash efficiency. The most optimistic result that can be expected, given the experiences of forest liming (Löfgren *et al*. 2009), is that 0.17 hectares of acidified lakes and streams will be restored for every hectare of acidified forest land that is treated with ash, corresponding to a value of ash efficiency, *Eff*, of 1.0. However, in the alternative scenario we have assumed that ash efficiency, *Eff,* is only one-tenth of this, 0.1 - a more realistic assumption, based on Löfgren *et al*. (2009). Consequently, a value of ash efficiency of 0.0 indicates a zero effect of ash on acidified lakes and streams (c.f. Bostedt *et al* 2010).

Baseline results show that the net social gain of choosing the alternative scenario over the base scenario is SEK -24.9 million, i.e. using the ash to restore acidified lakes and streams causes a net social loss. This loss is mainly caused by a loss of forest growth in organic forest land that would otherwise have been fertilized with ash, valued at SEK 31 million. The environmental benefits of restoring acidified lakes and streams is only slightly more that SEK 4 million in present value terms, and can therefore not compensate for the loss of forest growth.

The perhaps most interesting sensitivity analysis concerns the share of acidified forest land that is treated with ash. In the alternative scenario we have assumed that 78.6 % needs to be treated with ash, while the remaining share will restore through natural restoration processes. If the area that is treated with ash is reduced the environmental benefits will naturally also reduce, but ash will be freed up to be used to fertilize forests on organic soils. The result of this sensitivity analysis is presented in Figure 3.

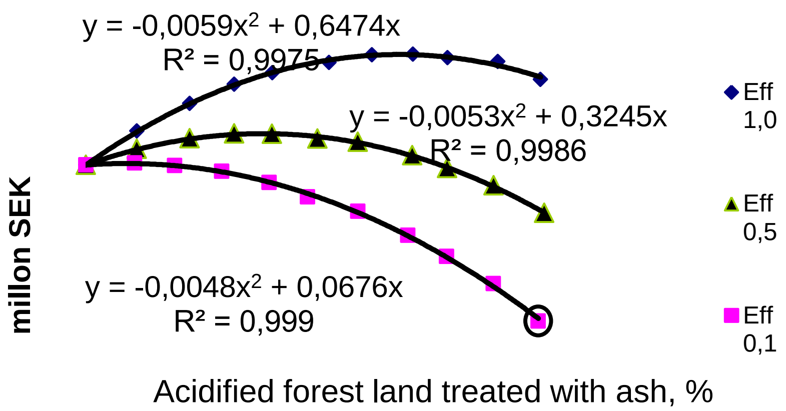
Figure 3. The effect of different assumptions concerning the share of acidified forest land that is treated with ash on the net social gain. Trp = Transport costs, Enviro = Environmental benefits, Soc = Net benefits to society, Forest = Difference in soil expectation value.



Although it is not entirely clear from the figure the net social gain curve follows an inverse U-shape, with a positive maximum at about 7 %. The net social gain is then SEK 0.24 million.

However, the optimal share of acidified forest land that is treated with ash critically depends on the previously mentioned efficiency of ash in combating acidification. The sensitivity analysis becomes even more interesting if this ash efficiency is also varied, see Figure 4.

Figure 4. How the optimal share of acidified forest land that is treated with ash depends on the efficiency of ash in combating acidification.



As Figure 4 shows the optimal share increases with increasing assumptions concerning the efficiency of the ash. If the ash efficiency is 0.5, i.e. if 5.85 hectares of acidified forest land is treated with ash then 0.5 hectares of acidified lakes and streams will be restored, then the optimal share of acidified forest land treated with ash increases from 7 to almost 31 %, and the corresponding net social gain increases from SEK 0.24 million to SEK 4.9 million. If the ash efficiency is 1.0, i.e. at tenfold increase from the baseline, then the optimal share of acidified forest land treated with ash increases from to almost 55 %, and the corresponding net social gain increases to SEK 17.8 million.

4 DISCUSSION

The increased demand of biofuel is tackled by the forestry sector by besides stems also harvesting logging residuals. Whole-tree harvesting is today the most common harvesting technique in Sweden. This cause increased export of base cat ions and other nutrients from the forest, which may affect forest growth and increase the soil and surface water acidification. The authorities tackle this problem by recommending ash return.

The basic assumption in the analysis is that 5.85 hectares of acidified forest land restores 0.1 hectares of acidified lakes and streams. The results from the base assumptions is that moving from the base scenario to the alternative scenario, i.e. using the ash to restore acidified lakes and streams creates a social net loss of about SEK 25 million in present value terms. The main reason is the opportunity cost in terms of lost forest growth on organic soils. If the share of acidified forest land that is treated with ash is allowed to vary the results shows that the net social gain is maximized if only 7 % of this forest land is treated with ash. The net social gain is then slightly positive, SEK 0.24 million in present value.

These results are however critically dependent on the previously mentioned ash effect value, which shows that the optimal share of acidified forest land that should be treated with ash depends on how optimistic you are about the effect of using ash to restore lakes and streams from acidification. More optimistic assumptions imply that the ash to larger extent should be used to ameliorate acidification. The more realistic assumption, given the experiences of forest liming (Löfgren *et al*. 2009), which was used in the baseline simulations shows that acidified forest land should not be treated with ash with the aim of restoring lakes and streams from acidification. From a socioeconomic point of view, this study indicates that ash simply does more good as fertilizer on forested organic soils.

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FOREST-ENERGY CHAIN IN TUSCANY: ECONOMIC, ENVIRONMENTAL AND SOCIAL EFFECTS IN SEVERAL MOUNTAIN TERRITORIES AND POSSIBLE TRADE-OFF BETWEEN TRADITIONAL PRODUCTION AND NEW ENERGY PRODUCTS

Claudio Fagarazzi [1] -Alessandro Tirinnanzi [1]

1. INTRODUCTION

The structuring of an economically and ecologically efficient biomass-energy chain requires an adequate evaluation of the economic, environmental and territorial effects linked with the new productive technologies. The choice of technologies to adopt, based on both the thermo-chemical processes (direct combustion, carbonisation, pyrolysis, gasification or stream explosion) and the biochemical ones (anaerobic and aerobic digestion, alcoholic fermentation, etc.) are the core aspects on which the economic sustainability of the chain depends. This choice is affected by the typologies of biomass available in the area and by the technological development of the different systems of energy conversion. Some of these technologies can be considered established and their products are ready to be traded in the market. Other more recent and complex technologies require further experimentation to increase efficiency and reduce energy conversion costs (eg. Gasification plant).

Both the economic and environmental analysis of these processes is an important step in verifying the sustainability of the system and to address any problems that may occur.

This paper intends to examine selected biomass-energy chains in Tuscany, based on a process of direct combustion configured with district heating technologies and using high efficiency boilers. In particular the study aims at assessing:the actual economic benefit of the technology, the long-term economic sustainability of the sector, the social effects induced on the business sector and the community (eg. Trade-off effect), the environmental effects caused by these new technologies and finally, identify any management and organisational problems highlighted by the different stakeholders involved in the chain (forest owners, logging companies, managers of Energy plants, end users).

The results of the survey provide support information during the design phase of the plant and of the supply chain. It takes into consideration both logistics and infrastructure providing a prediction of the socio-economic effects on the local community and on businesses.

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2. EXAMINED CHAINS: SAN ROMANO IN GARFAGNANA AND MONUTAIN COMMUNITY OF LUNIGIANA

Among the chains in Tuscany, two typologies were particularly interesting for their economic performance and their organisational model.

The chain of **Monutain Community of** Lunigiana (MCL) is based on the production of wood chips from the State forests. The district heating is managed by MCL and provides the service to three public utilities.

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The chain of Municipality of S. Romano Garfagnana buys wood chips from local forestry companies and the local sawmill to supply a district heating system for public facilities and private citizens.

The first chain uses wood chips from improvement interventions, such as thinning and pruning, in forests located at distances ranging from 5 to 50 km from the thermal plant. The logs are piled up at a *logistic centre* (AA.VV. 2006) located 1.8 km away from the plant. The storage of logs for the entire summer season reduces the Water Content (WC) from the initial 45-50% to 25-30%. The chipping is performed by a sub-contractor in early September each year and the wood chips produced are directly stored in a warehouse in the *logistic centre*. The thermal plant has a power of 220 KW and it is able to heat the central office of MCL, a kindergarten and the headquarters of Public Assistance, for a total of 6,300 cubic meters. The plant is only switched on during winter and the annual average energy efficiency of the plant is approximately 65%.

In the second chain the plant is directly managed by the local Municipal Administration which uses the heat produced to warm public facilities: the town hall, the library, the nursery school, the kindergarten, the elementary school, plus another 80 private households[4]. In this case the plant consists of two boilers of 500 and 320 KW power, which work winter and summer, for the production of domestic hot water. The average annual consumption of wood chips was 624 t f.m[5]. with 51 users, but in the winter 2012/2013 it will reach 860 t f.m (with 80 users). The energy efficiency, on an annual basis, exceeds 77%.

The Municipality (manager) sells the energy to private consumers at 45 €/MWh plus 10% VAT, to which the tax credit must be added[6].

3. EVALUATION OF THE ECONOMIC EFFICIENCY

The evaluation of the economic efficiency was performed by adopting strict accounting-financial guidelines able to provide useful results to support management decisions for Public Administrations[7] (Marinelli, Fagarazzi, Tirinnanzi, 2012).

The economic efficiency indicators are:

- the difference between the two costs defined above (ΔVAC)[8],
- the internal rate of return (*IIR*),
- the return on investment (ROI),
- the pay-back period (*PBP*),
- the price of Break Even Point (*Pbep*) for wood chips.

In the case of Municipality of San Romano Garfagnana, it was necessary to use “the full cost method” - an analytic approach coming from operational accounting (Fagarazzi, 2007)[9]. As a result it was possible to define the cost elements for the two production lines:

[4] The private users connected themselves at different times: 40 users in the first year, 11 in the third and 29 in the fourth.

[5] Fresh matter (considered equal to 30% of moisture content).

[6] The tax credit is equal to 25.82 €/MWh in accordance with Law 448/98 art. 8c. 10 letter. F, as amended by Law 354/00 art. 4 c. 4bis. Overall, the sale of 1 MWh generates a revenue of € 70.82.

[7] Thus, only the explicit costs were taken into account.

[8] The formula is: $$\Delta VAC = VAC^R - VAC^F = \sum_{t=0}^{n} \frac{C_t^R}{(1+r)^t} - \sum_{t=0}^{n} \frac{C_t^F}{(1+r)^t}$$

where “C^R_t” e “C^F_t” are, respectively, the total annual costs supported in the year n-th for the biomass-fired plant (*R*) and for the diesel-fired plant (*F*); *n* is the duration of the investment and *r* is the interest rate, or discount rate.

[9] The full cost analysis is based on the classification of the costs into:

- Direct costs, i.e. those directly linked to the achievement of the product (ex. fuel);
- Indirect costs, i.e. the costs associated with the production inputs used jointly for both products (ex. depreciation costs of the materials, administrative costs, etc.).

1. Energy for self-consumption of Public facilities;
2. Energy for sale to private users;

The most consistent procedure for allocating the indirect costs was to ascribe them according to the amount of product, given the hypothesis that the amount of inputs is proportional to the quantity of product (energy) produced by each productive line[10].

Economic results

Plant in the Mountain Community of Lunigiana

The investment is € 142.999 euro, fully covered by Mountain Community of Lunigiana[11].
The characterising parameters are the following:

- Plant life 15 years
- Applied discount rate 2.25%
- Production cost of wood chips: 43.50 €/t (only explicit costs)
- Average annual consumption of wood chips: 72 t f.m./year
- Average water content: 24%
- Gross energy content of wood chips: 271 MWh/year
- Efficiency of the plant for year 2010/2011 and 2011/2012: 64.94 %
- Average energy content of wood chips: 3,75 MWh/t f.m.

The first result, emerging from the monitoring activities, is the confirmation of the considerable impact of costs associated to the consumption of electricity (2,059 €/year), representing more than 65% of the costs supported for the supplying of wood chips (3,147 €/year).

The other important economic aspect is the high efficiency of the investment. In this case, the comparative approach between the two alternative investments (*ΔVAC*) estimated a present value of € 237,203 (in savings). It corresponds to an IRR of over 74% for the assumed 15-year life of the plant in a payback period of just two years (Tab. 1).

The wood chips BEP price reaches 303 €/t f.m., confirming the excellent efficiency of the investment compared to the production costs in the forestry sector (about 76 €/t f.m. in the territory of Lunigiana - Source MCL).

It is therefore an extremely efficient investment, since in a 7-year activity it let the Public Administration save 106.620 euro[12].

Tab. 1: Financial efficiency indicators for the investment

	Financial efficiency indicators considering "only self-consumption"	
	Without initial funding	***With Regional funding of 25%***
Payback time (years)	4	2
ΔVAC (€)	198.933	237.203
Internal Rate of Return (%)	32%	74%
BEP price of woodchips (€/t f.m.)	262	303
Average savings per year*(€/year)	15.773	18.808

* For the same energy output

[10] The evaluation has also considered the fact that the private users were not all yet connected when the plant was ready to start but connected at different times. For this reason the changes in costs that have occurred at different times, according to the level of productivity during the different periods, have been considered: 40 users connected in the first year, 51 in the third year and 80 in the fourth year (winter 2012/2013).

[11] Co-financed by the Tuscany Region on the basis of a voluntary agreement for the sector D.G.R. 882/2005 for 36,000 euro. There are no investments related to the implementation of the plant since it was already in available to the MCL before the construction of the plant.

[12] Considering the regional co-financing.

Production plant of Municipality of San Romano Garfagnana

The investment made by Municipality of San Romano Garfagnana is equal to € 684,450[13]. The characterising parameters are the following:

- Plant life 15 years
- Applied discount rate 2.25%
- Weighted interest rate on 20-year mortgage payments with the Deposit and Loan Bank: 4.803%
- Interest repayments on 20-year mortgage recalculated on the 15-year plant life
- Purchase price of the wood chips: € 56.5 euro + VAT
- Annual consumption of wood chips for 2009/2010 and 2010/2011: 532 t f.m./year
- Annual consumption of wood chips for 2011/2012: 624 t s.f./year
- Estimated annual consumption of wood chips for 2012/2013: 868 t s.f./year
- Average water content of wood chips: 38.7 %
- Gross energy of wood chips M38 for the years 2009/2010 and 2010/2011: 1,559 MWh/year
- Gross energy of wood chips M38 for the year 2011/2012: 1,828 MWh/year Estimated energy delivered to the plant with wood chips M38 for the years 2012/2013: 2,544 MWh/year
- Energy generated in the year 2009/2010 and 2010/2011: 1,184.84 MWh/year
- Energy produced in the winter 2011/2012 1,391 MWh/year
- Estimated Energy produced in the winter 2012/2013: 1,934 MWh/year
- Efficiency of the plant for years 2010/2011: 77.06 %
- Selling price of thermal energy: 70.28 €/MWh (including tax credit[14], net of VAT)
- Energy sold in the years 2009/2010 and 2010/2011: 748 MWh
- Energy sold in the years 2011/2012: 955 MWh
- Estimated energy sold in the years 2012/2013: 1498 MWh
- Thermal energy consumed by public facilities 436 MWh/year
- Turnover from energy sales for years 2009/2010 and 2010/2011: 56,100 €/year
- Turnover from energy sales for years 2011/2012: 71,625 €/year
- Estimated turnover from energy sales for winter 2012/2013: 112,350 €/year

Table 2 shows the economic results under the real-user dynamics of:

- 40 private users connected to the plant for the first and the second year,
- 51 users the third year and
- 80 users from the fourth year (winter 2012/2013).

With this configuration, the "payback time" of the investment is 8 years, the discounted savings will be equal to € 331,166 and the IRR will reach 14.9%, which is higher than the cost of money obtained at the Deposit and Loan Bank (4.08%). The *Pbep* of wood chips will reach € 97.9.

Under these conditions, the sum of the average annual savings achieved by the public and the annual net profit derived from the sale of energy to the 80 private users is 26,258 €/year (Table 2). The *Pbep* of the heat sold is 54.3 €/MWh (including tax credit).

Here the traditional economic efficiency indicators are not suitable for the verification of the efficiency because the evaluation was carried out with respect to the real incurred

[13] Partly co-financed by the Tuscan Region within the Exceptional Investment Programme (2005) and with POR-Creo call for a total amount of € 254,000.

[14] Tax credit € 25.82 €/MWh (in accordance with L. 448/98 art. 8 c. 10, letter. F, as amended by L. 354/00 art. 4 c. 4bis).

consumption. In the ex-post configuration a higher production of 37% is apparent if compared to the condition ex-ante (Table 4).
The above data shows that the traditional indicators (VAC, IRR, etc.) underestimate the investment efficiency (Table 2). Thereby Table 2 calculates the average cost of energy production prior and post to the delivery of the production facility:

Tab. 2: Overall assessment of the production line "consumption" plus the production line " thermal energy sales" considering the dynamics of 40 users for the first 2 years, 51 users for the third year and 80 users in the following years.

	Financial efficiency indicators considering "self-consumption and Energy sales" (*)	
	Without initial funding	*With Regional funding of 37%*
Payback time (years)	>16	8
ΔVAC (€)	-40.055	331.166
Internal Rate of Return (%)	NC	14,9%
BEP price for woodchips (€/t f.m.)	57,8	97,9
Average savings per year(€/year)*	-3.176	26.258
BEP price of Energy (€/MWh)	77,50	54,30
Average production cost of energy EX-ANTE (€/MWh)	**147,12**	
Average production cost of energy (€/MWh)	**65,84**	**53,04**

(*)These evaluations do not consider the same quantity of energy delivered ex-ante and ex-post. In the situation ex-post, the consumption by the users is 37% higher (Table 4). In this case, the parameter of appropriate reference is represented by the average cost of energy production.

Table 2 clearly indicates the cost of energy production is much lower in the ex-post situation than in the ex-ante, even in the absence of public funding. Specifically, the cost of energy production reaches € 65.84/MWh, with a cost reduction exceeding 55%. The investment is clearly highly effective even in the absence of funding.

The evaluation of the investment efficiency for private houses has been performed for the single user. The results show a variability that is the result of the mix of technologies installed in each dwelling (e.g. fireplace, wood stove, LPG boiler, etc.).

The key variable is the quantity of energy absorbed annually by the network and by each user. In particular, it was found that the users with the best economic performance are those that have a large absorption of heat from the district heating network. In these cases, the average costs of the thermal energy used in the household varies between 50 and 70 €/MWh in relation to the mix of energy consumption. If, however, the use of traditional fuels (firewood) is substantial, the average costs are between 70 €/MWh and 100 €/MWh.

The costs are much lower than the previous configuration where the consumption of fossil fuels led to an average cost between 95 €/MWh and 140 €/MWh[15].

Evaluation of the local socio-economic effects

The district heating systems using solid biomass are traditionally built in the mountain areas, because of the proximity of forest resources and the economic contributions for investments made in these disadvantaged areas (tax credits, grants, etc.). The sites where district heating plants are placed are characterised by the conspicuous use of fossil fuels, such

[15] The editorial requirements do not allow for an adequate discussion of the many results that emerged during the BIOMASS project. Specific studies on the assessment of investment efficiency for private users will be the subject of
further contributions.

as diesel and LPG, but also of firewood. Interestingly Tuscany is the largest consumer at national level of firewood, reaching approximately 1.4 million cubic metres per year (Pettenella, Andrighetto, 2011).

To assess the effects on the local community caused by the introduction of a wood chip–fired district heating system, it is essential to examine the dynamics of energy consumption before and after the establishment of the plants.

In the case of the plant at Fivizzano (Mountain Community of Lunigiana), there was a total replacement of fossil fuel (diesel) with renewable fuel (wood chips) (tab. 3).

The analysis of the past and present consumption at the public facility also allowed the verification of the variations which occurred in energy consumption. In particular, the users of the three structures (MCL headquarters, school and public assistance centre of operation) registered a warmer and more comfortable environment, as the current energy used for heating is about 76% more than in the previous scenario (with the use of fossil fuels) (Table 3).

The positive effects on the local forest-wood sector are limited to the involvement of a harvesting company in transport and chipping activities, because the actual forestry activities (pruning, felling and skidding) did not change since they were already carried out previously.

Tab. 3: Dynamics of fuel consumption for the heating of buildings connected to the district heating network Mountain Community of Lunigiana.

Energy consumption for heating			**EX-ANTE**		**EX-POST**		**VARIATION**
Sector	***Fuels***		***Energy MWh/year***	***%***	***Energy MWh/year***	***%***	**% ex-ante/ex-post**
PUBLIC	Fossil Energies	Diesel	100,00	100%			-100%
		LPG					
	Renewable Energies	Wood chips			176,00	100%	
		Firewood					
		Pellets					
		TOTAL	**100,00**	**100**	**176,00**	**100**	**76%**

A survey on all private households connected to the heating plant of San Romano Garfagnana was prepared in order to discover the types of available heating systems and their corresponding energy consumption. As it is shown in Table 4, the private users connected to the district heating network are still using other home heating systems. Only through a direct survey would it have been possible to define the previous and current energy mix of the individual users.

The results shown in Table 4 point out that the energy consumption of public utilities (2 schools, 1 kindergarten, library and City Hall) has also increased significantly from about 200 MWh/year to more than 430 MWh/year, with an increase of about 118%. Consequently, the thermal comfort of the users of these public facilities has increased considerably.

The same trend is also evident for private users with an increase of the thermal energy consumed of about 26% from 1,448 MWh/year to 1,828.79 MWh/year in the current situation.

With regard to private users, a shift from fossil fuels is evident, and also a drastic reduction in the consumption of traditional renewable fuels (firewood and pellets). Firewood decreases from 713.84 MWh/year to 315.28 MWh/year, with a reduction of about 56%, while pellets lower from 42.70 MWh/year to 15.51 MWh/year. In quantitative terms, the consumption of firewood has decreased from 432.71 t f.m./year to 199.06 t f.m./year, with a reduction of about 54%[16], while the consumption of pellets decreased from 9.26 t/year to 3.26 t/year.

Given that many users were self-supplying firewood[17], the amount purchased on the local market decreased from 295.73 t f.m./year to 124.30 t f.m./year, with an annual expenditure which has dropped from 27,650 € to 11,691 €.

A decline in firewood sales occurred at a local level, of approximately 15,958 €/year, while there has been an increase in turnover for the assortment of wood chips of about 53,946 €/year.

Tab. 4: Dynamics of fuel consumption for the heating of buildings connected to the district heating network Municipality of San Romano Garfagnana.

Energy consumption for heating			EX-ANTE		EX-POST		VARIATION
Sector	***Fuels***		***Energy MWh/year***	***%***	***Energy MWh/year***	***%***	**% ex-ante/ex-post**
PUBLIC	Fossil Energies	Diesel	51,04	26%	0	0%	-100%
		LPG	149,02	74%	0	0%	-100%
	Renewable Energies	Wood chips			436,10	100%	
		TOTAL	**200,06**	**100%**	**436,10**	**100%**	**118%**
PRIVATE	Fossil Energies	Diesel	296,43	20%		0%	-100%
		LPG	395,62	27%		0%	-100%
	Renewable Energies	Wood chips		0%	1.498,00	82%	
		Firewood	713,84	49%	315,28	17%	-56%
		Pellets	42,70	3%	15,51	1%	-64%
		TOTAL	**1.448,59**	**100%**	**1.828,79**	**100%**	**26%**
Total Energy Consumption			**1.648,65**		**2.264,89**		**37%**
District heating energy consumption					**1.934,10**		

4. CONCLUSIONS

This paper summarises some of the results derived from monitoring two biomass-energy chains in Tuscany over a two year period.

It examines the financial aspects, related to the management of power plants, and the long-term sustainability of the entire chain. In particular, the analysis considers two types of forest-wood-energy chains that, in respect to the organisational and financial performance, seem to have the greatest opportunities in terms of replicability and sustainability in Tuscany.

The paper aims to provide, with objective data, indications for the sustainability of the investments in the bio-energy sector linked to biomass from forests, and the effects that may take place on the local forest economies.

In regard to the sustainability of the investments, the high efficiency of interventions characterised by biomass heating systems, self-managed by the Public Administration exclusively for energy self-consumption (ex. MCL di Fivizzano), appears clear. It also shows that even in the absence of public financing, the investment is extremely efficient. It presents

[16] The quantities are affected by the different efficiencies of the technologies used by users (fireplace, stove, fireplace heat, etc.).

[17] Previously the amount of self-supplied firewood was 140 t f.m./year while currently it is 74.76 t f.m./year.

very high safety margins, compared to the price of wood chips, which can ensure the long-term sustainability of the whole chain even in the presence of strong variations in fuel prices.

For mixed projects, which include the energy consumption of public facilities and the sale of energy to consumers (e.g. Municipality of San Romano Garfagnana), the results are positive, but require the fulfillment of certain project prerequisites to guarantee the connection to the network of all private households identified in the design phase from the first year of operation. This is to be able to offer competitive prices for private users, compatible with the economic viability of the investment.

With regard to the local economic effects, the joining of private households to projects of district heating networks in rural areas determines a strong reduction in the expenditure for heat by the local community (ranging from -64% to -22% for the public facilities of San Romano Garfagnana) and a reduction of the local market of firewood in favour of the wood chip market. In this particular case, there was a decrease of 58% in volume and 57% in value of energetic wood (firewood). The market for wood chips however had a substantial increase (868 t f.m./year). Given that the current sources of wood chips consist solely of forestry interventions financed by various measures of the Rural Development Plan[18], it is clear that the structuring of the forest-wood-energy chains are having an amplification effect for the policies aiming at the improvement of the forest component initiated by the RDP. These interventions are those that make a tangible improvement in the forestry component not only in terms of the quality of the trees, but also in terms of public safety by improving the stability of slopes, reducing landslide risk and limiting fire risk.

It is a direct effect that the reduction in the demand for firewood will lead to a reduction of approximately 2 hectares of forest land annually used for this purpose.

Consequently, the structuring of forest-wood-energy chains which involve private users determines an increase in the maintenance and improvement of forestry interventions, which are typically with a negative stumpage value, realised by large forest companies. It also induces a reduction in the operations for the production of firewood, typically with a positive stumpage value, carried out by small family companies with limited equipment.

In order to guarantee a stable and balanced development of the sector and of the chains it is then necessary to verify in advance the existence of possible *trade offs* that can arise in the local economy. By doing so, the biomass production and its energy utilisation at local level can become a way for the development of the rural territory, for the preservation of the rural areas and for improving the quality of life of the community. These activities favour the development of positive economic *spin offs* linked with forest activities.

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ROLE OF COMMON PROPERTIES AND MUNICIPALITIES IN FOREST MANAGEMENT OF VENETO REGION (ITALY): CONFLICTING OR SYNERGIC RELATIONSHIP?

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Abstract: *Italian forestland ownership system is characterized by various local public and semi-public (or semi-private) institutions with different internal rules, competences and functions. The paper tries to describe the ongoing status of these institutions in the light of their recent development. In the past, Common Properties superintended to several aspects of local community life and acted as main regulator of the use of natural resources. Thought to be unable to promote technological and economic development in the agriculture sector, common domains have been tackled since 19th Century: common lands were progressively "freed" and put under the administration of Municipalities. Today, a new wave of devolution and institutional reorganization poses new focus on the role of forest commons in ensuring environmental conservation, and fostering socio-economical development of mountain areas. Moving from a renewed favourable State legislation, some Italian Regions promoted their reconstitution. The paper, based on information collected through a semi-structured questionnaire carried out among representatives of Municipalities where Common Properties exist, investigates the degree of cooperation between Municipalities and either long-lasting and newly reconstituted Common Properties. We try to demonstrate that not always the outcomes of the transformation of municipal forests to Common Properties are positive in terms of enlarged public participation by local residents, introduction of innovations and improved forest management practices.*

Key words: Common Properties, Community-based resource management, Common property reconstitution, institutional coordination, Veneto Region

1. INTRODUCTION

Common Domain are lands where customary rights stand on, regardless of the overarching institutional framework that the common pool resource is subjected to, such as the institutional regime (*sensu* Bromley, 1991) and the bundle of rights (*sensu* Schlager and Ostrom, 2010). Customary rights are those rights that a local community is entrusted with, so as the same community has the right to benefit some *utilitates* (fruitful things) provided by a natural common pool resource (CPR), such as collecting wood, picking mushrooms, gathering herbs, grazing, hunting, fishing, etc.

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In Italy, customary rights typically affect forest landscapes: a recent statistical survey (Istat, 2012) indicated that the Italian common domain globally extends over 1,668,851 hectares, that is almost 10% of the total agricultural area of the country. Noteworthy, it's probable that this figure is underestimated, since State commissioners have not verified the persistence of customary rights in several rural areas yet. Both historical vicissitudes and more recent institutional reforms concurred to built up a complex legal architecture distinguishing different situations within the general frame of the Italian commons. The most common situation occurs when a local community is entrusted with the right to practice customary rights regardless of the institutional regime that the resource is subjected to, i.e. irrespective of the regime being public or private (customary rights are also called civic uses – with "civic" originating from the Latin "*cives*", meaning citizens, local inhabitants). Such situations usually derive from historical vicissitudes that confirmed access and withdrawal rights to local communities after that the full ownership over the resource had been gained by a new owner, typically a landlord or liege lord. Nowadays, these lands are often owned *de facto* and managed in favour of the whole local community by public bodies, mainly Municipalities.

Common Property Institutions (CPIs) are instead associations provided with legal statutes and lists of people entrusted with property rights on the resource. They fully represent a common property regime (Bromley, 1991). According to the Ostrom's definition (1990), community members are proprietors but not fully owners of the CPR, since principles of inalienability, indivisibility and non-adverse possession apply to the Italian common pool resources, in addition to the unchangeability of the land use destination. Common Properties *sensu stricto* occur when a blood-line constraint is introduced in order to define right-holders, on top of the only residence criteria (*Open* Common Properties). Therefore, in the case of Common Properties *sensu stricto* only offspring and descendants of ancient inhabitants can be part of the commoners' community. Whereas Open Common Properties prevail in Central and Southern Regions, Common Properties *sensu stricto* are frequent in the North of the Country (as in the Veneto Region), particularly across the Alpine Chain. Civic use lands, characterized by the absence of associations and legal statutes, are widespread throughout the entire Country.

2. THE STUDY CONTEXT: VENETO REGION

Common Properties have a long-lasting tradition in the Veneto Region, insomuch as they were the most tenacious opponents to the national law no. 1766/1927 that, during the fascist regime, tried to suppress them. Their historical origin is controversial. Most ancient written documents testify their existence in the north-eastern Italian Alps before 1,000 B.C. (Zanderigo Rosolo, 1982 in Florian, 2004).

Veneto Region was first in line in the process of new recognition of the relevant role that Common Properties can play in protecting and sustainably managing forest landscapes, at the same time appointing them with socio-economical responsibilities going far beyond the mere forest and pasture management (Cacciavillani *et al*., 2012). Thus, moving from the favourable national legislation, and by means of the regional law no. 26/1996, Veneto Region even fostered the reconstitution of those CPIs that had been previously dismantled. Interestingly, despite the common property regime, CPIs are considered associations with private legal personality, but they are also explicitly called to play relevant public functions.

Data provided by Gatto *et al.* (2012) show good feedbacks about the regional law, since 17 CPIs have been re-constituted after its enactment. The total CPIs number in the Veneto

Region equals to 53, and other processes of formal recognition are currently ongoing, thus the figure is expected to increase in the next future. Either past (Florian, 2004) and more recent surveys (Carestiato, 2008; Wiebke, 2012) suggest that the institutional coexistence of and the relationship between Common Properties and Municipal Administrations (MAs) poses on a weak equilibrium, with the need of progressively reinforcing the coordination among these local institutions.

3. OBJECTIVES AND METHODOLOGY

This survey aims to evaluate whether reported institutional conflicts between Municipalities and local CPIs can be considered isolated cases, or more structured and chronic issues exist, possibly compromising the CPIs' effectiveness in promoting environmental conservation and socio-economical local development. To this end, face-to-face interviews have been carried out with several municipal representatives, using a semi-structured questionnaire, so as to make coherent and comparable gathered information. Representatives of 14 different Municipalities have been interviewed, corresponding to 82% of the whole municipal affected population, and with a representativeness of 37 out of 53 Common Properties (~70%). People covering different roles within the municipal administrations have been interviewed, namely 10 Majors, 2 aldermen, 1 municipal secretary and 1 office manager. The selection criteria corresponded to the officer most responsible for – or at least well informed about, the formal and informal relationships occurring between the municipal and CPIs Administration.

4. RESULTS

Communication channels. Recurrence and robustness of relationships occurring between municipal and common administrations have been surveyed. A substantial lack of coordination between MAs and CPIs, with rare and weak institutional contacts, has been described in 3 cases out of 14, involving six different Common Properties. Differently, 5 municipal representatives suggested stable and well-established institutional contacts with each single CPI standing within the administrative area (globally, 14 CPIs interested), even if such contacts are based on single and univocal relationships since a global coordination among different CPIs is missing. Finally, six times interviewees suggested stable institutional contacts with local Common Properties, with CPIs completely and synergically coordinating their positions (1 case, 2 CPIs) or also maintaining some single and specific communication channels with the municipal administration (5 cases, 15 CPIs).

Then, it has been addressed whether any commoner was also a member of the Town Council. Results showed that in every Town Council at least one counsellor, alderman or even the Major (9 times out of 14) was also a commoner, or alternatively a commoner's offspring that usually participates to the Common Assembly on behalf of the head of the household.

Finally, it has been assessed who are the reference persons within the municipal administrations in charge of maintaining formal contacts with local Common Properties, and vice versa. In 6 cases it resulted that only one person is in charge of such responsibility, whereas in four other cases one Alderman or the Deputy Major reinforce the Major's role. Only 3 times the institutional contacts originate from a collegial effort, through the involvement of the whole Town Council. As concerns the common-side, a main role is played by CPI Presidents (6 cases), sometimes supported by the Vice-President (3 cases), the Secretary (2 situations), or the Administrative Board (2 cases).

Administrative constraints. Quite unexpectedly, in the majority of cases municipal interviewees demonstrated not to feel severely constrained in their administrative management by the existence of Common Properties. Municipalities are in charge of designing, planning and implementing a comprehensive and balanced territorial development and management, as they are the smallest public local administrative units. On the contrary, the regional law limits the field of action and competences of CPIs to the forest landscape management. Thus, Municipalities still remain the main territorial reference institution, and they play a central role in regulating the entirety of the local socio-economical dynamics. This seems also testified by the fact that Municipalities are the main promoter of a continuous and close relationship with local CPIs: interviewees suggested that often municipal administrations take the initiative in the formal (and also informal) contacts with Common Properties (42.5%), whereas the latter usually make the first move only once (7%). In the other cases, a balanced or irregular situation has been described, nevertheless often with different roles played by these institutions, explained as follows. On the one hand, often Common Properties ask for the MA cooperation when they need to solve administrative and bureaucratic issues, e.g. for a land use destination change in order to convert former pasture huts and shelters in new commercial activities, such as agritourisms. On the contrary, Municipalities tend to involve Common Properties through proposals and projects to be implemented within the CPIs-owned territories.

In fact, 70% of surveyed Municipalities have lost the ownership of the majority of their lands since the process of CPIs reconstitution succeeded. Therefore, it’s almost impossible for Municipalities not to involve CPIs in their plans, strategies or designed activities concerning a comprehensive territorial development, as these almost inevitably would be applied on common lands. Thus, although theoretically the majority of municipal representatives do not feel to be administratively constrained by the existence of Common Properties, they also stated that administrative difficulties exist and relate to the “practical implementation” of such identified strategies and actions.

Economic effects. As already recalled, where the reconstitution process succeeded, large forest areas shifted from public management to the common one. Subsequently, CPIs also began to collect revenues coming from timber selling, leasing of pastures, management of alpine huts and concessions for pit sites and ski areas. Despite the high variability of such revenues, they are always quite relevant, ranging from ~50,000 €/year to more than 600,000 €/year (average value: ~200,000 €/year). Our hypothesis was that the abrupt shortage of these incomes could have generated negative impacts on economic balances and budget of Municipalities, particularly for those standing in mountain areas where the mass tourism is not so well developed. Thus, such economical effects have been assessed. Results suggested less negative effects than those expected. In fact, in 4 (28%) cases municipal representatives stated that no relevant changes occurred in the amount of services provided to the citizenry, as municipal balance sheet was “robust” and able to afford lower intakes. In 3 other cases (21%) municipal representatives argued that lower incomes substantially equal to the lower expenditures that every year occurred. Moreover, in 4 other situations, Municipalities never gained the ownership of local forests since CPIs *de facto* continued to manage them and, therefore, no economic effects can be computed. Thus, only in 2 situations interviewees stated that the Municipality suffered a heavy shortage of capital resources, and this led to lower level of services and higher tax pressure on local citizens.

Legal disputes and other frictions. The change of landownership has facilitated the rising of some legal arguments about the ownership rights, often triggered by the inaccuracy of cadastral information. 50% of times no legal arguments occurred at all, whereas in 3 cases they have been solved. In 4 other situations (almost 30%) some issues are still in place, even if it seems that the mutual willingness to reach friendly agreements recently prevailed. Resolution of pendant legal issues demonstrated to be a relevant driver for a progressive and relevant bettering of mutual institutional relationships.

In addition to the existence of legal disputes, interviewees were asked to answer if other frictions exist. Results show that 43% of times these divergences are currently in place, even if considered reasonably heavy in the majority of cases. A worse situation has been found for some social issues, namely: (a) the difficulty to be accepted as commoners for those people not descending from ancient local inhabitants, even if they have been living within the local community since several decades; (b) the hostile attitude of some commoners of feeling themselves "privileged", if compared with "foreign" people; (c) the absence of gender balance within the Common Communities, as in some cases women are not still accepted as commoners; (d) exclusion of non commoners from the possibility of benefitting some resource uses (e.g. woodfuel supply, incentives for young married couples, scholarships, building subsidies, etc.)

Effectiveness of CPIs and other opinions. Municipal representatives were asked to mark the real commitment of CPIs to the promotion of social development, economic development, tourism and environmental conservation and management. Despite promotion of tourism can be considered a sub-distinction of the economic development, it has been treated separately, considered the main role that it plays in shaping and defining the latter.

Worst judgments concerned the CPIs' effectiveness in promoting social development: negative opinions corresponded to 78.5% of the total answers. This figure is in line with those issues listed before. High relevance has been tribute to the "close mentality" of some commoners, especially old people. These still have great influence within the Common Assembly, as legal Statutes frequently assign preeminent representation roles to the heads of the household. Moreover, and not less important, municipal representatives argued that CPIs should commit themselves to support more deeply MAs in their welfare strategies, particularly because they are targeted to the whole local community and not only to the commoners. Nevertheless, they also admitted that CPIs allow local politicians to have a direct feedback about their choices from the local population, or at least a part of its. From this point of view, the occurrence of some social frictions is maybe the price to be paid in order to increase the participation of local people to the municipal administrative life.

With reference to environmental conservation, often interviewees admitted that forest landscape management has bettered since it is supervised by CPIs, mainly because forest management is the "core issue" that CPIs are focused on. Moreover, CPIs tend to reinvest the majority of their revenues in natural resource maintenance; on the contrary, the law impose to municipal administrations to compulsorily reinvest only 10% of revenues coming from forest resources on the resource itself. However, often CPIs are inclined toward an ordinary management only aimed to produce and sell timber, rather than being focused also on innovative management options and to supply goods and services that could support the local tourism. On the other hand, positive situations have been highlighted as well: some MAs and CPIs signed a memorandum of understanding, recognizing the importance to sustain and promote winter tourism. In some other cases, CPIs and Municipalities reached economic and procedural agreements regulating the mutual competences, roles and tasks in order to manage both winter and tourist services.

5. DISCUSSION AND CONCLUSIONS

Our initial hypothesis was that not always the effects of the transformation of municipal forests to Common Properties are positive in terms of enlarged public participation by local residents, introduction of innovations and improved forest management practices. Results showed contradictory and contrasting figures. Not rarely, municipal representatives admitted that forest landscape management has bettered since CPIs obtained the ownership of former public forests, sometimes having also relieved Municipalities of difficult and time-consuming administrative burdens. The renewed CPIs control over forest resources resulted also in an additional confidence that no speculative actions, detrimental for the environment, will be carried on within the local forest landscapes. Nevertheless, beside a positive action of safeguarding of their own territory, sometimes commoners look like moving from the fierce desire to resist to the globalization stances, rather than from the willingness to foster and ensure a sound and sustainable local development. By doing so, the risk to condemn their common lands and mountainous territories to a progressive social marginalization cannot be prevented. Often, the same "conservative attitude" apply also to the social environment. Whereas the gender issue are being progressively solved or mitigated (but there's still a long way to go), other social issues appear even more urgent than the former. This is the case of the exclusion of those people not descending from ancient local inhabitants from the possibility to enter the common community, even if they have been living within the local community since several decades and even if they demonstrated to be interested to actively participate to the common resource management. Reasons that led in the past to the institution of such "social barriers" (increasing human pressure on scarce and essential forest resources) don't seem to be justified anymore. On the contrary, nowadays they risk to trigger social frictions possibly detrimental for the same common community, and that for sure are not in line with the spirit of the regional law. On the other hand, the same survival of some CPIs could be threatened: in fact, several times interviewees stressed that the number of commoners dropped over the time, also because of too "closed" legal statutes. Thus, in a couple of centuries Italian CPIs shifted from struggling against the so-called "enclosure of Commons" (Bravo and De Moor, 2008) to a different, opposite issue, namely becoming "common enclosures" that risk the extinction if they will not be able to open and adapt to broad societal changes.

Our second hypothesis has been substantially confirmed, namely that the coexistence of new Common Properties and Municipalities poses on a weak equilibrium, with the need of progressively reinforcing the coordination among local institutions. Interestingly, CPIs' representativeness within the municipal administration is not a discriminating feature in order to set up positive or negative institutional relationships: in fact, Common Properties are well-represented in almost every Town Council. Rather that, results suggested the importance that formal (and informal) contacts between these two Bodies are carried out by more than one single municipal representative, otherwise, the whole institutional relationship may suffer any worsening of such single and private contact. Therefore, institutional mechanisms aimed to reinforce stable and enduring cooperation, such as procedural and economical memorandum and agreements, are worth to be established.

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OPTIMAL SITE-SPECIFIC SELECTION OF SOFTWOOD SPECIES SUBJECT TO SURVIVAL RISKS

Johannes Gerst[1] - Bernhard Möhring[1] - Thomas Burkhardt[2]

Abstract: *We consider the economics of a variety of Scots pine and White birch. Both species show considerable differences with regards to typical rotations times and susceptibility to survival risk, which both depend on site specifics.*
We derive parametric model functions for the value growth and analyze their profitability in both a deterministic as well as in a stochastic Faustmann-type framework. The value growth functions do reflect empirical knowledge of appropriate thinning strategies. Information on survival risk, which corresponds to the susceptibility of calamities like insects, fire, storm and others, is included by a survival function. The study was conducted as a part of the research project "Weichlaubhölzer - ungenutztes Rohstoffpotential?!" within the funding program " "Renewable Ressources" of the Federal Ministry of Food, Agriculture and Consumer Protection (BMELV).
The economic consequences of survival risks are investigated in a completely general stochastic discrete time Faustmann type model, which assumes a planned rotation time as well the risk of premature forced harvest caused by a calamity hit. The model is defined for a single stand, which is either completely hit by a calamity or not. If the calamity hits, the model captures a loss in value as well as potentially increased reforestation costs in a completely general way. The theoretical approach extends recent work by the authors to account for changes in tree species.
It is demonstrated with empirical data that both optimal rotation and tree species selection on a site are crucially influenced by survival risk, and appropriate changes are suggested as a measure of risk management or adaptation.
Appropriate expressions for both expected land value as well as land rent are derived. The difference between these values when compared with and without survival risk can be interpreted as the costs of risk. The costs are found to be substantial, dependent on age and particularly on tree species. Consequently, ignoring survival risks in forest management is likely to result in substantial losses. A change in tree species can reduce risk cost significantly. We see that the value associated with secondary tree species has a strong impact on the optimum time and cost effectiveness of forest conversion.

Keywords: Stochastic Faustmann model, Survival function, Hazard rate, Optimal rotation, Old age risk, Juvenile risk, Age dependent risk, Weibull function, Land rent, Land expectation value

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1 INTRODUCTION

Forest stands are exposed to a variety of natural risks, which threaten their survival. Reasons for a stand not reaching its planned rotation age can be calamities like insects, fire, storm or many others. They are usually connected with losses of revenue for the forest owner and therefore also pose an economic risk that has to be assessed and adapted in forest management decisions like rotation length and tree species choice. A suitable approach for the quantification and assessment of survival risks in forestry are survival functions (Staupendahl, 2011).

Survival functions can be incorporated in a Faustmann type decision model, which explains land value by the stochastic present value of the revenue from infinite repetition of identically planned forest rotations. Supplementary to the deterministic Faustmann approach, the stochastic model takes into account not only the planned rotation length, after which a stand is harvested at a cutting value if it survives until then, but also the calamity caused rotations of random length and the associated reduced revenues (Staupendahl and Möhring, 2011; Möhring et al., 2011)

The comparison between this stochastic and a deterministic Faustmann model shows that survival risks can noticeable reduce the magnitude of land rents and influence the optimal rotation length (Möhring et al., 2011). Changing the optimum rotation period can therefore be a measure of risk adaption.

We also see that both, risk level and risk type have strong influence on the adaptation strategy. Those factors do significantly depend on the tree species considered (Staupendahl and Zucchini, 2011). In many cases a change of tree species could also reduce the calculated risk costs (Bräuning and Dieter, 1999; Dieter, 2001; Knoke et al., 2008).

In the following we focus on the example of Scots-Pine stands under medium and poor site conditions in Northwestern Germany that are subject do different risk scenarios. It was analyzed how changing the optimum rotation period can reduce their economic risk and whether and when a conversion to naturally arising white birch is advantageous.

2 MODELS

Natural risks (calamities) were modeled by survival functions. Survival functions are descriptive tools that describe survival over time. The time of death is here denoted by the stochastic variable τ with the density t.

$$\mathrm{t}(\tau) \sim \begin{cases} w(\tau), & 0 <= \tau < T, \\ \delta(\tau - T)S(T), & \tau = T. \end{cases} \qquad [1]$$

The survival function $S(T)$ is defined to be the probability of the event $\tau > T$, short $S(T) = Prob[\tau > T]$ and $Prob[\tau_* \geq T_*] = 1 - \int_0^T w_* (t)dt$.

We used a stochastic Faustmann model in continuous time, that does not require any more specific assumptions about the properties of the survival function. In doing so, the fundamental ideas underlying the Faustmann approach remain valid.

The model considers a planned rotation time T, the time of death by a calamity τ and three types of payments: At the beginning, a pay-out of L is required for afforestation or reforestation. At the end of the rotation, we get an incoming payment $f(T)$, if the stand survives up to the planned rotation time, or $g(\tau)$ if the stand is subject to a calamity use before. Between these two points in time deterministic payments $D(t)$ can occure, e.g. for tending operations and thinnings. It is assumed that the harvest is followed by an immediate reforestation.

Furthermore we use a compounded interest rate i and the resulting discount factor $e^{(-i\cdot t)}$ over a time span t and alternatively a per period interest rate r defined by $(1+r)=e^{(i\cdot\Delta t)}$. For just one rotation, the equation for the stochastic present land value is

$$B_1(T) = -L\int_0^T D\,(t)e^{-it}\cdot S(t)\,dt + \int_0^T e^{-it}\,g(t)w(t)dt + e^{-iT}f(T)S(T) \qquad [2]$$

The stochastic present value of the revenue from one period infinite repetition of identically planned forest rotations $B = E[B]$ dependent on T is given by

$$B(T) = B_1(T)\cdot\frac{1}{1-v(T)} \quad \text{with} \quad v(T) = E[e^{-i\tau}] \qquad [3]$$

The optimality condition for the optimal planned rotation T can be denoted as

$$f'(T) + D(T) = i\cdot f(T) + (f(T) - g(T))\cdot h(T) + i\cdot B(T) \qquad [4]$$

To determine the cost effectiveness of forest conversion the model was generalized to a model which explains land value by the stochastic present value for non-identical replacement of tree species. This value results from the stochastic present value for just one rotation of a first species a and the stochastic present value for infinitely many following rotations of another species b.

The stochastic present value $B_W = E[B_W]$ dependent on T_a is

$$B_W(T_a, T_b) = B_{1,a}(T_a) + v_a(T_a)\cdot B_b(T_b) \qquad [5]$$

This yields in the optimality criterion for T_a

$$f_a{}'(T) + D_a(T) = i\cdot f_a(T) + (f_a(T) - g_a(T))\cdot h_a(T) + i\cdot B_b(T_b) \qquad [6]$$

In the following we used the land rent as the economic target instead of the present value. The land rent is more intuitive than the land value. It can be interpreted as the potential consumption per year attributable to the land value. We define the yearly land rent simply as the product of land value times yearly interest rate.

3 DATA

Sample-stands of Scots Pine and White Birch were initialized with realistic starting values and simulated over one rotation Periode with the Waldplaner 2.0 (Hansen and Nagel, 2001).[19] The volumes of the residual and the used stand were mapped in 5-year periods and valuated with costs and revenues according to Offer and Staupendahl (2009) and Offer (2012). To get a

[19] Simulations and parameterization of the underlying growth functions were done by Fischer (unpublished) as a part of the research project "Weichlaubhölzer - ungenutztes Rohstoffpotential?!".

steadily development of the stumpage value and the yields from thinnings over time, the discrete, a bit erratic data were smoothed by polynomial functions.

As loss of net revenue if a calamity hits the stand we assumed a proportional reduction of 40% from the stumpage values based on (Dieter, 2001). In addition, a general increase in costs of $2500,-EUR/ha$ was assumed for calamity caused final harvest, due to additional logging residues and difficult replanting (orientated on Offer (2013)). Altogether, we assumed $g_n = 0.6 \cdot f_n - 2500/ha$.

Furthermore costs for stand establishment of $L = 2500.-EUR/ha$ and a real interest of r=2.0 % p.a entered the model.

Figures 1 and 2 show the development of the stumpage values $f_*(T)$, yields from periodic thinnings $D_*(T)$ and inner values $\int_0^T e^{i \cdot t} D_*(t)dt + f_*(T)$ over time for Scots-Pine and White-Birch.

Figure 1. Development of the stumpage values, yields from periodic thinnings and inner values for Scots-Pine

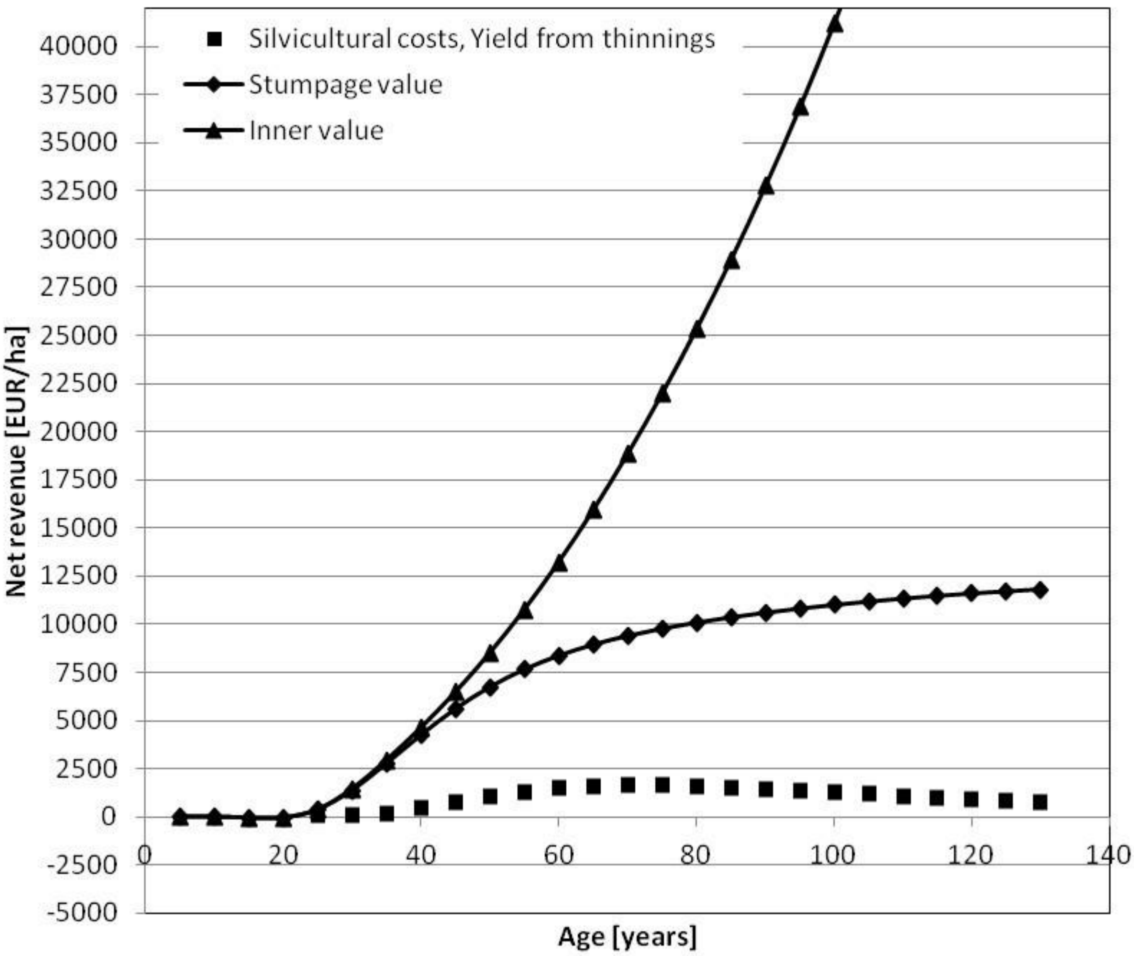
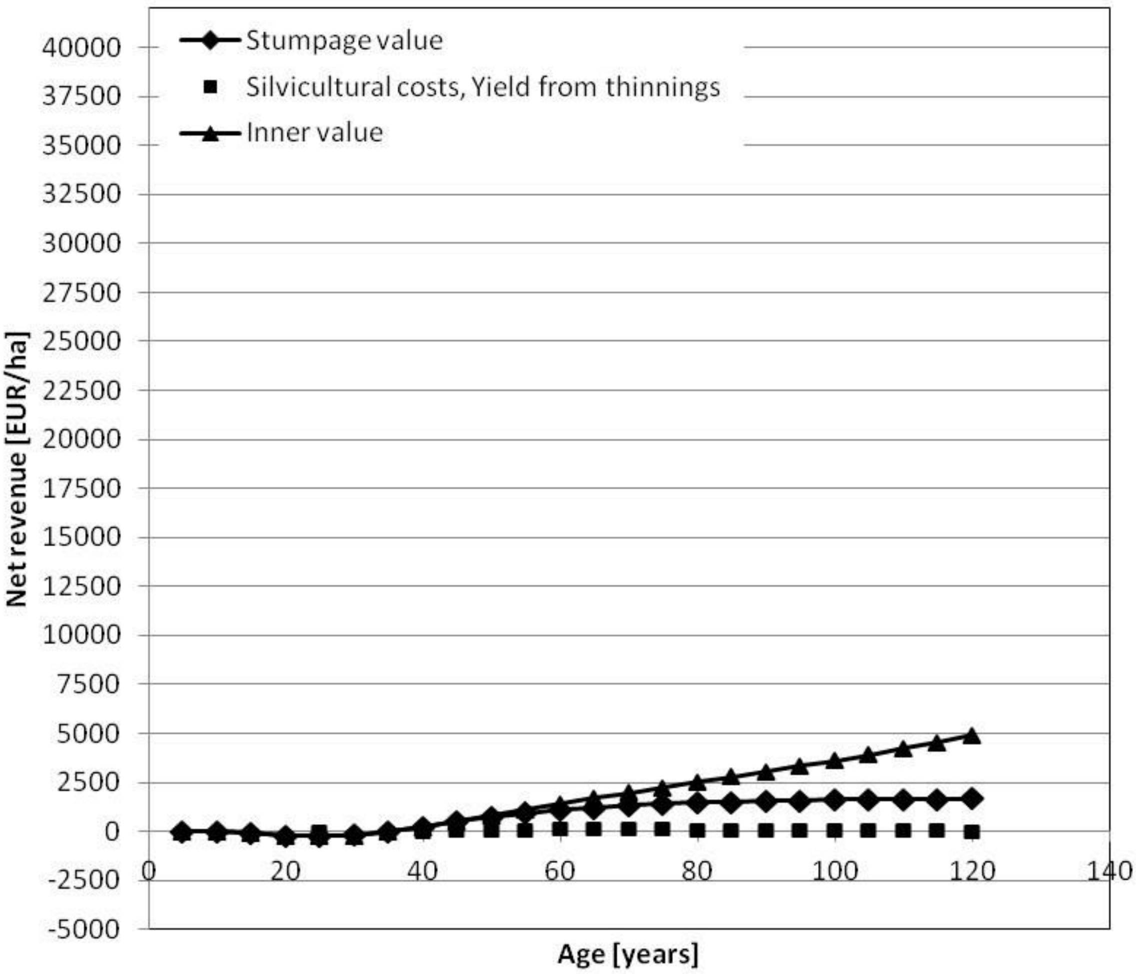


Figure 2. Development of the stumpage values, yields from periodic thinnings and inner values for White-Birch

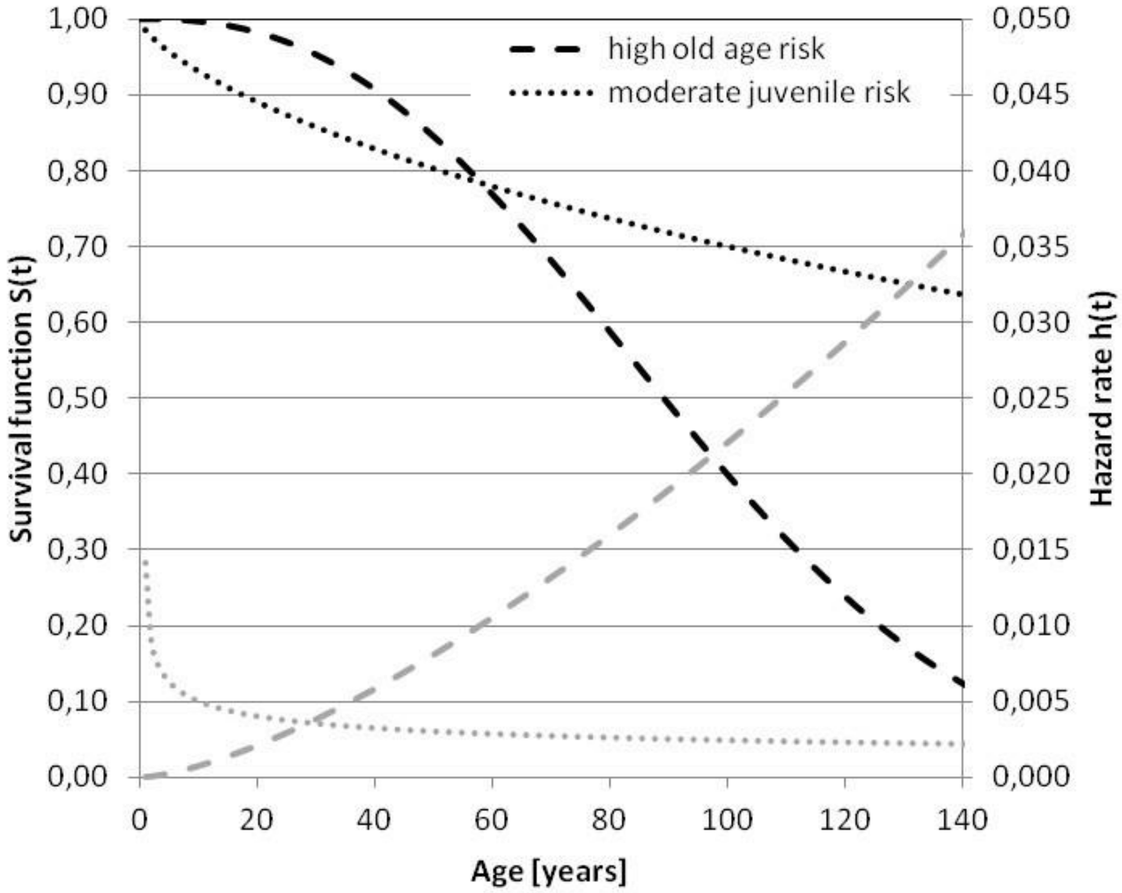


A Weibull distribution function (Weibull, 1951) was used for actually modeling the natural risk scenarios. It requires only two parameters and is quite flexible. It has a proven history of useful application in modeling natural risks in forestry (Pienaar and Shiver, 1981; Kouba, 2002; Holecy and Hanewinkel, 2006; Staupendahl, 2011a; Möhring et al., 2011). If τ is Weibull distributed with the parameters S_{100} and α, $S(T)$ is given by

$$S(T) = S_{100}^{-(\frac{t}{100})^{\alpha}} \qquad [7]$$

S_{100} is thereby equivalent to the value of the survival function at age 100, whereas the parameter α characterizes the shape of the survival function (Staupendahl, 2011).
Fig. 3 shows the survival functions and annual hazard rates of the Weibull-distributed time of death τ for the two risk scenarios *high old age risk* ($S_{100} = 0.4$, $\alpha = 2.45$) and *moderate juvenile risk* ($S_{100} = 0.7$, $\alpha = 0.7$) for Scots-Pine. The naturally arising White-Birch was assumed to be risk free.

Figure 3. Weibull-survival-function and hazardrate for high old age risk ($S_{100} = 0.4$, $\alpha = 2.45$) and a moderate juvenile risik ($S_{100} = 0.7$, $\alpha = 0.7$)



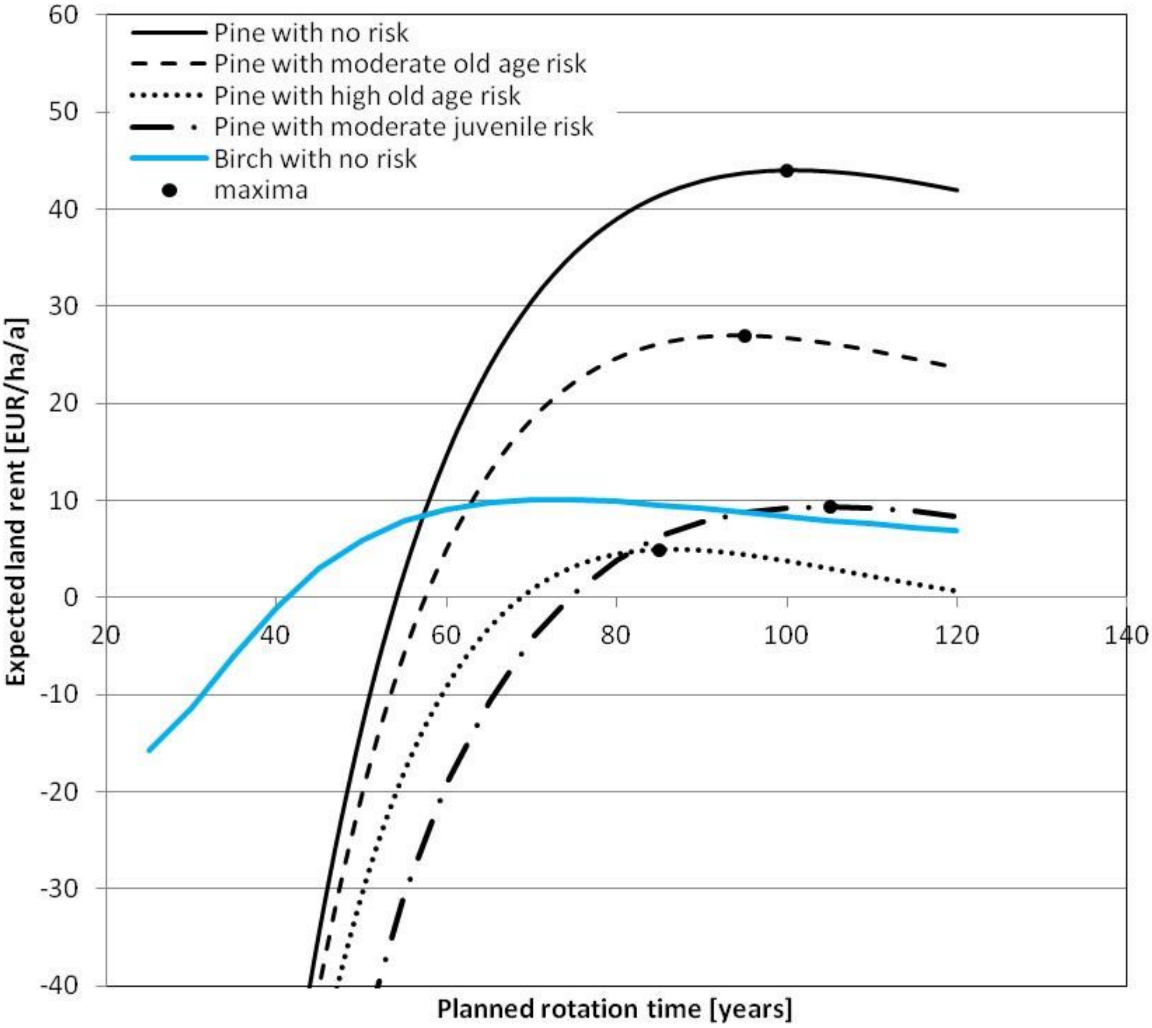
4 RESULTS

The optimal rotation period for Scots-Pine under various realistic risk scenarios and for a risk free case was analyzed. Figures 4 and 5 show how the expected land rent as a function of the planned rotation time changes with varying risk level (S_{100}) and risk type (α). The rotation periode with the maximum land rent is the optimal planned rotation time.

Figure 4 shows the results for the risk scenarios *high old age risk* ($S_{100} = 0.4$, $\alpha = 2.45$) and *moderate old age risk* ($S_1 00 = 0.7$, $\alpha = 2.45$). For the risk free case we find a maximum land rent of $44.-EUR/a/ha$ at a rotation periode of 103 years. The land rents decrease with increasing risk levels, the corresponding maxima of the land rent also decrease.

The figure also shows the scenario *moderate juvenile risk* ($S_{100} = 0.7$, $\alpha = 0.7$). We observe that the risk type has a major influence on the land rent and the optimal rotation time increases.

Figure 4. Land rent for Scots Pine with "no risk", "moderate old age risk", "high old age risk" and "moderate juvenile risk" ($S_{100} = 0.7$ "moderate risk" or 0.4 "high risk", $\alpha = 2.45$ „old age risk" or $\alpha = 0.7$ „juvenile risk".), land rent for White Birch with "no risk".

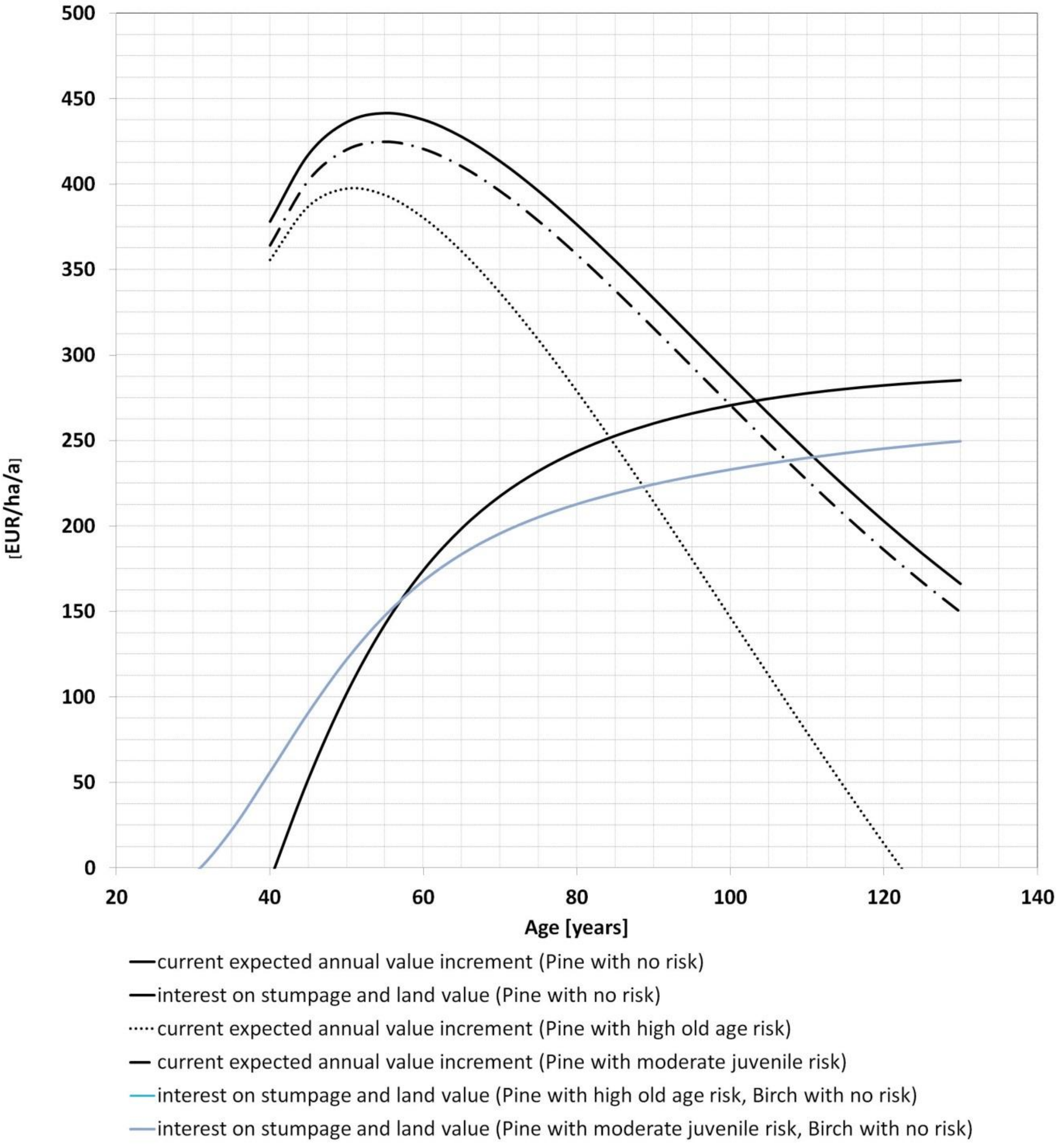


The calculated land rents for Scots-Pine under the different risk scenarios were compared to the land rent of a risk free White-Birch stand: Under the given site conditions the land rent of a risk free White-Birch stand is significantly higher than the land rents of Scots-Pine stands with a high old age risk or even a moderate juvenile risk. Therefore a conversion to naturally arising White Birch is advantageous. In case of a moderate old age risk, the calculation showed that a conversion is not advantageous, still the maximum of the land rent decreased compared to the risk free case for Scots-Pine, so the planned rotation period has to be adapted.

To determine the economical maturity of the Scots-Pine stand for the different risk scenarios and adaption strategies we looked at the optimality criterion for $T_{ScotsPine}$. A moderate old age risk reduces the optimal rotation periode form 112to 85 years.

Figure 5 shows the economical maturity of the Scots-Pine stand as the intersection of the current expected annual value increment and the interest on stumpage and land value (see Equation 6).

Figure 5. Economical maturity of the Scots-Pine stand as the intersection of the current expected annual value increment and the interest on stumpage and land value



A strong old age risk reduces the optimal rotation period even more. The stand should be harvested at an age of about 90 years and afterwards left to natural regeneration of White Birch. Typical juvenile risks make the harvest of the current stand and an investment in another stand of Scots Pine economically less attractive, because it will immediately be exposed to these risks. It is advantageous to exploit the expected annual value increment of the Pine stand until an age of nearly 110 years and then leave the land to natural regeneration of white birch.

5 DISCUSSION

The results show, that survival risks c.p. reduce the value of an existing stand and all following stands as well. The optimality criterion (equation 6) particularly depends on the expected land rent of the following stand, it's productivity and it's vulnerability.

Especially juvenile risks have great influence on economic decision criteria. Whereas moderate old age risks can be adapted to by shortening the rotation period, under medium and poor site conditions and juvenile risks, it can be advantageous to avoid high costs of stand establishment and leave areas to their natural development. This is, in particular, the case if areas were hit by calamities and seedling survival is expected to be low.

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INTEGRATIVE INDICATOR FOR OPTIMIZING DECISIONS IN MULTIFUNCTIONAL FORESTRY

Mihail Hanzu[1]

Abstract: *The multiple functions of any forest ecosystem are separable only at theoretical level. Practically a Forest cannot be managed to fulfill only one forest function without fulfilling any other one. This reality raises the problem of choosing an optimum forest stand structure whenever there is more than one possible sustainable option.*
The aim of the article is to present a possible indicator to be used in policy decision process. For this, some of the existing scientific knowledge is integrated into an adaptable "efficiency" indicator based on multicriteria analysis, decision techniques and linear algebra. At this stage of knowledge, the indicator can integrate (i) productive, (ii) protective and (iii) aesthetic functions, evaluated by (i) biometric, (ii) probabilistic and (iii) psycho-cognitive methods. These three forest functions can be evaluated objectively and dynamically but the results are very inhomogeneous ones; still not linear independent ones. The inhomogeneous results are integrated into a highly adaptable modular indicator, using new methods based on multicriteria analysis, Saaty's decision techniques and linear algebra.
Such a method represents possible criteria for optimizing and harmonizing policy decisions with sustainable multifunctional forest management science.

Keywords: optimal stand structures; heterogeneity; multicriteria analysis; cluster analysis; Ward method.

1 INTRODUCTION

The activity regarding the spatial and temporal optimization of possible forest functions emerged as the increasing interest in the late 1960's in analyzing and evaluation of multiple benefits determined by the ecosystems. This process was induced by the undervaluation of these benefits in the decisional processes (Hein et all. 2006) that led to unsustainable forest management.

In order to be able to manage forest sustainably there is a variable number of criteria that should be considered corresponding to different authors. According to UNPEF there are 6 criteria that should be considered. Briefly these principles are referring at least to the maintenance of forest: resources, vitality, production, biodiversity, protection functions and socioeconomic functions, other than the ones mentioned before. According to Romanian authors there are four main principles to be considered in sustainable forest management planning, these principles are: the continuity principle, the functional efficiency principle, the rational use of all the available resources and the ecologic principle (Giurgiu 1988).

In order to optimize the forest management according to sustainability idea, these criteria should be objectively evaluated first separately and then integrated all into an efficiency indicator. This need for merging all criteria into a unique ecosystem efficiency indicator is a consequence of the fact that multiple functions of forest ecosystems are separable only at theoretical level but, practically any forest fulfills multiple functions.

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However, nowadays, most of the studies that are dealing with the optimization of the ecosystem functions are rather unilateral ones, done throughout a single component of the system such as: environmental effects, productive effects or aesthetic effects.

There are also studies that are trying to analyze the whole forest ecosystem in order to examine the sustainable forest management. One of the reached conclusions is that for being able to build an applicable methodology for evaluating the sustainable forest management, a meta-indicator should be developed in order to integrate the wide heterogeneous existing knowledge.

Some of the protective effects seems to be antagonist ones, for instance the increment of the wood production function by spruce plantations in a beech site leads to a decrease of the aesthetic effects (Hanzu 2009) and ecological ones too (Augusto et al. 1998).

Since the different effects of any ecosystem can be separated only theoretically, for study purposes, the need to integrate all the results for optimizing the decisions in multifunctional forestry arises.

2 DESCRIPTION

There is a wide range of studies and methodologies dealing with certain effects of the forest ecosystems. But the results are as well widely heterogeneous, and therefore directly incomparable. Yet, even heterogeneous, the results are not independent. For example, substitution of beech by spruce in a low productivity forest stand is increasing the timber production (Pretzsch 2009), but is also increasing the acidity of the soil (Augusto et al. 1998), is reducing the stability to storms (Dobbertin 2002) and is reducing the preference of the general public for that stand (Hanzu 2009). Still an overall effect exists, but it is not quantifiable by any of the indicators, known so far. This correlation between different effects of an action can be quantified using statistical methods, ANOVA for instance. However, this approach can not explain all the variation of one effect based only on the variation of other effects. This is due to the fact that the correlations are not explaining causality relations.

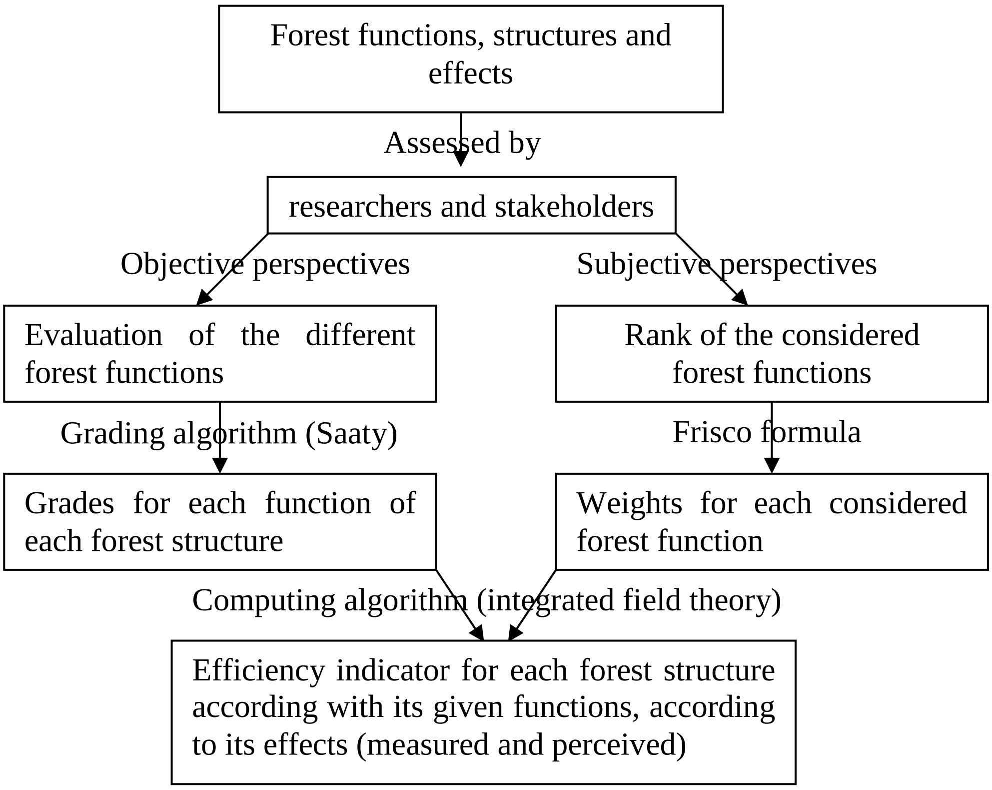
Accepting the linear approach to model the forest ecosystem effects, the efficiency and therefore the possible value of forest ecosystems is given by the resultant of all the considered vectors. This resultant represents the overall efficiency of the forest ecosystem.

Therefore any characteristic of a forest stand can be described as vector whose length is equal with the amount of effect produced by the stand. The vectors are not representable in a 3-dimensional space because they are representing different concepts, and therefore are conceivable in a more or less complex hyperspace, with an unknown number of linear independent dimensions. Although different in nature, the vectors are not independent, and the amount of interdependency can be expressed by the correlation coefficient. This is a remarkable fact. It represents a link between the field of statistical mathematics and the field of linear algebraic mathematics which will be named further on as integrated field mathematical theory. The integrated filed theory is a method to estimate the resultant of any set of vectors, not linear independent, describing the effects of a forest ecosystem without putting too much weight on one dimension of the considered hyperspace. Basically, the first considered vector quantifying the effect of the forest stand represents the main function of that stand, and it has a weight that equals with 1 in the resulting integrative indicator, after that, when the second vector is added in the algorithm, its weight is decreased by the degree of dependency of its length on the variation of the other already considered vector. When the third vector is added, its weight is decreased by the degree of dependency of its length on the variation of the two others already considered vectors. And so on, until the considered multiple functions of the forest stand were integrated in an abstract indicator that represents the overall efficiency of the forest ecosystem.

In order to integrate heterogeneous results from different studies, and to obtain results that if applied are producing effects that are accepted and perceived by the society at a certain time as positive ones, the method should always integrate the general public opinions regarding the forest issues.

For achieving this goal, the proposed method is based on the logical scheme presented in Figure 1.

Figure 1. Logical scheme of the method



The study was conducted in mixed forest stands that are typical in the natural forest types from Cindrel Mountains. The Cindrel Mountains are covering approximately 900 km^2 surface, with a maximum altitude of 2245 m above sea level; the tree line altitudinal limit is at 1800 – 1900 m, depending on the local conditions. Between 850 and 1300m is the altitudinal belt of European beech-silver fir-Norway spruce mixed stands. In the past, the human activity in the region was intense; leading to changes in the entire vegetation cover, therefore today only a surface of 4505 ha is covered by the described forest types. The species whose height dynamics was studied are *Fagus* sylvatica (L.), *Abies alba* Mill. and *Picea abies* (L.) H. Karst.

Eighteen stands with an age varying from 55 to 140 years were selected for the studies. In each stand, plots of 0,25 hectares were sampled.

For evaluating forest efficiency a multicriterial analysis was done using the Frisco formula. Three criteria are taken into account, namely: (1) the productivity of the forest which is estimated by the average height; (2) the protective effect of the forest which is estimated by the stability of the forest stand for climatic hazards and (3) the aesthetic effect of the forest which is estimated by the people’s perceptions and preferences for different forest structures.

The Frisco formula, considered is:

$$W_k = \frac{2P_k - P_{min} + S_k + 0{,}5}{0{,}5 * n + P_{max} - P_k}$$

W_k – the absolute weight coefficient;
K – the order number of the criterion;
P_k – the global grade of criterion k;
S_k – number of criteria whose global grades are smaller than the grade of current criterion.

Height measurements were carried out using a Vertex III device, whose precision is, according to the user manual +/- 10 cm[20]. The heights of all trees with a diameter of more than 7 cm were measured. Average heights were calculated for each stand and for each species. The average heights were compared with the heights from the yield tables. The used yield tables were developed for the entire Romanian Carpathian range. The stand age was determined using cores.

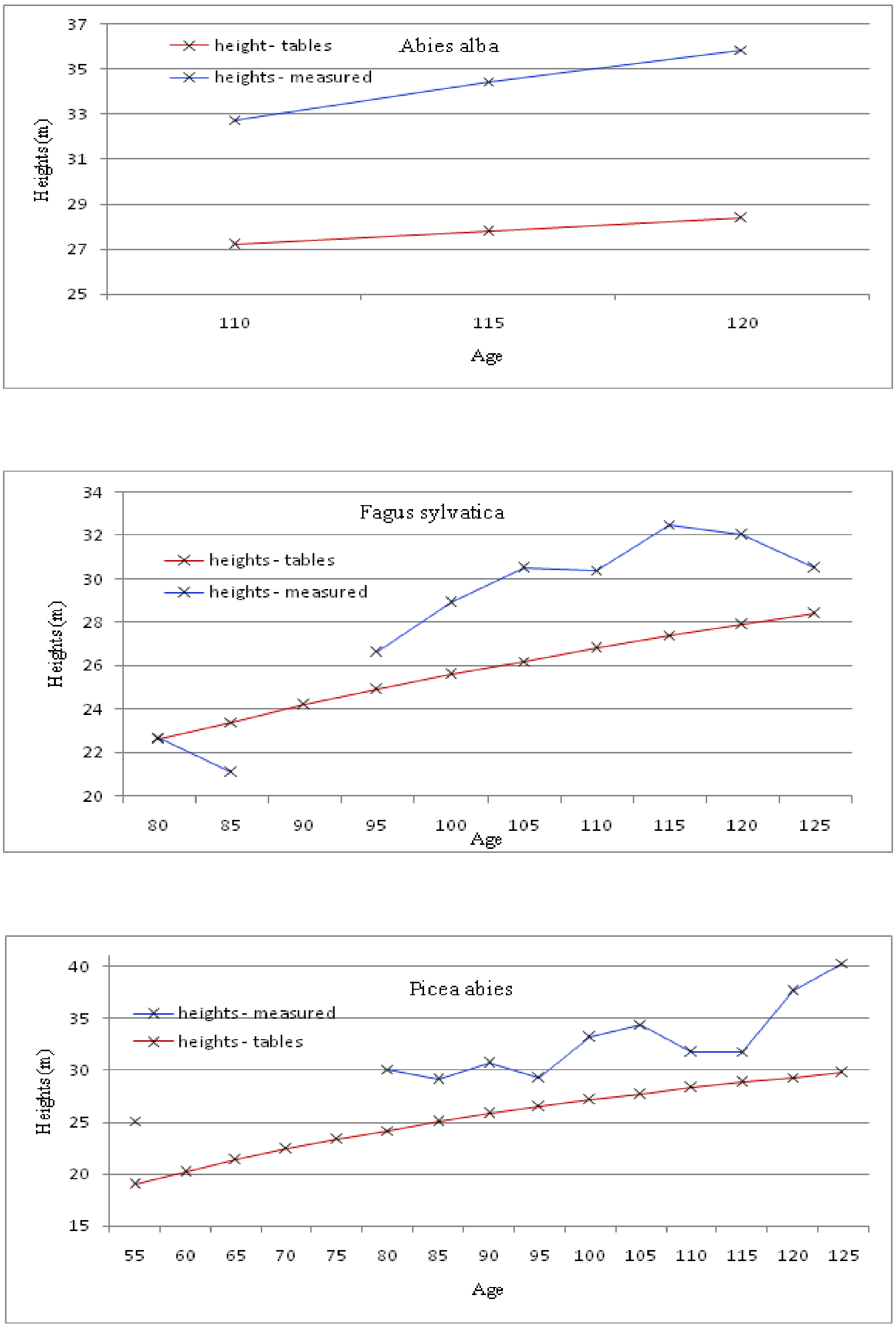
Evaluation of the protective effect for each forest type was done by an indicator that consists from the area affected by wind throws and wind breaks in a certain period of time divided by the total area of the forest, at the beginning of the time interval. The reason for this choice is the fact that any protective effect is conditioned by the very existence of the forest, therefore if the forest is more likely to be affected in a catastrophic way by a climatic hazard; the protective effect is less likely to exist. For this forest sites according to the literature (Dincă 2010) the most sensitive to wind damage are the Norway spruce forests, followed by white fir forests. More stable to wind damage are the European beech forests; and the most stable are the mixed forests of resinous and beech forests. Even if from productivity perspective *Picea abies* – (L.) H. Karst. is overwhelmingly superior to *Fagus silvatica* – L. on many sites under normal conditions, storm damage in *Picea abies* - (L.) H. Karst stands is four times as high as in *Fagus silvatica* – L. stands. (Pretzsch citing von Lüpke and Spellmann 1999).

The aesthetic effect of the forest was estimated through a perception and preference study that was carried out according to a methodology published by Santos J.M. (1998) and it is based on the so called cognitive psychological approach. According to a study on perceptions and preferences already done (Hanzu M, 2007) the most preferred scenery from the possible scenery in this vegetation belt is represented by mixed forest stands with high forest followed by pure beech stands followed by spruce stands.

Regarding the productivity of the stands expressed by the average height the following results were obtained for the tree species that are forming mixed stands. As it can be seen from Figure 2 the average heights for the tree species considered is constantly above the reference heights from the yield tables. The only exception is formed by the eighty-five years old beech that is bellowing the reference limit of the yield tables.

[20] It might be practical to notice the impossibility to use the device near a creek, probably because of the noise produced by the creek.

Figure 2. The average heights (in meters) for tree species growing in mixed stands in comparison with the heights from the yield tables



Regarding the estimation of different forest structures integrated effect the following multicriterial analysis has been done. The way how this integrated effect of the forest was computed can be seen in table 2 and 3. The criterion assigned number is the same as in methodology section, namely 1 – productivity, 2 – stability, 3 – aesthetics. As it can be seen from table 3 the most efficient forest for these sites seems to be the mixed forest stands.

Tab. 2. Calculating relative coefficient of weight for the three criteria taken into account

k	criterion	1	2	3	P_k	L_k	S_k	W_k	w_k
1	1	0.5	0	0.5	1	2.5	1	0.833333	0.138889
2	2	1	0.5	1	2.5	1	2	4.333333	0.722222
3	3	0.5	0	0.5	1	2.5	1	0.833333	0.138889
							Total	6	1

P_k – global grade of criterion k
L_k – the place of criterion k
S_k – number of criteria with global grades lower than criterion's k grade
W_k – the absolute coefficient of weight computed with Frisco formula
w_k – the relative coefficient of weight computed as: $w_k = W_k / \sum_{k=1}^{k=n} W_k$
n – number of criteria

Tab. 3. Ordering of the possible compositions, based on the relative weight coefficients

G_k – grade of each possible composition for each criterion k		Possible composition for the forest stand							
		Spruce stand		Fir stand		Beech stand		Mixed stand	
criterion	w_k	G_k	G_k*w_k	G_k	G_k*w_k	G_k	G_k*w_k	G_k	G_k*w_k
1	0.138889	8	1.111112	8	1.111112	6	0.833334	9	1.250001
2	0.722222	5	3.61111	6	4.333332	7	5.055554	9	6.499998
3	0.138889	4	0.555556	4	0.555556	8	1.111112	9	1.250001
		Total	5.277778	Total	6	Total	7	Total	9
		Rank	4	Rank	3	Rank	2	Rank	1

3 DISCUSSIONS

The height of the trees that are forming mixed forest stands are constantly above the reference model that is the yield tables. There are few possible explanations for this fact. One is that the yield tables were designed for pure stands and for all the area covered by spruce, fir and beech from Romania, while some local conditions, including that the species are forming mixed forest stands, are different. This is inducing a different dynamic of each species in the stand so therefore even if the production class was properly established, when the management plans were elaborated, the species forming the forest have different natural development curves than the ones considered. This leads, in time, either to overstocking or to under stocking of the stand, in both situations the possible amount of wood that is either unsustainable either not harvested entirely. Another explanation is that data used for the yield tables is old and the growing conditions changed.

The integrated filed theory analysis could not be applied in this example because of the impossibility to determine correlation coefficients with just one set of data.

Regarding the possibility of estimating an integrated effect for the forests the multicriterial analysis seems to be quite an effective tool in determining such an indicator. The result is in accord with the previously known facts, that the mixed forests are more effective than the pure ones. This is a good way of building indicators that are quantifying the global effect of a forest or of an ecosystem in general. However it might be difficult to apply such a method because of the subjectivity in the grade giving process. This disadvantage can be, at least partially reduced, by introducing a rigorous grading algorithm, but it is time consuming to develop a proper algorithm for each of the considered criteria. Due to this reason the result should be carefully interpreted.

Such a method can be used in forest management in order to integrate, hard to quantify social services of a forest and economic services of the forest, in order to estimate optimum structures to be promoted through human interventions.

4 CONCLUSION

The method allows integrating inhomogeneous results into a highly adaptable modular indicator. Although in this state of research is not clear if the grading algorithms should be based on linear – continuous or discrete scales or on nonlinear ones, the advantages provided by Saaty's decision technique or by multicriterial analysis permits to overcome the difficulty of combining different results of heterogeneous indicators into a unique efficiency indicator.

Such a method represents possible criteria for optimizing and harmonizing policy decisions with sustainable multifunctional forest management science, but still further research needs to be done, in order to verify it in more complex situations.

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COST-BENEFIT ANALYSIS OF FORESTRY INSTRUMENTS

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Abstract: *Forests have been managed under the concept of multiple uses since the sixties. However, timber was supposed to pay for providing the non-market, ecological and social benefits. Today, in certain forests, non-timber products such as annual hunting fees dwarf timber income. In the future, non-timber ecological and social services could find markets also. We want to transit toward a more sustainable economic development. Should we speed up the transition process by offering public incentives to reward owners for providing goods and services for which they may not be rewarded financially today but for which a market could appear or be created in the future? A method for tailoring possible forest instruments for this transition period will be presented and the way to operationalize the method discussed. The method relies on the dual financial and economic analyses of forest investments.*

Keywords: cost-benefit analysis, environmental valuation, social valuation, forestry instruments

1. INTRODUCTION

The analysis of forest investments has become more challenging as the various demands on the forest resources are evolving and the environmental and socio-economic contexts are changing rapidly. Reflecting on the new socio-environmental values of forest investments, a question arises: should forest investments benefit from special help while new values are not yet marketed?

Forests have been managed under the concept of multiple uses since the seventies. However, timber was supposed to pay for providing the non-market, ecological and social benefits. Today, in certain forests, non-timber products such as annual hunting fees dwarf timber income. In the future, non-timber ecological and social services could find markets also. We want to transit toward a more sustainable economic development. Should we speed up the transition process by offering public incentives to reward owners for providing goods and services for which they may not be rewarded financially today but for which a market could appear or be created in the future?

An approach is proposed in this paper to decide on the necessity of forest investment instruments in Europe after reviewing the basic concept of the benefit-cost analysis of investments in general and of forest investments in particular. A new tool to systematize the approach is then presented with an application example.

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Cost-Benefit Analysis

Cost-Benefit Analysis (CBA) simply said is the comparison of the advantages and disadvantages of a certain course of action which could be a new investment, project or policy. The History of CBA goes back to the French engineer and economist Jules Dupuit and was popularized by the US Army corps of Engineers for water projects initially (see box).

History of CBA

The concept of CBA dates back to an 1848 article by Jules Dupuit and was formalized in subsequent works by Alfred Marshall. The Corps of Engineers initiated the use of CBA in the US, after the Federal Navigation Act of 1936 in the US effectively required cost–benefit analysis for proposed federal waterway infrastructure (History of Benefit-Cost Analysis, Proceedings of the 2006 Cost Benefit Conference http://home.gwu.edu/~scellini/CelliniKee21.pdf). The Flood Control Act of 1939 in the US was instrumental in establishing CBA as federal policy. It demanded that "the benefits to whomever they accrue [be] in excess of the estimated costs".

CBA compares the costs and benefits of different courses of action duly accounting for the opportunity costs of the inputs used in the context of a marginal or *with-without analysis*. It identifies the choices that maximise welfare from an utilitarian perspective and so doing be Pareto efficient action, one that makes some better off and nobody worst off.

Recognising all future costs and benefits of a given course of action has become risky and uncertain in today´s world, this is especially the case for forest investments that span over decades and even centuries. This brings the question of the value of time which links with all the debates about the proper discount rate to use. Forest investments are also peculiar in that they are characterised by frequent externalities and option values.

A number of classical references dating to the 60-70s introduce the classical CBA. Mishan (1973) is the most often quoted academic. For the practitioners the OECD and UNIDO guidelines brought the application of CBA to the economic development field. More recently, and specifically for Europe, the 2008 *Guide to Cost-Benefit Analysis of Investments Projects* (http://ec.europa.eu/regional_policy/sources/docgener/guides/cost/guide2008_en.pdf) is particularly relevant to explain the approach to decide on public forestry investments and instruments by the European Commission to the Regions.

2. COST-BENEFIT ANALYSIS IN FORESTRY

The literature on CBA as it relates to Forestry is not extensive even if the cash flow type of analysis is found in the forest economics literature since practically the time of Dupuit. More recently the forest economics literature has enthusiastically followed the environmental valuation field to attempt valuing the numerous non-timber and non-market goods and services derived from the forest.

The first manual to guide public forest investment in forestry using the CBA dates back only to 1979 with the FAO Forestry Paper No 17, titled *Economic Analysis of Forestry Projects*. The FAO Manual was one of the most frequently quoted and used in that Forestry Paper collection. In those days, the environmental dimension of forest investments was not considered as important as today. The manual does not cover at all the environmental valuation of the non-market goods and services provided by the forest cover. It discusses the social and developmental dimensions of these investments.

A book, *Essays in Forestry Economics: Appraisal and Evaluation of Forestry Investments, Programs and Policies* (Harou, 1987a), covers some specific topics related to the use of CBA in the forestry sector such as the social discount rate, the shadow exchange rate and the shadow price of labour. The environmental values such as the value of biodiversity and fuelwood shadow prices are introduced in the investment analysis of forestry investments. It also introduces the notion of equity in forestry project appraisal.

More recently, the Observatory for European Forests of EFI has undertaken the elaboration of different working papers related to the CBA in forestry in its program of Microeconomics. In the future, these different working papers will serve as material to prepare a Manual on CBA in forestry.

In order to present the approach followed to decide on the needs of instruments to incentivise forest investments, let´s define some terms which will be used in the following section of the paper. The first aspect to clarify is the point of view from which the investment is prepared. The analysis of an investment can be made from different points of view: a private concerns such as a forest landowner or an industrialist or a public concern such as a commune or the forest service of a country. The CBA concerns typically public investments. These investments costs and benefits are seen from Society´s point of view and typically do not include taxes and incentives considered as transfer payments. They used the social discount rate and not the opportunity cost of capital prevalent in the sector. They used the true opportunity costs of the inputs and outputs used in the project often referred to as shadow price by opposition to the market prices used for private investments.

As in the FAO guidelines, we will call the private investment analysis a *financial analysis* by opposition to the same investment made from the point of view of Society which we will call an *economic analysis*. The economic analysis is what is understood as Cost-Benefit Analysis and is covered in public finance literature. The financial analysis is part of the broad field of finance by opposition to the accounting field. The mechanic of the calculation of the profitability of the forest investments made in the financial and economic analyses are identical. The prices, discount rates and transfer payments marks the differences between the two cash flows of a same investment. Differences are also more trenched when we consider the environmental and social dimensions of the forest investments. The economic analysis will have to incorporate to a larger degree many of the new elements brought by the environmental and social impacts assessments.

3. INSTRUMENTS FOR PRIVATE FORESTS

In this paper, the decision on public forest investments is tantamount to the decision to provide public instruments for the private sector or not. In Europe, where an important part of the forest area is privately owned, most countries offer some kind of instruments to help forest long term investments. It is in this perspective that we refer to public instruments for forestry. In the case where forests are owned by the State partially or completely as in Russia and Canada, the problem becomes one of general public investments. CBA has been designed especially for public decisions. However, we will see in a moment that in addition to the economic analysis of public investments, the financial analysis of the private investors is also relevant to decide on the necessity to provide incentive to guide forest investments in the proper direction required for a greener economy.

The approach is simple to explain in theory but more difficult to apply in practice for the forestry sector. The approach consists in analysing a standard private investment in a given region susceptible to benefit from a public help from both a financial and economic analysis. First, the analyst will have to show that the financial profitability from managing the private property in a certain way desired by Society is not possible. In a second step, the analyst will have to clearly demonstrate that the type of forest management desired by Society is economically profitable. If indeed the financial analysis is negative but the economic analysis positive, an argument exists to eventually use an instrument to entice the private landowner to follow the forest management desired by Society.

To be efficient, an economic instrument will have to help the private owners so that she just breakeven in the financial analysis. Any amount of money transferred over and above that breakeven point would be inefficient from an economic standpoint. It would not be Pareto optimum.

The EC CBA Guide (EC 2008)suggests the same approach to decide if the European Investment Bank for instance should help financially some private investments that could generate positive green growth. The approach described above is summarized in figure 1 below.

Figure 1. Steps in deciding to invest under EU funding

1. Context Analysis and Project Objectives
2. Project identification
3. Feasibility and option analysis
4. Financial analysis
5. If NPVf greater than zero: no EU investment
6. If NPWf is lower than zero perform an economic analysis
7. If NPWe is lower than zero: no EU investment
8. Il NPWe is positive. Eventual EU funding
9. If the sensitivity analysis and risk assessment is acceptable invest

The approach proposed to decide on the necessity of public expenditures to help private forestry follows the same logic. A guide to help prepare the terms of references for analysing forestry project has been prepared by EFI (Snowdon and Harou, 2013) and distinguishes similar steps listed in Figure 2.

Figures 2. Steps to present the appraisal of forestry investments

1. Define the issues, the rational for actions and objective
2. Identify options
3. Identify costs and benefits of selected options
4. Make tax and subsidy adjustments
5. Adjust costs and benefits for future changes in values and prices
6. Identify risks and uncertainty
7. Assess distributional impacts

The steps are similar than for the EU guidelines but more effort is made to adjust for environmental externalities, risks and social impact of forestry investments before comparing the financial and economic analyses of the same investment.

Shadow pricing forestry projects can be a difficult task. We will not cover these aspects here, they can be found elsewhere (Markandya et al.2001). The first step is to define the scope of Society: a commune, country or Europe (Harou, 1987b). Shadow pricing consists in finding the proper opportunity costs of using the inputs and the benefits derived from all aspects of the standing forests in addition to its timber and non-timber products. For forestry the discount rate and labor costs are important elements that vary the profitability of forest investments especially in small scale forestry and the differences between the financial and economic analysis of a project. National Governments often will provide these values to the analysts since it implies a value judgement that the analyst is not entitled to make. For non-market values, a data base of previously estimated values could be useful to ease possible value transfers (Stenger et al. 2009 and Cost E 45, 2012)

Many different instruments are used in forestry (Cubbage et al. 2009). The instruments we are more concerned with here are the economic instruments but the command and control options and extension activities may be better instruments depending on the context. Each and every of these instruments involve a cost from the public treasury. So the benefits of these public expenditures need to be assessed to justify the budget of forest institutions to their finance ministries. How to prepare these analysis in a systematic way is the purpose of the following section

4. CBA AND DATABASE ON FOREST INVESTMENTS

To provide forest instruments with public financing for a greener economy, we said the financial analysis needs to show negative returns while the economic analysis should show a positive return to Society. To obtain information to assess the profitability of private investments is not easy. To facilitate the task an open-source software has been developed to record and store these cash flows and create a data base with the underlying biophysical and prices information, both market and shadow prices. Such a system would be particularly important also to monitor these public expenditures since the forestry sector as well as many other sectors of the economy are in increasing flux derived from the globalisation and climate change among others. This has an impact on the economics of the forestry sector and forest investments (Harou et al 2013).

Two software are being prepared to facilitate that task. One of which is a web based software, FInWEB, *Forest Investment Web Application* (Lobianco, 2013). The other is a computer base software with the same capability and outputs. Both are derived from the software CASH (Rose, 1994). They are generic cash flow and sensitivity analysis programs. Both will be downloadable from the EFI website shortly.

FInWeb is an online version of the cash flow software described by Rose (1994). The idea behind the web version is that while forest professionals can use it to pursue their own needs of evaluating a forest investment, the structured information they fill can at the same time be used to build a public database of forest investments. In that way, typical forest costs and benefits could be compared across regions and species.

In order to achieve this objective, an editorial workflow has been set that while allowing users to immediately receive a feedback on the profitability of their investment project, the information feeds the public repository only after editorial approval.

Profitability indicators are given for both financial and economic analysis. A distinctive characteristic of FInWeb is its full transparency over the computations of the outputs. For each variable, users are exposed with a first "descriptive" level that can then be deepened up to the source code that actually generates the variable.

FInWeb, currently in private testing status, will soon be accessible through a web browser from the EFI web site and will require users to register. Once registered, users can either start a new forest investment project from scratch or clone an existing public project and perform over them their own modifications. Within the newly created or cloned project, they are asked to provide project specific information (e.g. species, location, currency and discount rate) as well as any activities that generate a positive or negative cash flow during the project life.

Among the project information users can specify if they want to keep their project private or leave the default option of making it public. In either cases, while they receive an immediate feedback on the project profitability, the project would require an editorial approval before becoming public and entering the data base.

Computation is done in real terms. It does not consider inflation and use a real discount rate. It assumes that each future cost or revenue will be proportionally impacted by inflation. However, to account for possible relative price increases, users can specify a rate for relevant activities.

Each cash flow activity can span different time periods on which different quantities or price can be specified so to avoid duplications when entering the information. If a project needs to be modified, a new revision will be made. Revisions allow comparing different versions of the project, hence representing a simple way to test the importance on profitability of various components of the project itself.

The main financial indicators of the investment (Net Present Value, Equivalent Annual Income, Soil Expectation Value, Benefit-Cost Ratio, Internal Rate of Return) are provided for both the financial and economic analysis. To help the forest professionals to correctly judge the investment, the output is completed with a cash flow table that details for each period the individual and cumulative cash activity of the investment (total and by activity). Two sensitivity analysis tables are produced. One highlights the importance of each individual activity to the overall project profitability. The other shows the influence of the discount rate on profitability of long term forest investments. The revision system itself is a way to implement a sensitivity analysis over *any* characteristic of the project.

The construction of the data base is an important feature of FInWEB. While providing structured information for their own project, users contribute with a bottom-up approach to the building of a public repository of forest investment information. The key element here is the *structured* level of the information. To each forest project is assigned a given location trough a point-and-click visual map from which, trough reverse geo-coding, the country and region are determined. Projects can be tagged with up to five species. Individual activities are free-tagged. This information can then be used to browse projects by species and country, compare activities and compute averages values.

Users can directly contact the author of the investment analysis on the system and leave a comment on their projects. Borrowing from the experience of internet blogs and forums, each project can be seen as the first post of a new thread over which a discussion on the project can develop.

While still roughly implemented and not the primary goal of this project, the possibility of cloning existing projects, handling of projects-as-a-forum implementation and dividing users into different groups, all implement an idea of communities of practice within forest professionals. That community could be further expanded with successive projects.

5. AN EXAMPLE

The original study attempts to compare the relative profitability of Pine Plantations in Aquitaine France and the South Brazil (Fereira 2013). Here we will refer only to the plantation of maritime Pine (Pinus Pinaster) representing an area of close to one million hectare in the South West part of France: Pine plantations in Aquitaine are well suited to sandy and acid soils with some water deficit. Soil varies from rendzimas limestone to podzolic soils. The mean annual temperature ranges from 11 to 14^{o}C. Precipitation is well distributed all year around from 600 to 1.200 mm per year, with possibility of drought periods between spring and summer.

The example is for one hectare of standard characteristics and site index. The forest yield has been modeled using the Capsis platform http://capsis.cirad.fr/capsis/models and average 11 m3 per hectare and per year. The soil are poor but genetic improvements have allowed a doubling of the yield in the last fifty years

The financial and economic cash flows provided in annex will help us illustrate the approach discussed above and the software calculation and database construction explained in the precedent section.

The private forest owner considered here has an opportunity cost of capital of 3%. If she does not invest in the forestry plantation and sell the land, she can get a 3% on that capital.
The financial cash flow, CF1 in the annex, shows that the investment is not profitable (Figure3) at a 3% discount rate which corresponds to the landowner opportunity cost of capital. The internal rate of return is 2.6%, i.e. below the acceptable rate of return. In that case, the landowner could neglect forest management on that land as happens often on the small forest estates encountered in Europe. Note that in Aquitaine the medium property size of 8 hectare is well above the average forest area size of 3 hectares in France. The owner could also change the use of that land or sell it.

Figure 3. Profitability indicators for the financial analysis (CF1)

Variable	ir -1%	Value	ir +1%
Net Present Value (NPV)	605.508	-301.724	-938.312
Equivalent Annual Income (EAI)	23.7467	-13.6331	-48.3387
Soil Expectation Value (SEV)		-468.068	
Benefits-Costs ratio (BC ratio)		0.901421	
Internal Rate of Return (IRR)		2.62662 %	

If we want the owner to plant in order to supply the numerous forest products mills of the region, we will want to help the landowners to invest in their forests. An economic analysis of the same investment needs to be done now to gauge the profitability of the investment but from a societal standpoint this time. This analysis is found in the CF2 of the annex and now the public investment is clearly profitable (Figure 4). The social discount rate is given at 2%. The difference between the two analyses resulted also from shadow pricing labor and carbon. Unemployment is high not only because of the ongoing economic crisis but is structural in the region. It was estimated that the true opportunity cost of the unskilled worker used in forest plantation could be half the wage paid in the private sector which is the minimum wage. In addition a value is attached to the fact that extra carbon is fixed by the plantation and is worth approximately €30/ha/year (Zhang, 2011 p.368).

Figure 4. Profitability indicators for the economic analysis (CF2)

Variable	ir -1%	Value	ir +1%
Net Present Value (NPV)	3283.08	1855.47	842.892
Equivalent Annual Income (EAI)	110.531	72.7674	38.0851
Soil Expectation Value (SEV)		3711.14	
Benefits-Costs ratio (BC ratio)		1.68772	
Internal Rate of Return (IRR)		4.20749 %	

The financial analysis has thus showed that the investment by the private owner is clearly not profitable in this case. However, from a Society stand point it is a good investment. Using this dual analysis, the analyst has build an argument to provide an instrument to entice forest investments by the private sector.

Which instruments to choose is another matter. As said earlier, a panoply of possible instruments exist. We have to choose the one that is most efficient, easy to manage and equitable. A CBA for each possible instrument has to be run and their NPV compared. The instrument with the highest NPV, *ceteribus paribus*, is retained.

A payment for fixing carbon has been found the most appropriate and efficient instrument in this case. A payment of € 30 per hectare and per year to fix the carbon on one hectare is proposed. It is the same value as used to shadow price carbon in the economic analysis. Using this shadow price for carbon as the incentive to the private forest owner, the financial analysis shows the investment profitable (figure 5 and CF3 in the annex).

Figure 5 Financial analysis indicators with a carbon payment of €30/ha/year (CF3)

Variable	ir -1%	Value	ir +1%
Net Present Value (NPV)	1355.47	342.892	-378.374
Equivalent Annual Income (EAI)	53.1585	15.4932	-19.4926
Soil Expectation Value (SEV)		531.932	
Benefits-Costs ratio (BC ratio)		1.11203	
Internal Rate of Return (IRR)		3.43379 %	

However, is this instrument, consisting in a payment of €30/ha/year for carbon fixing, efficient? To be efficient, the private forest investment in the financial analysis should just breaks even with the carbon payment and no more. Any payments over and above that point represent an inefficient transfer since it was not necessary to entice the private owner to invest. It was fond that a carbon payment of half that amount, or €15/ha/year was just enough to break even. The instrument recommended is thus a payment for carbon of just €15/ha/year.

Figure 6. Financial analysis indicators with a carbon payment of €15/ha/year (CF4)

Variable	ir -1%	Value	ir +1%
Net Present Value (NPV)	980.487	20.5838	-658.343
Equivalent Annual Income (EAI)	38.4526	0.930055	-33.9156
Soil Expectation Value (SEV)		31.9319	
Benefits-Costs ratio (BC ratio)		1.00673	
Internal Rate of Return (IRR)		3.02575 %	

6. CONCLUSION

We have shown a simple approach to decide on the need for forestry instruments, the type of instruments and the amount of transfer needed to be efficient in administering the instrument chosen. A new web based software developed at OEF has been introduced to handle the dual financial-economic analysis of forest investments on which the approach is based. The approach has illustrated the usefulness of using the dual financial and economic analysis defined in the literature on public expenditure, public finance and CBA.

The Cash Flow approach is still very approximate in forestry. The production functions are difficult to quantify and subject to the vagaries of nature. Prices can change faster now as international trade expands. The sensitivity analysis built in FInWEB needs to be carefully considered and the sensitive variables analysed in more depth. The monitoring of the investments are crucial during the life of the project.

The Alternative Test to monitor forest investments is particularly relevant in an ever changing world (Harou et al. 2013). While one may think that one will never abandon a forest project after few years because most of the costs are incurred at the beginning of the project and only benefits have to be received in the future, in fact the situation is often more complex. If past costs are indeed sunk, the opportunity cost of the land can be changing suddenly with a change in policy or natural events making the abandonment of the forest use or the forest land a financial necessity.

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Annex 1 Cash flow Aquitaine Plantation:

Financial Analysis of a standard private hectare (i = 3%) CF1

Activities	Unit	Periods															
		0	1	2	3	4	5	6	7	18	23	24	25	26	27	28	35
Costs																	
- Soil preparation	€/ha	-500.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
- Seedlings	€/ha	-500.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
- Pre thinning maintenance	€/ha	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
- Administrative and management cos	€/ha	0.00	-29.13	-28.28	-27.45	-26.65	-25.88	-25.12	-24.39	-64.61	-15.20	-14.76	-52.54	-13.91	-13.51	-13.11	-28.43
- Cost of land	€/ha	-1,250.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Period Costs		-2,250.00	-29.13	-28.28	-27.45	-26.65	-25.88	-25.12	-24.39	-64.61	-15.20	-14.76	-52.54	-13.91	-13.51	-13.11	-28.43
- economic analysis		-2,250.00	-29.13	-28.28	-27.45	-26.65	-25.88	-25.12	-24.39	-64.61	-15.20	-14.76	-52.54	-13.91	-13.51	-13.11	-28.43
Cumulative Costs		-2,250.00	-2,279.13	-2,307.40	-2,334.86	-2,361.51	-2,387.39	-2,412.52	-2,436.91	-2,772.75	-2,853.45	-2,868.21	-2,920.75	-2,934.66	-2,948.16	-2,961.28	-3,060.74
- economic analysis		-2,250.00	-2,279.13	-2,307.40	-2,334.86	-2,361.51	-2,387.39	-2,412.52	-2,436.91	-2,772.75	-2,853.45	-2,868.21	-2,920.75	-2,934.66	-2,948.16	-2,961.28	-3,060.74
Revenues																	
- Thinning 1	€/m3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	177.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00
- Thinning 2	€/m3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	308.06	0.00	0.00	0.00	0.00
- Clear Cut	€/ha	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1,829.34
- land sales	€/ha	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	444.23
Period Revenues		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	177.39	0.00	0.00	308.06	0.00	0.00	0.00	2,273.57
- economic analysis		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	177.39	0.00	0.00	308.06	0.00	0.00	0.00	2,273.57
Cumulative Revenues		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	177.39	177.39	177.39	485.45	485.45	485.45	485.45	2,759.01
- economic analysis		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	177.39	177.39	177.39	485.45	485.45	485.45	485.45	2,759.01
Period Net Revenues		-2,250.00	-29.13	-28.28	-27.45	-26.65	-25.88	-25.12	-24.39	112.78	-15.20	-14.76	255.52	-13.91	-13.51	-13.11	2,245.13
- economic analysis		-2,250.00	-29.13	-28.28	-27.45	-26.65	-25.88	-25.12	-24.39	112.78	-15.20	-14.76	255.52	-13.91	-13.51	-13.11	2,245.13
Cumulative Net Revenues		-2,250.00	-2,279.13	-2,307.40	-2,334.86	-2,361.51	-2,387.39	-2,412.52	-2,436.91	-2,595.36	-2,676.06	-2,690.82	-2,435.30	-2,449.21	-2,462.71	-2,475.83	-301.72
- economic analysis		-2,250.00	-2,279.13	-2,307.40	-2,334.86	-2,361.51	-2,387.39	-2,412.52	-2,436.91	-2,595.36	-2,676.06	-2,690.82	-2,435.30	-2,449.21	-2,462.71	-2,475.83	-301.72

Economic Analysis shadow pricing labor and carbon at €30/ha/year (i=2%) CF2

Activities	Unit	Periods													
		0	1	2	3	4	5	6	7	18	25	32	33	34	35
Costs															
- Soil preparation shadow price	€/ha	-250.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
- Seedlings shadow price	€/ha	-250.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
- Pre thinning maintenance	€/ha	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
- Administrative and management	€/ha	0.00	-29.41	-28.84	-28.27	-27.72	-27.17	-26.64	-26.12	-77.02	-67.05	-15.92	-15.61	-15.30	-40.00
- Cost of land	€/ha	-1,250.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Period Costs		-1,750.00	-29.41	-28.84	-28.27	-27.72	-27.17	-26.64	-26.12	-77.02	-67.05	-15.92	-15.61	-15.30	-40.00
- economic analysis		-1,750.00	-29.41	-28.84	-28.27	-27.72	-27.17	-26.64	-26.12	-77.02	-67.05	-15.92	-15.61	-15.30	-40.00
Cumulative Costs		-1,750.00	-1,779.41	-1,808.25	-1,836.52	-1,864.23	-1,891.40	-1,918.04	-1,944.16	-2,324.05	-2,508.76	-2,627.10	-2,642.71	-2,658.01	-2,698.01
- economic analysis		-1,750.00	-1,779.41	-1,808.25	-1,836.52	-1,864.23	-1,891.40	-1,918.04	-1,944.16	-2,324.05	-2,508.76	-2,627.10	-2,642.71	-2,658.01	-2,698.01
Revenues															
- Thinning 1	€/m3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	211.45	0.00	0.00	0.00	0.00	0.00
- Thinning 2	€/m3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	393.15	0.00	0.00	0.00	0.00
- Clear Cut	€/ha	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2,573.89
- land sales	€/ha	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	625.03
- carbon price	€/ha	0.00	29.41	28.84	28.27	27.72	27.17	26.64	26.12	21.00	18.29	15.92	15.61	15.30	15.00
Period Revenues		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	211.45	393.15	0.00	0.00	0.00	3,198.93
- economic analysis		0.00	29.41	28.84	28.27	27.72	27.17	26.64	26.12	232.45	411.43	15.92	15.61	15.30	3,213.93
Cumulative Revenues		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	211.45	604.60	604.60	604.60	604.60	3,803.52
- economic analysis		0.00	29.41	58.25	86.52	114.23	141.40	168.04	194.16	661.21	1,190.30	1,308.65	1,324.25	1,339.55	4,553.48
Period Net Revenues		-1,750.00	-29.41	-28.84	-28.27	-27.72	-27.17	-26.64	-26.12	134.43	326.10	-15.92	-15.61	-15.30	3,158.92
- economic analysis		-1,750.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	155.44	344.38	0.00	0.00	0.00	3,173.93
Cumulative Net Revenues		-1,750.00	-1,779.41	-1,808.25	-1,836.52	-1,864.23	-1,891.40	-1,918.04	-1,944.16	-2,112.60	-1,904.16	-2,022.51	-2,038.12	-2,053.42	1,105.51
- economic analysis		-1,750.00	-1,750.00	-1,750.00	-1,750.00	-1,750.00	-1,750.00	-1,750.00	-1,750.00	-1,662.84	-1,318.46	-1,318.46	-1,318.46	-1,318.46	1,855.47

Financial Analysis with Carbon payment of €30/ha/year CF3

Activities	Unit	Periods													
		0	1	2	3	4	5	6	7	18	25	32	33	34	35
Costs															
Soil preparation	€/ha	-500.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Seedlings	€/ha	-500.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
- Pre thinning maintenance	€/ha	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
- Administrative and managem	€/ha	0.00	-29.13	-28.28	-27.45	-26.65	-25.88	-25.12	-24.39	-64.61	-52.54	-11.65	-11.31	-10.98	-28.43
- Cost of land	€/ha	-1,250.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Period Costs		-2,250.00	-29.13	-28.28	-27.45	-26.65	-25.88	-25.12	-24.39	-64.61	-52.54	-11.65	-11.31	-10.98	-28.43
- economic analysis		-2,250.00	-29.13	-28.28	-27.45	-26.65	-25.88	-25.12	-24.39	-64.61	-52.54	-11.65	-11.31	-10.98	-28.43
Cumulative Costs		-2,250.00	-2,279.13	-2,307.40	-2,334.86	-2,361.51	-2,387.39	-2,412.52	-2,436.91	-2,772.75	-2,920.75	-3,010.02	-3,021.33	-3,032.31	-3,060.74
- economic analysis		-2,250.00	-2,279.13	-2,307.40	-2,334.86	-2,361.51	-2,387.39	-2,412.52	-2,436.91	-2,772.75	-2,920.75	-3,010.02	-3,021.33	-3,032.31	-3,060.74
Revenues															
- Thinning 1	€/m3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	177.39	0.00	0.00	0.00	0.00	0.00
- Thinning 2	€/m3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	308.06	0.00	0.00	0.00	0.00
- Clear Cut	€/ha	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1,829.34
- land sales	€/ha	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	444.23
- carbon price	€/ha	0.00	29.13	28.28	27.45	26.65	25.88	25.12	24.39	17.62	14.33	11.65	11.31	10.98	10.66
Period Revenues		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	177.39	308.06	0.00	0.00	0.00	2,273.57
- economic analysis		0.00	29.13	28.28	27.45	26.65	25.88	25.12	24.39	195.02	322.38	11.65	11.31	10.98	2,284.23
Cumulative Revenues		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	177.39	485.45	485.45	485.45	485.45	2,759.01
- economic analysis		0.00	29.13	57.40	84.86	111.51	137.39	162.52	186.91	590.00	1,007.84	1,097.11	1,108.42	1,119.40	3,403.63
Period Net Revenues		-2,250.00	-29.13	-28.28	-27.45	-26.65	-25.88	-25.12	-24.39	112.78	255.52	-11.65	-11.31	-10.98	2,245.13
- economic analysis		-2,250.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	130.40	269.85	0.00	0.00	0.00	2,255.80
Cumulative Net Revenues		-2,250.00	-2,279.13	-2,307.40	-2,334.86	-2,361.51	-2,387.39	-2,412.52	-2,436.91	-2,595.36	-2,435.30	-2,524.57	-2,535.88	-2,546.86	-301.72
- economic analysis		-2,250.00	-2,250.00	-2,250.00	-2,250.00	-2,250.00	-2,250.00	-2,250.00	-2,250.00	-2,182.75	-1,912.90	-1,912.90	-1,912.90	-1,912.90	342.89

Financial Analysis with a carbon payment of €15 per hectare CF4

Activities	Unit	Periods											
		0	1	2	3	4	5	6	7	8	18	25	35
Costs													
- Soil preparation	€/ha	-500.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
- Seedlings	€/ha	-500.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
- Pre thinning maintenance	€/ha	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-63.15	0.00	0.00	0.00
- Administrative and management costs	€/ha	0.00	-29.13	-28.28	-27.45	-26.65	-25.88	-25.12	-24.39	-23.68	-64.61	-52.54	-28.43
- Cost of land	€/ha	-1,250.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Period Costs		-2,250.00	-29.13	-28.28	-27.45	-26.65	-25.88	-25.12	-24.39	-86.84	-64.61	-52.54	-28.43
- economic analysis		-2,250.00	-29.13	-28.28	-27.45	-26.65	-25.88	-25.12	-24.39	-86.84	-64.61	-52.54	-28.43
Cumulative Costs		-2,250.00	-2,279.13	-2,307.40	-2,334.86	-2,361.51	-2,387.39	-2,412.52	-2,436.91	-2,523.74	-2,772.75	-2,920.75	-3,060.74
- economic analysis		-2,250.00	-2,279.13	-2,307.40	-2,334.86	-2,361.51	-2,387.39	-2,412.52	-2,436.91	-2,523.74	-2,772.75	-2,920.75	-3,060.74
Revenues													
- Thinning 1	€/m3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	177.39	0.00	0.00
- Thinning 2	€/m3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	308.06	0.00
- Clear Cut	€/ha	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1,829.34
- land sales	€/ha	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	444.23
- carbon price	€/ha	0.00	14.56	14.14	13.73	13.33	12.94	12.56	12.20	11.84	8.81	7.16	5.33
Period Revenues		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	177.39	308.06	2,273.57
- economic analysis		0.00	14.56	14.14	13.73	13.33	12.94	12.56	12.20	11.84	186.20	315.22	2,278.90
Cumulative Revenues		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	177.39	485.45	2,759.01
- economic analysis		0.00	14.56	28.70	42.43	55.76	68.70	81.26	93.45	105.30	383.70	746.65	3,081.32
Period Net Revenues		-2,250.00	-29.13	-28.28	-27.45	-26.65	-25.88	-25.12	-24.39	-86.84	112.78	255.52	2,245.13
- economic analysis		-2,250.00	-14.56	-14.14	-13.73	-13.33	-12.94	-12.56	-12.20	-74.99	121.59	262.68	2,250.47
Cumulative Net Revenues		-2,250.00	-2,279.13	-2,307.40	-2,334.86	-2,361.51	-2,387.39	-2,412.52	-2,436.91	-2,523.74	-2,595.36	-2,435.30	-301.72
- economic analysis		-2,250.00	-2,264.56	-2,278.70	-2,292.43	-2,305.76	-2,318.70	-2,331.26	-2,343.45	-2,418.45	-2,389.05	-2,174.10	20.58

SOCIO-ECONOMIC ANALYSES OF SUSTAINABLE FOREST MANAGEMENT IN CENTRAL PART OF THE HYRCANIAN FORESTS OF IRAN

Seyed Mohammad Hosseini [1] – Alois Skoupy [1]

Abstract: *The Hyrcanian Forests of Iran are located in the north of Iran near the Caspian Sea. These forests are completely natural broadleaf forests which cover 1.8 million hectares of land area. As all of these forests are state forests, the Forest Management Organization had a lot of socio- economic problems with rural people who were living in these forestlands for preparing fuel, charcoals, land for buildings, timber for reconstruction of houses and so on. About 10 years ago, forestry managing board of Iran, started a new project in the central parts of these forestlands as sample projects in order to find permanent solutions for forest sustainable management. In this project, foresters tried to encourage cattleman and rural people to participate in forestry managing plans with many different ways. The statistical data after one decade shows, unofficial timber harvesting, charcoal consumption and land reduction by rural people have been reduced 45%, 98% and 82% in respectively.*

In this paper, new decision making of sustainable management and socio-economic problems in central parts of the Hyrcanian Forests of Iran during last two decades will be discussed in details.

Keywords: Socio-economic, sustainable management, rural people, Hyrcanian Forests.

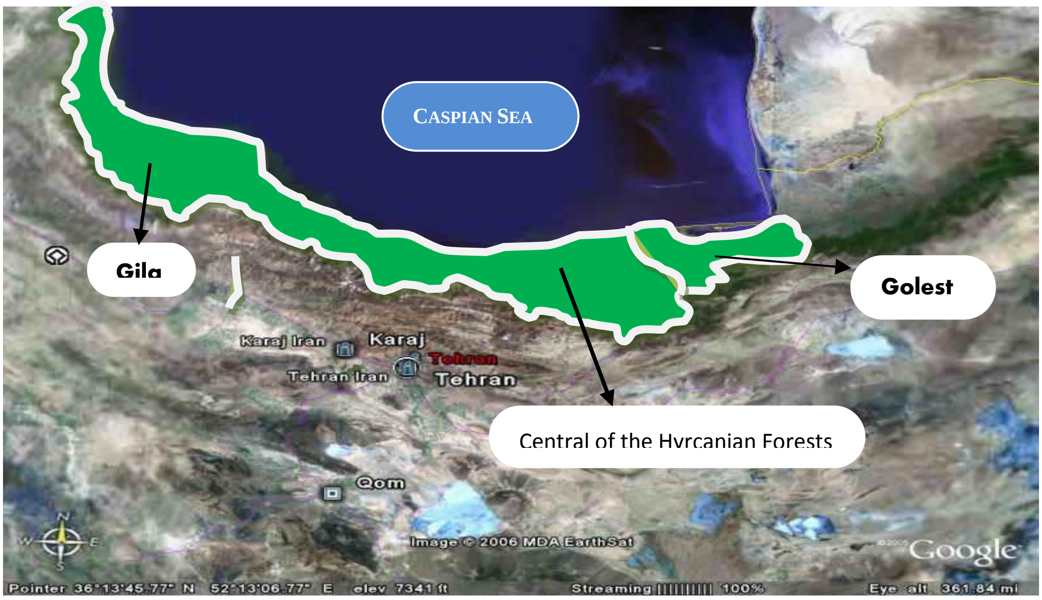
1. INTRODUCTION

The average annually rainfall in Iran is about 250mm which are distributed mostly in winter, but in the north part of this territory has completely different situations of climatology which average rainfall is about 1000 mm per year. Following to this climate case, there is a beautiful green line of natural broadleaf forest coverage on the Alborz Mountains near the Caspian Sea. The total forest cover in Iran is 12 million hectares, which amounts to 8% of the total land area. About 1.8 million hectares of these forests are located in the north of Iran (i.e. the Hyrcanian Forests) on the northern slopes of the Alborz Mountains overlooking the Caspian Sea. The length of this forests strip is about 1000 km with a width of about 30 km.

The Hyrcanian Forests consist of mixed broadleaf deciduous species (Table 1) and are distributed across three provinces: Golestan, Mazandaran, and Gilan. The majority of these forests are located in Mazandaran province with 967,790 ha (51 %), Gilan with 511,306 ha (27 %) and Golestan with 421,905 (22 %) (Figure 1).

[1] Czech University of Life Sciences, Department of Forest Harvesting

Figure 1. Central part of The Hyrcanian Forests location



Tab. 1. Species composition of the Hyrcanian Forests.

Species	Percentage of area
Beech(*Fagus orientalis*)	33
Hormbean(*Carpinus betulus*)	31
Oak(*Quercus castanaefolia*)	8
Alder(*Alnus sp)*	8
Maple(*Acer sp)*	7
Persia(*Parrotia persica)*	4
Lime(*Tillia begonifolia*)	3
Other species	6

Due to the ecosystemic and environmental aspects, biodirversity, ecology and eco-tourism values and their historical background, these forests are one of the important ecological resorces in the world. For these reasons, socia- economic sustainable forest managemnet are one of the main strategies of the Iranian Forety Managing Board. This paper will discuss results of socio-economic project which was carried out by state forestry organization in central parts of the Hyrcanian Forests during last decade.

2. BACKGROUND

All these forests owned by state forests and are managed based on two sylvicaltural methods as schelterwood and slection methos with objectives of natural regeneration.

The first scia-economic development policies started in 2001 when one statisctical report showed that one million m3 timber was used by cattle families annuually for fuel consuption and house reperation [1]. Meanwhile, another paper estimated nearly 640 million of natural regenerations will be disturbed by cattles per year [2].

According to latest agriculture national census which carried out in 2001 [3], about 32% of cattle houses are located in the central parts of the Caspian Forests (Table 2).

Tab. 2. General information about forest dwellers and cattle's information in central part of the Hyrcanian Forest (2001)

State	Amounts	Percentage (%)
Cattle houses (No.)	10 569	32
Villages inside forests (including less than 20 families)	1 284	38
Cattle families (No.)	24 893	31
Cattles (No.)	1 628 000	37
Annually timber consumption (m3)	444 000	33
Land use (ha)	14 300	25

Above table shows that not only a lot of natural regenerations were be damaged by animals, but a large amounts of timber volume were being used for house repairing, charcoals and so on. As official timber harvesting volume which were carried out through the forestry planning was 2.5 million m3 per year and rural timber consumption are increasing year by year (because of high population rate), the forestry managing board decided to find sustainable socio-economic solutions for this disaster.

3. Objectives

General main aims of this project are as follows:

1. Conservation and protection of the Caspian Forests
2. Development and increasing of the Caspian Forests
3. Rehabilitation of degraded Caspian Forests
4. Optimization of management system
5. Decrease of social-economic problems aimed at forest development
6. Regeneration and rehabilitation of forests
7. Reduction and elimination of forest degradation factors
8. Removal of livestock from forests and centralization of sporadic villages
9. Rehabilitation of degraded forest areas
10. Alteration of livelihood patterns of forest communities

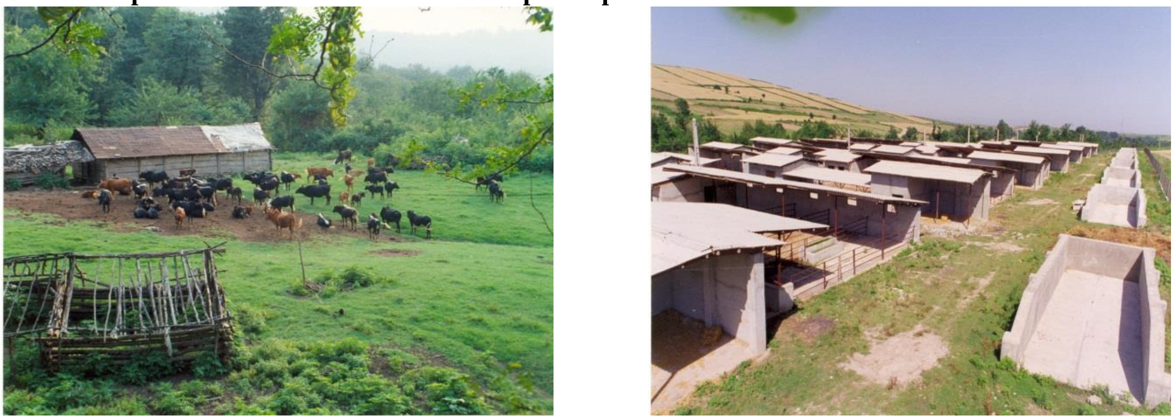
4. Results

For the first phase of these policies, 10 cooperative agencies were established by state supports. According to the main articles of these agencies, all staff and workers should be used from forest dwellers and regional forestry managing boards are responsible for controling. Other important articles are:

- these companies can not be owner of forestlands, but they can use all other forest potentials like, fishery, tourism etc with guidance of state foresters,
- tree selection for cutting will be done only by foresters who come from state organization,

- removing livestock from forest to the new modern camps in outside of forests (Figure 2),
- forest dwellers should living in a centralized villages instead of living in sporadic houses.

Figure 2: livestock places before and after new development policies

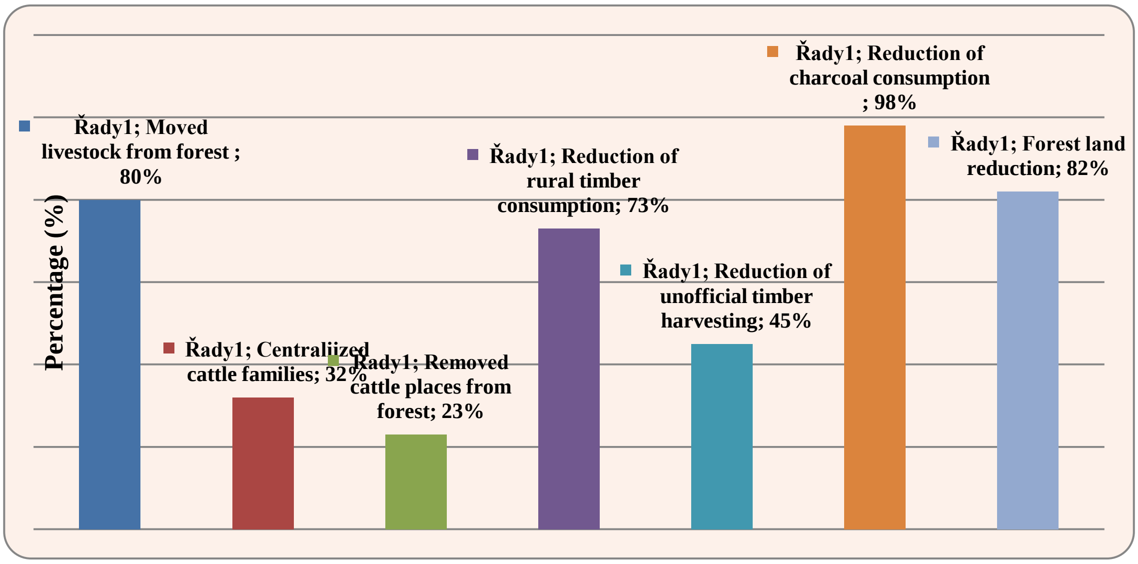


Before After

Forest dwellers who are working in cooperative agencies will be covered by insurance and social companies and could obtain more hygiene facilities for their life, easier services for children schools and so on.

After 10 years, data analyzed are showed about 370,000 livestock moved to out of forest, centralized 7950 cattle families to villages near to forests, 2450 cattle houses removed from forestlands and reforested in same places and rural timber consumption reduced to 121,000 m3. The comparison data from before new decision making of socio-economic policies, confirm that this strategy was quite effective not only for elimination of forest land reduction, but also was very successful for controlling unofficial timber harvesting (Figure 3).

Figure 3. Histogram of social-economic satiations after 10 years new policies plan.



5. CONCLUSION

As many rural inhabitants are living inside or villages near to of the Caspian Forests, the most important target of this project was finding permanent solutions for social-economic problems. Meanwhile, geopolitical situations of these forests are very attractive for tourism investments, because of moderate climate and beautiful landscape with overlooking to Caspian Sea, and so, lands are quite expensive. Before last decade, forest areas annually been degreased by rural people, while after following to this new policies it reduced up to 82%.
The results indicate when rural people take grantee for permanent job near to their home, and can have better living situation, they will be satisfied to social-economic developing program and will not be harmful for forests.

In the end, it is necessary to emphasis that following to above mentioned policies need a lot of state supports and many costs, but comparison to incoming benefits; it is suggested to be continued for other parts of Caspian Forests.

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MEDIA COMMUNICATION IN FORESTRY: CASE STUDY OF THE SLOVAK STATE FOREST SECTOR

Ján Lichý [1]

Abstract: *The paper is based on the theoretical knowledge of principles of communication channels between forest enterprises as message senders on one hand and general public as message receivers on the other hand. One of the basic tools of communication policy of forest enterprises is their presentation in media including print media as well as electronic media together with the modern information and communication technologies. In the paper, taking into account the model of the forest enterprise presentation in media, the general principles of communication policy in forestry are discussed using special case of the Slovak state forest sector. The results include the descriptive analysis of the historical overview as well as the present condition of mass media presentation of the state forest enterprise Lesy SR, š.p., Banská Bystrica – the occurrence of media outputs divided into the positive, neutral and negative ones is analysed and the main communication tools are described. Finally, the basic principles of effective mass media communication of forest enterprises are examined.*

Keywords: communication, mass media communication, forest enterprise, media, efficiency

1 INTRODUCTION

Nowadays, taking into account the process of globalization internationalisation and growing competitiveness, the mass media communication – as an inseparable part of the enterprise communication strategy – is getting more and more important. Moreover, the significance of mass media communication is stressed by the following typical characteristics of the future markets (JUSLIN 1994):

1. the individual customer needs will be getting more and more different,
2. the enterprise will grow bigger and they will perform their activities within supranational and transnational scope,
3. the information environment will be more transparent, global and it will be rapidly varying,
4. the number of persons involved enforcing environmental values will grow,
5. the importance and impact of social problems will be more significant

Recently, use of the mass media communication procedures and tools has been characterized as an inevitable assumption of effective management of all enterprises, including forest enterprises (IVAN 2008). Mentioning forest enterprises, such use is even more essential as forest enterprises provide social and environmental functions preferred by the general public (ŠULEK 2000). Furthermore, forests with their diversity contribute to the regional development and they may be considered to be an integrated part of the rural development strategies as well as a part of the European nature wealth.

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The position of communication within the EU forest sector is also stressed by the fact that the number of strategic documents adopted and implemented by both the EC bodies as well as the individual member states bodies deal with the role and position of communication as a part of the forest enterprise management models.

2 THEORETICAL FRAMES OF REFERENCE

According to MALETZKE (1963), communication might be described in two ways – one of them being the perception of communication as a part of processes of information transfer with reference to technical, biological, psychic, physical and social information system. The specific perception of communication is based on the process of understanding, conformity and provision of certain meaning in between live entities. The communication serves as the means of achievement of common objectives by the human beings.

In general, the communication is defined as the process of information transfer from one person (or group of persons) to another person (or group of persons). Based on this definition, the following six basic elements of communication process are distinguished (SEDLÁK 1997):

- message sender – communicator,
- message content – statement,
- channel – medium through which the content comes to the recipient,
- message recipient,
- bias – the interference with the transmitted message and
- feedback

The primary type of communication within socio-economic relations and processes is human communication. The human communication describes the communication between people, only – it exclusively deals with the social communication processes. Still, the human communication denotes only one type of communication within its hierarchic distribution – taking into account the scope of this paper, the mass media communication is more important (MCQUAIL 1999).

In order to provide the enterprise communication with its environment more efficient, using the mass media presentation, it is necessary for any enterprise to follow a few principles:

- to cooperate with media,
- to stay in touch with the general public,
- to dispose of own resources in the sphere of media work,
- to support the above standard relations with the business partners,
- to use so-called multiplicities (journalists, public opinions)

The managers responsible for the enterprise mass media communication, during the process of strategic decision making on the enterprise mass media presentation, have to answer the following questions firstly (KOBZINA , BACHHOFER 2005):

1. What concrete messages do we want to communicate?
2. What target groups do we want to address?
3. How to prepare messages for given media in order to make them attractive?
4. Which tools of media work do we want to use for message processing?

The first two questions need to be answered by the communicator himself, within the complete enterprise communicate strategy. The other two questions miss definite answers – here, it is necessary to take into account the knowledge of the media work theory.

Considering the enterprise characteristics, the communication is affected by the following factors:

- enterprise size,
- range of provided goods and services,
- activities of competitors,
- size and nature of market,
- enterprise locality,
- regional problems,
- knowledge of public relations activities,
- bad enterprise image,
- crisis situations,
- inter-enterprise atmosphere,
- approaches to problem solving,
- mode of enterprise administration,
- global character of enterprise corporate culture

Following the analysis of theoretical backgrounds, it is possible to state that the fundamental of appropriate mass media work in the enterprise reposes upon three components (LICHÝ 2008):

1. perfect and sophisticated know-how in own enterprise,
2. professional knowledge of public relations activities,
3. adequate understanding of the media world

The base of the model of forest enterprise presentation in mass media creates the answers to the following issues:

- which media and in what scope provide information,
- which journalists tend to respond to the given message positively and which of them negatively,
- what tool of mass media communication shall be chosen by the enterprise,
- whether it is necessary to communicate the message or to supress it

Thus, it is obvious that the model of presentation of forest enterprises in mass media shall deal with the issues of the enterprise spokesman (communicator), issues of types of media (tools of mass media communication) used, and issues of style (form) of mass media communication.

3 MASS MEDIA COMMUNICATION IN THE SLOVAK FORESTRY: PRESENTATION OF THE ENTERPRISE LESY SR, Š.P., BANSKÁ BYSTRICA IN MASS MEDIA

It is striking that the active communication of the Slovak forest enterprises with the general public using mass media was not the case here during the 1990s, neither at the level of individual forest enterprises not at the level of state forest administration bodies (MARUŠÁKOVÁ ET AL. 2006). Only sporadic unsystematic and uncoordinated activities were recorded as forest enterprises in a long term relied on positive perception of forestry by general public. Moreover, the managers of forest enterprises did not exactly realized the importance of regular and operative contact with media. Thus, the Slovak forest sector has been positioned in communication defensive, even if there has been great potential for its positive perception. The communication with mass media in the Slovak forest enterprises has just been slowly developing and the most developed enterprise in this respect is the state forest enterprise Lesy SR, š.p., Banská Bystrica.

After creation of the enterprise Lesy SR, š.p., Banská Bystrica in 1999, both the compact conception of mass media communication as well as the organisational unit dealing with mass media communication virtually did not exist within the enterprise. Then, in 2003, after the changes of the enterprise top management, the organisational structures of media communication has systematically started to be created. In June 2004, the first complex communication strategy was developed. During the following years, the media communication has continued and finally, in March 2006, the autonomous department for public relations was created within the section of director general. In May 2007, this department was transformed into the independent division of public relations. The motto of mass media communication of the enterprise Lesy SR, š.p., Banská Bystrica has been formulated as follows: "positive message every week".

Nowadays, this strategy is still applied, using individual tools of mass media communication. The enterprise distributes approximately 50 press news annually, the press conferences are organised irregularly as a reaction to the actual situation (i.e. ad-hoc press conferences), in average 2 – 3 times per year. Moreover, the enterprise division of public relations organises so-called media trips (similarly ad-hoc trips organised 2 – 3 times per year).

To provide the global picture, the case of use of mass media communication tools in the state forest enterprise Lesy SR, š.p., Banská Bystrica in 2008 is described in detail. In mentioned year, totally 724 media outputs dealing with the enterprise were published – in comparison, in 2007, there were 598 media outputs, thus, the 21 % increase was recorded. Considering the structure of the media outputs, 405 outputs (56 %) were of neutral nature – those informing about the given event or activity in a balanced way, 279 outputs (39 %) were of positive nature – so that the enterprise activities were promoted in a "good light" in terms of the public perception of forest management. Such positive outputs shall be considered to be a product of a systematic enterprise effort in the area of actively managed communication. According to the Annual report of the enterprise Lesy SR, š.p., Banská Bystrica 2008, the majority of published positive outputs dealt with the successful and prestigious forestry events (e.g. Tree Day, Forestry Days, Christmas Tree for Christmas, etc.). Consequently, only 40 media outputs (5 %) were of negative nature – these outputs dealt dominantly with the doubts about transparent and sound lease of hunting grounds, use of chemical substances against the bark beetles, distribution of state subsidies, etc.

In 2008, the most important month from the media point of view was July when 133 media outputs in total were recorded (27 of them were TV messages, 32 of them were messages in leading daily newspapers). On the other hand, the medially least successful month was September with 33 media outputs only. At that time, the general objective of the enterprise management was to achieve at least 60 positive media outputs per month. The enterprise should analyse the quantitative as well as qualitative aspects of publicity taking into account two points of view:

- the point of view of successful actively managed communication and
- the point of view of negative glances of journalists and general public into the enterprise activities.

One of the most important moments in the state forest enterprise Lesy SR, š.p., Banská Bystrica in 2008 was the approval of the enterprise communication project titled "Forests of the Slovak Republic – forests for all of us". This project defined the objectives and tools of public communication policy during the years 2008 – 2010 – the main objective is to develop relations between general public and forest sector in a systematic and conceptual way, to increase credibility of forest professionals and to build image of the enterprise Lesy SR, š.p., Banská Bystrica as a socially responsible enterprise. The following tools of public relations are defined within the project:

- forest pedagogy – the key programme aimed especially at the children and teenagers,
- forest information offices – the places of first contact distributed among the all organisation units of the enterprise,
- important forestry sites – historical sites connected to the history of forestry in the area if Slovakia,
- forestry education paths,
- Forestry Open-air Museum in Vydrovo Valley near Čierny Balog as an unique natural museum,
- Forestry and Wood Museum in Zvolen,
- the enterprise magazine Lesník – it should provide room for presentation of the enterprise activities to the professional as well as general public.

Considering mentioned facts, the following tools of mass media communication shall be used by all forest enterprises in general: press news, press conferences, press briefings, media trips, participation in public discussion in media, forestry events with the media participation, exhibitions and fairs, publication of articles, movie production.

To summarize analysed issues, it might be stated that the following factors affect mass media communication of the enterprise Lesy SR, š.p., Banská Bystrica:

1. costs of the enterprise mass media communication – the enterprise management considers them to be the key factor of the successful mass media communication of the enterprises,
2. size and locality of the enterprise – it affects the global character of the enterprise communication connected to the nationwide coverage of the enterprise activities,
3. seasonality during the year – at the beginning of the year, the mass media communication is relatively reduced, then, its activity increases with the first peak occurring in April (so-called Month of the Forests), the second peak occurring during the summer (analysis of operation results of the previous months) and the third peak occurring just before the Christmas time (in connection to the provision of Christmas trees what is considered to be the traditional forestry topic),
4. nature of communicated news, resp. crisis situations – it is much easier to communicate negative messages as it is much more attractive for the audience,
5. approach to the problem analysis – the basic objective of the enterprise in this respect is to apply such media strategy that would correspond to the enterprise mission.

The systematic, purposeful and proactive mass media communication is one of the basic elements of successful development of the socially responsible enterprise.

4 CONCLUSION

It is obvious that one best way of communication does not exist. The global communication strategy shall take into consideration especially following aspects: message, communication objective, recipient, and available communication media. The mass media communication as a basis of the enterprise presentation in media significantly affects several areas – the most important ones are emotional behaviour, senses as well as form of verbalization.

The mass media communication used by the forests enterprises is a relatively new form of public communication as a part of the public relations themselves. Due to the fact that the forest enterprises shall take into account important social and environmental values perceived by the general public, such communication is even more important.

Media relations represent primary way of acquisition of general public support. It is extremely difficult to be covered by media for the entity that does not present itself – even if it is so, such coverage is mostly negative. Thus, the proactive approach to the media is crucial. One of the best possible ways of communication with the media is to help them to obtain information that shall be made public in the interest of the enterprise communicator himself. Then, it is inevitable to follow rules and principles of truthfulness, accuracy, clearness and unanimity of words and activities.

Considering effective management of the process of mass media communication, it is necessary to maximize potential benefits of communication and to minimize the potential shortages of such process (ŠULEK 2009). Thus, it is inevitable for forest enterprises to take into account such factors that may disturb the effective communication between forest enterprises and recipients including individual interest groups of general public and, moreover, to implement measures for elimination of such factors. It is obvious that, in accordance with principles of effective communication policy of all kinds of enterprises, also forest enterprises need “to do things in a right way”. Based on this, the mass media communication of forest enterprises shall pay attention to the needs of both the individuals as well as the society. It also shall integrate the functions of forest enterprises for global benefits of the society.

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Stakeholders' perceptions on Sustainable Forest Management (SFM) in a rural district of Southern Italy

Alessandro Paletto [1]- Isabella De Meo [2] - Umberto Di Salvatore [3] - Fabrizio Ferretti [3]

Abstract: *In the last decades a new paradigm of forest management based on the principles of sustainable development has been accepted at international level. Sustainable Forest Management (SFM) is a dynamic concept, defined with the main purpose of maintaining and enhancing the economic, social and environmental value of forests, for the benefit of present and future generations. SFM has spread in the scientific community and among policy makers, while a few studies investigated the real perception of this concept by stakeholders and local communities. The paper aims to contribute to the SFM discourse and focuses on stakeholders' perception of SFM in a case study in Southern Italy (Alto Matese district, Molise region). The analysis of perception has been realized in order to support the managers in the development of the forest management strategies of the district. A semi-structured questionnaire was submitted face-to-face to 39 forest stakeholders selected with the stakeholder analysis. The data collected were used to produce a collective cognitive map referred to the SFM. The knowledge of the stakeholders' perceptions and the cognitive network of forest management practices and SFM criteria were used to compare results of the various stakeholders.*

Keywords: Sustainable Forest Management (SFM), stakeholders' perception, preferences analysis, cognitive maps, Alto Matese (Italy).

1 Introduction

During the '90s a crisis due to the distrust among forest enterprises, governments, environmental groups and communities and the conflict between outcome and oriented values allowed the emergence of a new paradigm in forest management, based on sustainability principles (McDermott, 2011). Traditional forest management paradigm - based on stand-level process and sustained-yield - fell into crisis due to the low social acceptance and the decreased economic value of timber and other wood products (Glück, 1987). The new paradigm - called Sustainable Forest Management (SFM) - is a dynamic concept focused on the maintenance of the economic, social and environmental value of forests, for the benefit of present and future generations. SFM contributes to maintain the role of forests as sources of timber and other forest products (i.e. fuelwood and non-wood products), while simultaneously contributing to maintain biodiversity and to protect watershed and other ecosystem functions (Putz, 1994). This paradigm introduced in the forest management three key-aspects: sustainability, multifunctionality and public participation (Glück and Humphreys, 2002).

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Going in the direction of inclusive SFM means take into account different values and knowledge of communities and adding the connection of communities knowledge with scientific knowledge can strengthens SFM (Tabor, 2009). The awareness of people's perception of the forest and of the issues related to this topic is relevant for forest policy and planning, because contributes to reduce the distance between communities and managers (Trakolis, 2001). Moreover this kind of information, together with technical competencies and knowledge of the territory that managers possess, could increase managers ability to manage forests more effectively for all stakeholders involved.

Starting from these considerations, the paper investigates a method to analyse community's perception of SFM criteria, using semi-structured questionnaires and collective cognitive maps. The cognitive mapping is an approach to strategic thinking, in order to explore the values, issues, perspectives, goals and objectives of the social actors (Axelrod, 1976). The cognitive mapping is a useful tool to support natural resources management and to capture the local knowledge or the structure of individual value-goal-aspirations systems, in order to provide information with management applications (Özesmi and Özesmi, 2004). Consequently, a cognitive map provide a method to analyze complex concept relationships because is a graphical representation of the structure of knowledge, of the idea of an individual or collective actor (Isaac et al., 2009). Besides, during the decision making process the cognitive maps are useful to limit conflicts between forest users and to reduce dysfunctions such as the groupthink phenomenon (Hjortsø et al., 2005).

The method was tested in a case study in a rural district of Southern Italy (Matese district, Molise region). The research aims to contribute to the SFM discourse in investigating the meaning of seeking new points of view on forest management methods.

2 MATERIALS AND METHODS

Study area

The study area, Matese district (41°29'12'' N; 14°28'26'' E), is located in southern Italy (Molise Region) and occupies about 36,500 ha, including 11 municipalities. Nowadays, the population is 21,022 inhabitants (density 0.58 inh./ha), as a result of the historic trend of population decline (1951-2009 trend: -35.5%). The main land uses in the district are: forests 44.1%, agricultural crops 29.2% and grasslands 15.9%. With respect to forest property, privately-owned forests cover approximately 66% of the area, whereas the remaining 34% is publicly, owned by various municipalities and by the Molise Region.

Research framework and questionnaire

The research framework was structured in three stages, summarized as follows: stakeholders analysis, investigation of stakeholders' perceptions, statistical data analysis and elaboration.

For this research the definition of stakeholder by Grimble and Wellard (1997, 175 p.) seems appropriate: "stakeholder is any group of people, organized or unorganized, who share a common interest or stake in a particular issue or system". According with this definition, the actors operating in the forestry sector of Matese district, who are directly involved in the issues relating to forest management were considered as stakeholders. Given the multi-stakeholder nature of forest management, a stakeholders analysis was implemented to identify the key stakeholders, their roles and their relations. The stakeholder analysis identified 39 stakeholders and examined their roles in the forestry sector, their relationships and finally stakeholders were subdivided in 4 groups: 14 public administrations and public forest owners, 10 forest enterprises, 5 environmental associations and 10 farmers and private forest owners.

The investigation of stakeholders' perception of SFM was developed taking into consideration the preferences expressed and using cognitive maps.

A semi-structured questionnaire composed by 6 sections and 47 closed-form questions was developed. The sections of the questionnaire focused on the main issues related to forest management and other connected aspects, such as sustainability of management, forest functions, forest-wood-energy chain, relationship between people and landscape, social capital, and forest certification. In the present paper are presented the results of the section "Sustainability of forest management", which is composed by 7 questions, two of which focused on the SFM criteria (Table 1). The importance of the SFM criteria was evaluated using a 5-point Likert scale. The relationship between management actions and SFM criteria are determined by the last question, which is the primary data-source to construct the cognitive maps. The cognitive map was constructed considering the positive, neutral or negative impacts of forest practices on the SFM criteria, as stated by stakeholders.

Tab. 1. Questions related to the Sustainable Forest Management (SFM).

Question	**Closed-form answer**
Q1. Have you ever heard of Criteria and Indicators of SFM? If "YES", in your opinion what is the importance of the following criteria for the Matese forests management? (5-point Likert scale, 0=not important/not suitable, 4=very important)	1. Maintenance and appropriate enhancement of forest resources and their contribution to global carbon cycles 2. Maintenance of forest ecosystems' health and vitality 3. Maintenance and encouragement of productive functions of forests (wood and non-wood) 4. Maintenance, conservation and appropriate enhancement of biological diversity in forest ecosystems 5. Maintenance and appropriate enhancement of protective functions in forest management (notably soil and water) 6. Maintenance of other socio-economic functions and conditions
Q2. Which is the relationship between the following management practices and the SFM criteria? +1=positive influence 0=neutral influence -1 =negative influence	1. Increasing forest cutting and timber and wood biomass extraction 2. Utilization of wood residues (top and branches) for wood chips production 3. Leaving in the forest the coarse woody debris and the standing dead trees (minimum size of diameter 30 cm) 4. Apply silvicultural treatments to favor mixed forests with a diversified structure (horizontal and vertical structure) 5. Develop tourist facilities (paths, benches and tables, etc..) 6. Develop the forest road and the log dumps to stock timber in the forest 7. Support the transition from coppice to high forest 8. Sanitary cuttings to remove sick and dead trees 9. Restriction of harvesting in forest areas with a high slope

The data collected were used to construct collective cognitive maps using the software yEd Graph Editor. The forest management practices are represented as nodes, while the lines are the relationship between the activities and the SFM criteria.

A collective map for all the key stakeholders was constructed considering the average values of each forest management practice on a criteria. When the average value is ≤ -0.2 the influence of a practice on a criteria is considered negative, when > 0.2 positive and in the range between -0.2 and 0.2 the practice does not influence the criteria.

In the last step of the analysis, the cognitive maps have been used to compare results of the various groups of stakeholders.

3 RESULTS AND DISCUSSION

In Table 2 are presented the stakeholders' preferences for the single SFM criteria (Q1). The results show an overall preference for the hydrogeological protection (Criteria 5) and the maintenace of ecosystems vitality (Criteria 2). It is possible to observe that the encouragement of productive functions of forests (Criteria 3) is the criteria to which all categories assign the lower score. The only exception is represented by forest entrepreneurs. Only environmentalists assign a high score to the conservation and enhancement of forest biodiversity.

Tab. 2. Average values assigned to the SFM criteria by groups of stakeholders (5-points Likert scale).

SFM criteria	Public administrations		Forest enterprises		Environmental associations		Private forest owners		Total	
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*
Criteria 1	2.79	0.43	2.33	1.12	2.20	0.45	2.50	0.97	2.53	0.80
Criteria 2	2.93	0.27	3.00	0.00	2.00	1.22	2.60	0.52	2.73	0.61
Criteria 3	2.07	1.00	2.75	0.46	1.40	0.89	2.00	0.67	2.11	0.88
Criteria 4	2.57	0.65	2.33	0.52	3.00	0.00	2.50	0.71	2.57	0.61
Criteria 5	2.93	0.27	2.63	0.52	3.00	0.00	2.80	0.42	2.84	0.37
Criteria 6	2.57	0.51	2.43	0.53	2.00	0.71	2.10	0.57	2.33	0.59

- Grey highlighted the highest values for each group of stakeholders.

The results of Q2 are analyzed with the collective cognitive map (Figure 1) and then considering the various groups of stakeholders, to evidence convergences and divergences (Table 3). Figure 1 shows that the respondents (22 of 39 stakeholders) perceive six forest management practices having a positive influence on SFM Criteria. In particular, silvicultural treatments to favor mixed forests with a diversified structure (Practice 4) is the forest management practices in the Matese forests perceived by all the respondents as having a positive influence on the overall criteria. Another silvicultural practice considered having positive influence, but with lower scores, on all the SFM criteria are the sanitary cuttings to remove sick and dead trees from the forest (Practice 8). The restriction of harvesting in forest areas with a high slope (Practice 9) and the support of the transition from coppice to high forest (Practice 7), have positive influence, but respectively on four and three criteria and with lower scores respect to Practice 4. The development of the forest network (Practice 6) is perceived having a positive influence to enhance timber production and other socio-economic functions of forests. At least, the respondents consider the practice of leaving deadwood in the forest (Practice 3) having a negative effect on all the criteria influenced.

Considering the results subdivided per groups of stakeholders (Table 3), the representatives of environmental associations seem to have a different perspective from other groups of stakeholders. In particular, sanitary cuttings to remove sick and dead trees (Practice 8) and utilization of wood residues for wood chips production (Practice 2) have a positive effects on SFM criteria for all the respondents except environmental associations. Vice versa, leaving in the forest the coarse woody debris and the standing dead trees (Practice 3) is considered negative by all groups of stakeholders, while the representatives of environmental associations assigned a positive score to this practice for all SFM criteria. The increasing forest cutting and timber extraction (Practice 1) and the development of forest road and log dumps to stock timber in the forest (Practice 6) are considered two positive forest management practices in order to improve all SFM criteria by the forest entrepreneurs, but negative practices by the environmental associations.

Tab. 3. Average values of the perception of the forest management practices' effect on SFM criteria per groups of stakeholders.

Criteria/Practices		1	2	3	4	5	6	7	8	9
Public administrations (n=10)	C1	0.1	0.6	-0.5	0.9	0.2	0.1	0.5	0.7	0.4
	C2	0.2	0.6	-0.7	0.8	0.3	0.2	0.5	0.9	0.4
	C3	0.7	0.5	-0.2	0.4	0.1	0.8	0.2	0.6	0.0
	C4	0.2	0.3	-0.5	0.8	0.0	0.0	0.2	0.8	0.3
	C5	-0.2	0.2	-0.7	0.7	0.1	0.0	0.0	0.6	0.6
	C6	0.3	0.5	-0.5	0.5	0.8	0.8	0.3	0.4	0.2
Forest entreprises (n=4)	C1	0.75	1.0	-0.5	0.5	-0.25	0.75	0.0	1.0	0.75
	C2	1.0	1.0	-1.0	0.75	-0.25	1.0	0.0	1.0	0.75
	C3	1.0	0.75	-1.0	0.5	-0.25	1.0	0.5	0.75	0.5
	C4	0.75	0.75	-1.0	0.5	0.25	1.0	0.25	1.0	0.25
	C5	1.0	0.75	-0.75	0.0	0.0	1.0	0.75	1.0	1.0
	C6	1.0	1.0	-1.0	0.75	1.0	1.0	-0.25	0.75	0.25
Environmental associations (n=4)	C1	-1.0	-0.75	1.0	0.25	-0.25	-1.0	0.5	-0.25	0.5
	C2	-1.0	-0.75	0.75	1.0	-0.5	-1.0	0.25	0.25	0.75
	C3	-0.75	0.25	0.0	0.0	0.0	0.0	0.0	0.5	0.5
	C4	-1.0	-0.75	1.0	1.0	-0.75	-1.0	0.25	-0.5	0.75
	C5	-1.0	-0.75	0.75	0.5	-0.25	-0.75	0.5	-0.5	1.0
	C6	-0.75	0.5	0.25	0.75	1.0	0.25	0.25	0.25	0.75
Private forest owners (n=4)	C1	0.0	0.5	-0.25	0.75	-0.5	0.0	0.25	0.75	0.0
	C2	-0.25	0.5	-0.5	0.75	-0.25	0.25	0.0	0.75	0.5
	C3	0.5	1.0	-0.25	0.5	-0.25	0.75	0.0	0.75	0.0
	C4	-0.5	0.25	0.0	0.5	-0.5	-0.25	0.25	0.5	0.25
	C5	0.0	0.25	-0.25	0.25	-0.25	0.5	0.5	0.5	0.75
	C6	0.25	1.0	-0.5	0.75	0.75	1.0	0.0	0.75	0.0

- Light grey highlighted the highest values (+1.0), in dark grey the lowest values (-1.0).

4 CONCLUSIONS

This study provided an insight into the perceptions of stakeholders about forest management practices and their effects on sustainability.

The study pointed out that slightly less than half of the respondents – who are all actors of the forest sector – stated that they know the concept of SFM.

Findings highlighted that the management perception of representatives of the environmental associations is quite different from other groups: they focuses on the improvement of biodiversity conservation and perceive as positive the influence of management practices that improve biodiversity, such as leaving in the forest the coarse woody debris and the standing dead trees. Public administrations, according to their institutional mission, favorite practices of SFM linked to the improvement of health and stability of forest ecosystem (mixed forests with a diversified structure and a low presence of sick and dead trees). Finally, forest entrepreneurs focuses on the practices useful to valorize conditions for timber production (increasing forest cutting and developing forest roads and tracks).

The cognitive map allowed to represent the network of concepts used to form chains of argumentation. In particular, clearly showed that respondents perceive as positive in the direction of sustainability the influence of silvicultural treatments finalized to improve biodiversity and to protect from hydrogeological risk.

Therefore, the findings of this survey provide a good understanding of the local stakeholders perception towards forest management and sustainability and also provide an effective support for governance; the synthesis of the answers by groups of stakeholders could be, for example, the basis to promote management strategies or to understand the necessity to improve knowledge concerning SFM criteria and local forest policies.

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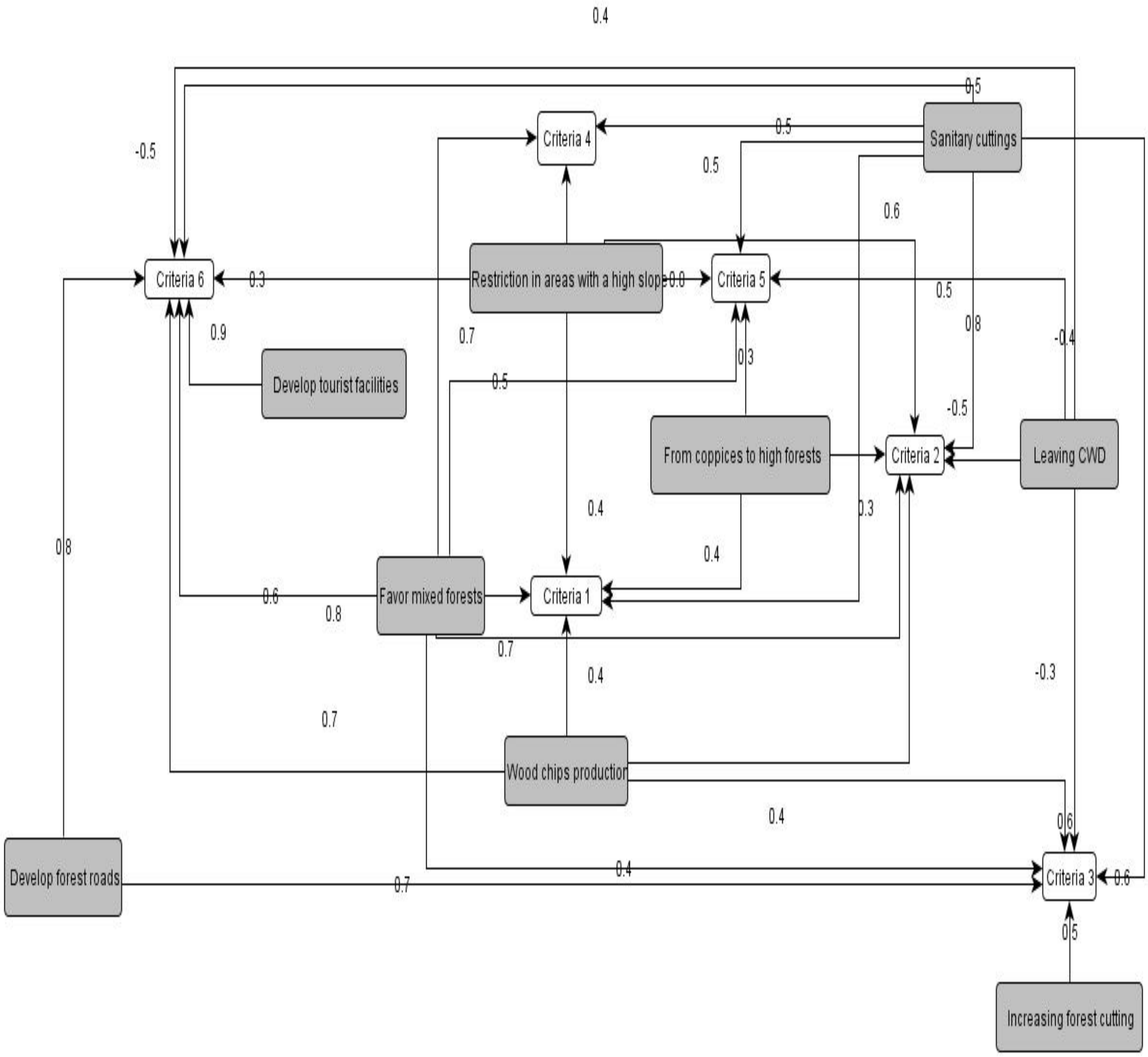
Figure 1. Cognitive map of relationship between forest management practices and SFM criteria by all stakeholders.



ECONOMIC ANALYSIS OF FOREST ADAPTATION TO CLIMATE CHANGE UNDER RISKS AND UNCERTAINTIES

Jean-Luc Peyron[1]

Abstract: *Climate change is a major concern for forestry. It is expected to influence forests and, in the same time, to be influenced by them. From the first point of view, it represents threats and opportunities for forests and leads to adaptation measures in order to reduce the possible impacts of threats and to take advantage of the opportunities. From the second point of view, forests have the potential to sequester and store carbon, to substitute renewable wood to energy intensive materials and fossil energy resources, and thus to mitigate climate change. Although there is a real originality for forests in the ability to tackle climate change in two ways, we discuss here mainly the first one, ie adaptation. Note that adaptation to climate change determines the effectiveness of mitigation of climate change. Note also that adaptation will, in many circumstances, not be successful if mitigation measures are not themselves implemented and effective.*

From the adaptation point of view, there is another real originality for forests in the fact that foresters have to decide today about species that will have to grow not only under present conditions but also under future temperature, precipitation and wind speed averages and variations. However, these future conditions are not known today. There are several possible scenarios for the future, based on different socio-economic developments, as they have been described by the International Panel on Climate Change (IPCC, 2000). Many analyses aim at finding the best strategy fitting to a given scenario but this is not enough to solve the forest adaptation problem since we don't know which will be the future scenario. Any solution to the forest adaptation problem should thus cope with the prevailing uncertainties and risks.

Economics and, more generally, social sciences can play a major role in order to deal with the management of this uncertainty as well as the management of forest resources subject to risks. In forestry, natural sciences have long been integrated with economics in order to both value forests and optimize their management. Martin Faustmann (1849) developed an economic theory based on ecological forest models that played a pioneering role not only in forestry but also more generally in the field of investments. This theory is the main root of cost-benefit analyses. Since its first formulation, it has been much discussed and then confirmed by, among others, the Nobel Prize Samuelson (1976). At this stage, it allows to take into account trade-offs between present and future expenses and revenues. Several extensions have been made since then towards integration of (i) externalities such as values of non market ecosystem services (Hartman, 1976; Strang, 1983), (ii) catastrophic risks (Reed, 1984), Hanewinkel et al., 2010; Zhou & Buongiorno; 2011, Härtl et al., 2013), and (iii) uncertainties (Williams, 2009; Yousefpour et al., 2012; Eriksson, 2012). This whole theoretic corpus allows taking into account climate change issues from an economic point of view and in interaction with ecological sciences. It makes it possible to analyze trade-offs between different ecosystem services, more or less risky options, certain or uncertain issues. More developments are however necessary in order to better support decision making at the forest owner level.

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Thus a major issue is nowadays to support adaptive strategies in terms of species composition and rotation age, among others, in order to bear risks and uncertainties and to answer questions such as: (i) until what period present stands could be maintained? (ii) which species are suited both to present and future conditions? (iii) when should an existing stand be converted to a new one?...

In order to answer these questions, a model has been built with five modules dealing successively with (i) climate change and global warming, (ii) growth at thermal optimum, (iii) response of productivity to climate change, (iv) catastrophic risk under climate change, and (v) economic context (forest revenues and costs, land value, discount rate). These elements can be progressively combined, first in physical terms and then in an integrated economic framework.

This papers presents briefly the model with its fives modules, gives some results and finally discuss the usefulness of such a model.

1. DESCRIPTION OF THE FIVE MODULES OF THE MODEL.

1.1. Climate change

Climate change is characterized by the single temperature trend of the location of the compartment under consideration. This assumption does not mean that the effects of climate change result from temperature alone, but that they are likely to be correlated with it. The trend is represented by the deviation from the average temperature of the pre-industrial era considered to be completed by 1900. It is based on scenarios built by the Intergovernmental Panel on Climate Change (IPCC, 2000). To simplify the subsequent simulations, it fits within two extreme curves between which intermediate scenarios curves can be constructed by simple interpolation (Figure 1). The deviation from the pre-industrial temperature is supposed to determine the future productivity of stands of each species or origin, and the probability of catastrophic risk and destruction of the stand.

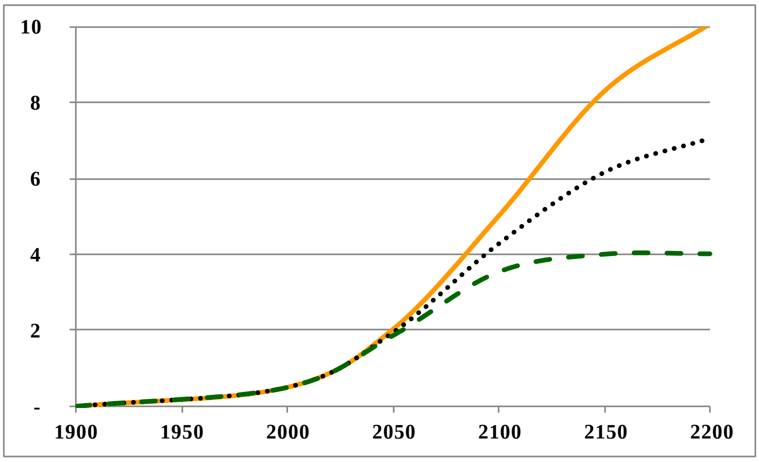


Figure 1. In solid and dashed lines, extreme scenarios of the temperature increase (vertical axis in ° C additional to the pre-industrial average temperature) over time (horizontal axis in years). These extreme scenarios are approximately based on those of the IPCC (2000). They are supposed to reflect the conditions of the stand under consideration. Intermediate scenarios can be obtained by simple interpolation (scenario shown in dotted lines).

1.2. Growth under optimal and stable conditions

The stand growth is characterized for an even-aged forest hectare in a stable environment and at the optimum for the given species in the given site. This is the reference to which will then be added the effects of climate change and the time period considered. A major simplification is made here in order to manage then easily many different cases: growth is represented through the increase of the growing stock after thinning and natural mortality. Thus the main focus is on the final cut rather than on the silvicultural treatment that precedes it and the corresponding intermediate costs and revenues are neglected in the economic evaluation. Three cases are considered corresponding to three growth speeds leading to maximum mean annual increments at ages of about 50, 100 and 150 years (Figure 2). They have the same productivity (5.5 m3/ha/year) in order to show the consequences of different rotation ages.

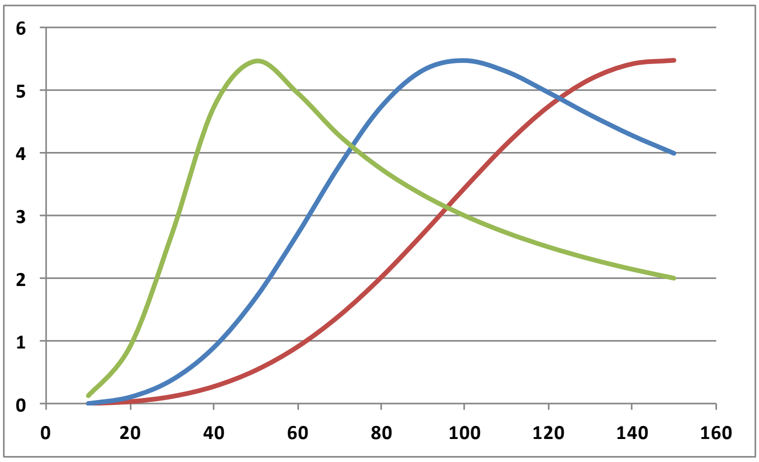


Figure 2. Evolution with stand age (horizontal axis in years) of the average annual increase in growing stock (vertical axis in m3 per hectare and per year). The three cases correspond to three different ages for the maximum average increase in volume (50, 100 and 150 years) and one productivity at these ages (5.5 m3/ha/year).

1.3. Climate change effect on productivity

It is expected that the productivity of a species initially close to the cold limit of its range first increases with climate change, then stagnate before decreasing until the warm edge of the distribution area moves to the site under consideration. A species planted in a site initially colder than the cold limit of its distribution edge will experience the same evolution, but in the future. Moreover, the productivity of a species initially at its optimum in the core of the distribution area will progressively decline with climate change. The range of temperature between cold and warm edges of the distribution area varies from one species to another. Two different spectrums have been considered, narrow (5-10 °C) or large (10 to 15 °C). Finally six cases are considered (Figure 3).

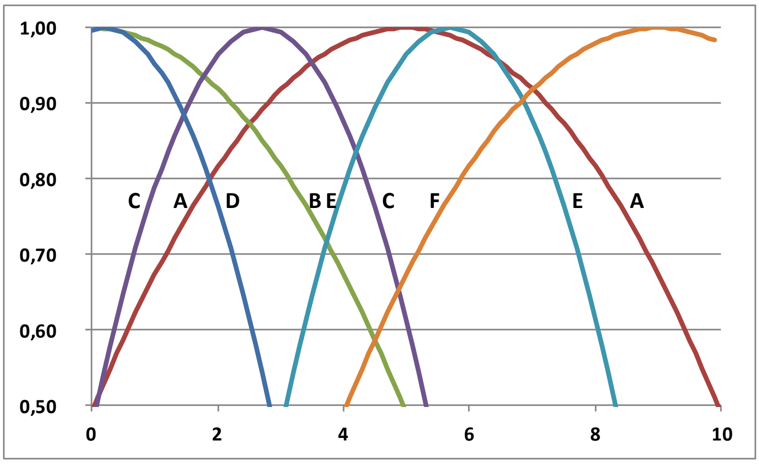


Figure 3. Evolution of the relative stand productivity (vertical axis, dimensionless number considered here between 0.5 and 1) with the deviation from the pre-industrial temperature (horizontal axis, in °C). The cases A to F correspond to different situations in terms of range of the distribution area and position of the site in it or even out of it at the pre-industrial era.

1.4. Climate change effect on catastrophic risk

Previous hypotheses have considered the effect of climate change on trends affecting the stands but they have not taken into account the risk of destruction. This risk is supposed not to decrease in any case because climate change is likely to increase the risk of drought (In France at least) and the likelihood of major biotic threats. The risk is represented by an annual probability of destruction. For simplicity, this destruction is considered complete and its probability is the same regardless of the age of the stand. Three cases are considered and depend on whether the stand experiences a steady, increasing or strongly increasing risk with warming (Figure 4).

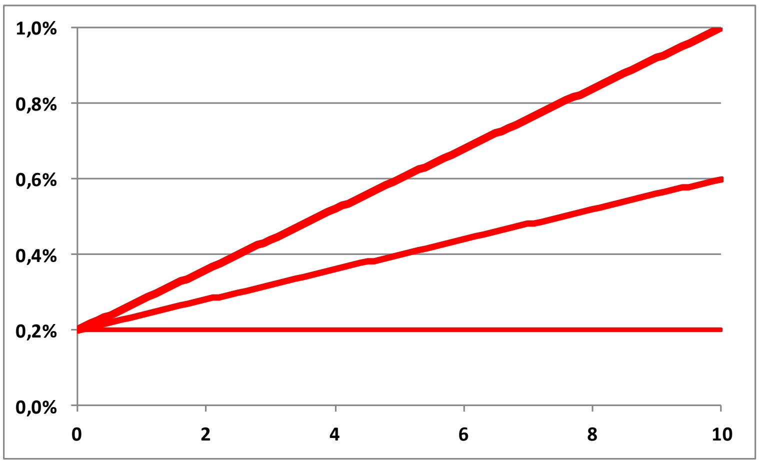


Figure 4. Annual probability of total destruction of the stand (vertical axis, percentage per year) as a function of the deviation from the pre-industrial temperature (horizontal axis, in °C) for three levels of risk evolution with climate change.

1.5. Economic conditions of forestry

Economic conditions of forestry are described here in a simplified form. They consist of the constitution cost of a new stand, the stumpage price of roundwood, the property value of woodlots, and a discount rate. The constitution costs are assumed to be identical in all cases and 2,000 €/ha. The stumpage price is given as an average for the final harvest. It is 50 €/m3. The discount rate is calculated first for a stand at 80% of its optimal growth, harvested at its optimal rotation age, subject to a low catastrophic risk (annual probability of 0.2%), in such a way that the land expectation value is equal to the actual land value on the land market (supposed to be 1000 €/ha). Then it is apply to all calculations concerning the same kind of stand. This discount rate is 2.66%, 1.89% and 1.46% respectively for rotation ages around 50, 100 and 150 years.

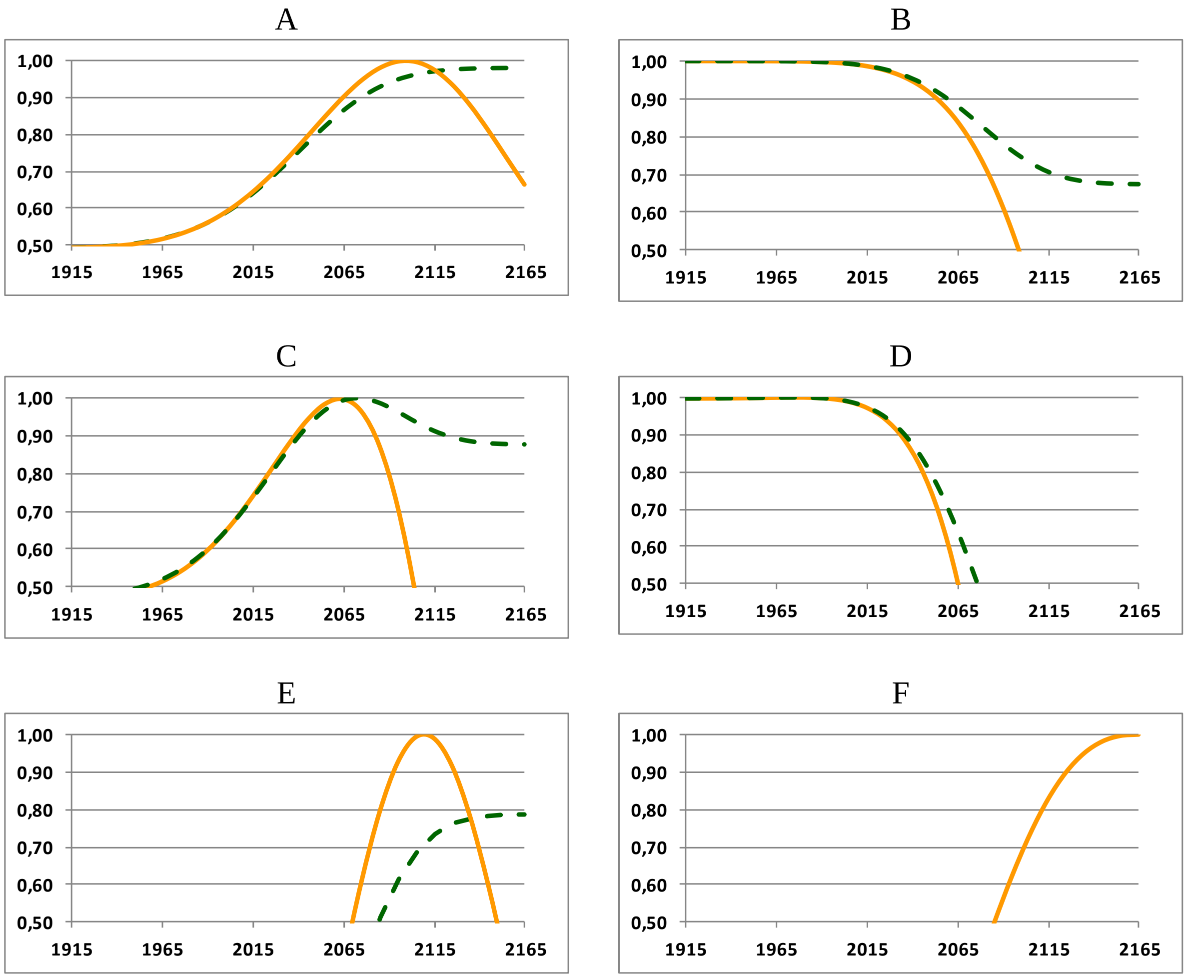
2. SYNTHESIS OF THE TECHNICAL, CLIMATIC AND ECONOMIC INFORMATION

The previous hypotheses have distinguished a range of climate scenarios, and 54 cases resulting from three growth types under stable environment, six different productivity evolutions under climate change and three different risk evolutions under climate change. These 54 cases could be considered as virtual species or provenances available for the site in question. In order to analyze the behavior of these “species” under climate change, their characteristics can be progressively combined with climate change.

2.1. Productivity change under climate change

The combination of climate scenarios (cf. figure 1) and the evolution of productivity with warming (cf. figure 2) show very different situations for stands that would be constituted between 1915 and 2165 (Figure 5). In case A, the stand grow until 2165 with productivity higher than 50% of the optimum, regardless the climate scenario. In cases B and C, growth will be correct during the next 150 years under a moderate warming but will become problematic after 2100 under a marked scenario. In case D, the conditions were good in the past but will be still acceptable during some 50 years in the future. In case E, a stand can only be planted after 2080 and in case F, the same result is obtained but only under a marked warming.

Figure 5. Evolution of the relative stand productivity (vertical axis, dimensionless number) over time (horizontal axis, in years). It is provided for the two extreme climate scenarios: moderate warming in dashed lines and marked warming in solid lines. The capital letters refer to the type of productivity change in Figure 3.



2.2. Life cycle under climate change

The previous hypotheses give the possibility to represent stand growth under different climatic scenarios and varying climatic conditions along stand life-cycle by combining reference stand growth (Figure 2) with the evolution of the relative stand productivity over time (Figure 5). The result is presented for one case on Figure 6.

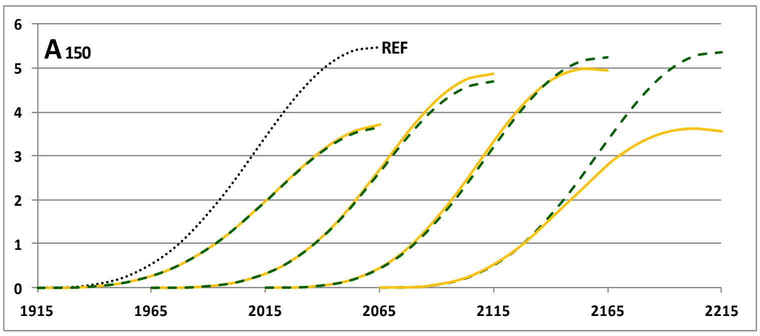


Figure 6. Evolution of the mean annual volume increment (vertical axis, in m3/ha/year) over time (horizontal axis, calendar years) for a stand of type A at maturity when it is about 150 years old. This evolution is shown for the reference growth (dotted curve), and for stands initiated in 1915, 1965, 2015, or 2065 and considered under two scenarios (moderate warming in dashed lines and marked warming in solid lines).

In the case A, the stands created over the last hundred years experienced and will experience a gradual increase of their productivity. However, future stands that will be created in the next fifty years will evolve differently depending on the climate scenario: for a moderate warming scenario, productivity will continue to grow or remain at a high level but for a marked warming, productivity will begin to fall.

2.3. Catastrophic risk under climate change

The risk of total destruction of the stand was previously linked to the average warming represented by the deviation from the pre-industrial temperature (Figure 4). Its variation with time can also be represented by combining the information given by figures 1 and 4 (Figure 9). Under moderate climate scenario, warming tends to stabilize around 4 ° C in the early 22th century, and the same kind of evolution applies to the corresponding risk of destruction. But under the strong climate scenario, the inflection is less clear and destruction risk continues to grow strongly.

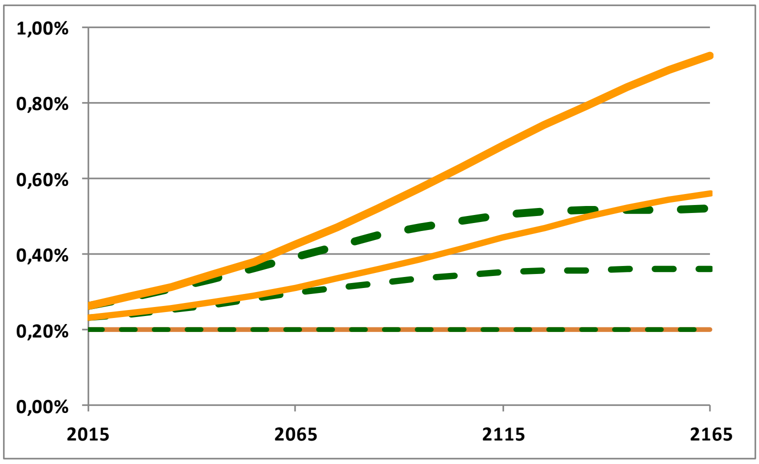


Figure 7. Evolution of the annual probability of total destruction of the stand (vertical axis, as a percentage per year, for all ages of trees) over time (horizontal axis, in calendar years). The level of risk can be low (horizontal thin line), increasing with climate change (low thick lines) or strongly increasing with climate change (very thick lines). It is given for two climate scenarios (moderate warming in dashed lines and marked warming in solid lines).

2.4. Forest economics under climate change

Several modules have been integrated until now on a biophysical basis but economics becomes necessary for three different reasons: (i) integration of any available information, in particular about trends and catastrophic risks, (ii) consideration of investments that means expenses and revenues at different times, and (iii) identification of the best rotation age under different assumptions. The decision criterion is here the land expectation value and the main goal is to determine whether its optimum is higher than the market value (1000 €/ha) or at least positive, and to identify the optimal rotation age. The result is presented in figure 8 for one case (A). In this case, stands created in 1915 (series of curves on the far left) could be harvested around 2040. But they would be characterized by a rather low profitability since the land value would be lower than the reference (market) value in all cases. During this period of limited climate change, the climate scenario doesn't lead to any significant difference, except that the lower the catastrophic risk, the higher the land expectation value. Stands created in 1965 (second series of curves from the left) have a better profitability because they have better growth conditions, even better under a marked warming. However, for high catastrophic risks, the land expectation value doesn't reach the reference level (1000 €/ha). Stands created around 2015 (third series of curves from the left) will have still better growth conditions but the moderate climate scenario progressively becomes better and the weight of catastrophic risks increases and becomes a major problem for high risks under marked warming. Stands created around 2065 (series of curves on the far right) would experience acceptable conditions only under a moderate climate scenario or low catastrophic risk.

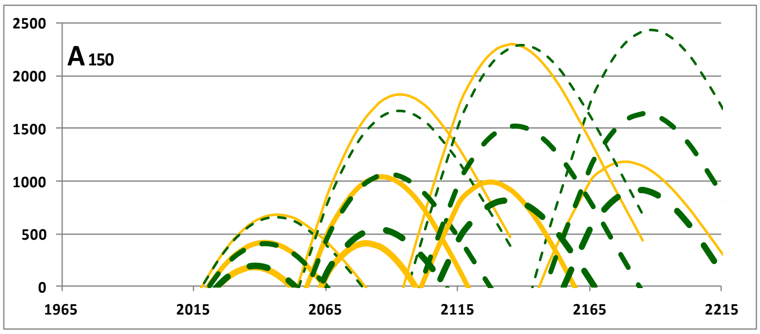


Figure 8. Evolution of the land expectation value (vertical axis, in €/ha) over time (horizontal axis, calendar years) for a stand of type A created in 1915, 1965, 2015, or 2065 (series of curves from left to right). Two scenarios are considered (moderate warming in dashed lines and marked warming in solid lines), and three levels of catastrophic risks (increasing with the line thickness).

3. CONCLUSION

Such a model could be used on case studies. Another approach has been chosen here with the elaboration of a large set of virtual situations differing in terms of (i) growth, (ii) impact of climate change on the productivity and (iii) the level of catastrophic risks, (iv) creation date of the stand and (v) economic parameters. This method allows to analyze a great variety of situations, and to simulate the elaboration of strategies facing climate change and related uncertainties. Only some examples have been shown here.

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THE ECONOMIC SIGNIFICANCE OF NON - WOOD GOODS AND FOREST SERVICES: BIG BUSINESS OR JUST PEANUTS?

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Abstract: *Multifunctional forestry in general and forest services in special are generally held in high esteem. However, most services accrue in terms of external effects and share the characteristics of public goods. Whereas related benefits increasingly contribute to social welfare, value added production of the timber business tends to decline at least in real terms. Hence, diversification has become a major issue for forest owners. In this context, the potential of non-wood goods and forest services for value-added production is of crucial interest. The paper investigates the status of diversified, multifunctional forestry from a managerial point of view. Empirical evidence stems from Austrian forest accountancy data networks which serve as infrastructure for monitoring the economic developments in forestry. The capability of these accountancy networks for assessing the profitability of diversification appears to be limited, however. Especially bigger ventures which are established as separate legal entities are hardly captured by forestry-related monitoring schemes. Other hurdles and possible biases associated with the data available are highlighted as well.*

Keywords: multiple use forestry, diversification, non-timber products, forest services, auxiliary activities, forest accountancy data networks, farm forestry, Austria

1. INTRODUCTION

Forest services are generally held in high esteem (e.g. EC 2008, Hunziker et al. 2012). They are of crucial importance in terms of multiple use forestry and hence also as regards sustainable forest management (Forest Europe 2011). However, providing any such service is not necessarily a relevant goal on behalf of forest owners. Many of the services accrue at least to some extent as a more or less unintended by-product of sustainable timber production. Property rights tend to be politically allocated and reinforced in such a way, that forest services but also major non-wood products like e.g. mushrooms show the characteristics of public goods. Consequently, the economic appraisal is likely to yield highly divergent results depending on the level of investigation. Whereas an assessment in terms of welfare usually indicates a high significance for society, yardsticks such as jobs, income and value added tend to document a marginal role for the economy. FAO (2011) provides data for 2006 which imply, that roundwood production accounts for 0.25 % of GDP and 0.11 % of the labour force globally, the respective figures for Europe (0.15 % / 0.31 %) and Austria (0.50 % / 0.17 %) indicating comparable magnitudes. Conversely, Rauch-Schwegler (1994) in her assessment of 5 major forest functions associated merely 5 % of the established values of Swiss forestry with market-related outputs. In another study for the same country, Alfter (1998) identified 20 non-wood goods and 14 services related to forestry. The estimated value of these outputs exceeded the market output of timber production about tenfold.

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In their Italian case study, Goio et al. (2007) concluded, that standard national accounting systematically underestimates the significance of forestry, timber accounting only for 19 % of the value of outputs from forestry. The compilation of Croitoru and Merlo (2005) is a good example reflecting the obstacles of assessing the total economic value of forests at national and international levels, data deficits implying a substantial underestimation. Although the individual results of different studies vary to a great extent, the general implication is obvious: forestry triggers substantial benefits, which contribute only to a minor extent to value added and entrepreneurial income within the sector.

In Austria, gross output of timber production is suffering from stagnation or even decline in real terms in spite of substantially increased cuttings. This long-term development forces forest owners to look for additional sources of income. Hence, diversification has become a major issue also in Austrian forestry (Rametsteiner et al. 2005; Weiss et al. 2011). It is an appealing approach at the enterprise level to exploit the economic potential of all available resources more thoroughly especially by marketing non-wood goods and forest based services. However, a successful diversification in these fields may require a re-allocation of property rights as well as efforts of product development coined 'transformation' and 'development' by Mantau et al. (2001). In the following it is investigated whether and to what extent the established economic monitoring schemes are capable of addressing the issues of diversification and multiple use forestry.

2. MATERIAL AND METHODS

Forest accountancy data networks have a long tradition as an infrastructure for monitoring the profitability of forestry, especially in German speaking countries (Hyttinen et al. 1997). They represent more or less stable samples of farms or bigger forest enterprises which provide their accounting data in regard to forestry on a voluntary basis. In Austria, there exists a network of bigger forest enterprises (> 500 ha; Sekot & Rothleitner 2009) as well as one comprising farm forests with a forest area between 5 and 200 ha (Sekot 2001). The latter one is a non-representative sub-sample of the national Farm Accountancy Data Network which serves as an instrument for evaluating the income of agricultural holdings and the impacts of the Common Agricultural Policy. Both forestry networks consist of about 100 units and apply a scheme of cost accounting in regard to timber production. Non-timber revenues directly related to the forest enterprise are recorded under the headings of minor forestry products (e.g. Christmas trees), charges (e.g. for using forest roads), reimbursements (e.g. insurance benefits) and subsidies. Cost and returns of any other activities are delimited irrespective of whether they accrue within the same legal or fiscal entity or not. Only hunting is generally captured as an auxiliary activity, the hunting right being directly attached to land ownership in Austria. However, respective costs and proceeds do not affect the profit of the timber business but are related to a specific, additional cost centre and are subject to a separate profit calculation. In the network of bigger forest enterprises, other auxiliary activities may be documented in the same way but on an optional basis. It is up to the individual enterprise to decide, which respective activities shall be documented and the results are not part of the standard aggregation and reporting at group level. Ten more or less frequent activities are pre-defined as cost centres, ranging from fishing to tourism. An additional 7 auxiliary activities may be defined individually.

3. RESULTS

There is a restricted set of ratios available for characterising the significance of non-timber proceeds and auxiliary activities which may be derived from the basic data (Sekot & Rothleitner 2009). A standard approach is to express monetary values per m^3 of actual or annual allowable cut and per ha of productive forest area. However, there is not in all cases a direct relationship with the intensity of fellings or land. Relating figures to the respective values of timber production indicates the relative significance of the individual item. The corresponding cutting volume (CCV) is derived by dividing a figure through the average stumpage value per m^3. The resulting quantity may then be related to the volume of the annual allowable cut (AAC). A negative sign indicates a respective share of AAC being compensated by net revenues, whereas a positive sign means, that the given percentage of cutting volume is necessary for financing a net cost.

Average results from the network of bigger forest enterprises (>500 ha) are provided in Tables 1 and 2.

Tab. 1: Weighted average values of real earnings per hectare, relation to earnings of timber production (ETP) and corresponding cutting volume (CCV) in % of the annual allowable cut (AAC) for the periods 1997 - 2006 and 2007 – 2011.

	weighted average 1997 - 2006			weighted average 2007 - 2011		
	real earnings	relation to ETP	CCV in % AAC	real earnings	relation to ETP	CCV in % AAC
	[€/ha]	[%]	[%]	[€/ha]	[%]	[%]
minor forest products	1.0	0.2	-0.4	2.0	0.4	-0.8
charges	11.0	2.3	-4.7	13.1	2.4	-5.5
reimbursements	3.1	0.7	-1.4	24.7	4.3	-10.3
subsidies	8.8	1.8	-3.8	15.3	2.8	-6.4

Due to changes in the methodology of data recording, time series up to 2006 and from 2007 onwards are not consistent. Only lately, the transportation of timber to the millgate is depicted in such a way, that associated revenues are recoded under the heading of reimbursements. The higher level of subsidies in recent years may be explained by aftereffects of calamities and a special subsidy for diesel oil available since 2004. Altogether, non-timber proceeds amount to an average of 55.1 €/ha, which is a magnitude of 9.7 % of the earnings of timber production over the last 5 years. These proceeds are an equivalent to some 22.7 % of the annual allowable cut valued at the average stumpage price.

Tab. 2: Documentation and results of auxiliary activities based on optionally addressed additional cost centres, corresponding cutting volume (CCV) in % of the annual allowable cut (AAC), relation of earnings to earnings of timber production (ETP) and relation of costs to costs of timber production (CTP) for the periods 1997 – 2011.

	weighted average 1997 - 2011						
		all participants			documented values		
	documented by companies	CCV in % of AAC	relation costs to CTP	relation earnings to ETP	CCV in % of AAC	relation costs to CTP	relation earnings to ETP
	[%]	[%]	[%]	[%]	[%]	[%]	[%]
Hunting	97.5	1.2	9.0	6.2	1.3	9.9	6.8
Agriculture	79.1	-1.4	1.2	1.5	-1.8	1.6	2.0

Fishing	76.9	-2.8	1.2	2.1	-3.5	1.5	2.6
Provision of services	47.4	0.1	2.4	1.8	0.2	4.1	3.1
Renting of buildings	39.1	1.0	2.7	1.7	2.3	6.3	3.9
Renting of landed estate	33.9	-1.0	0.2	0.6	-2.1	0.3	1.1
Water	33.2	-0.1	0.0	0.1	-0.3	0.0	0.2
Gravel and sand	24.4	-1.4	0.4	0.9	-3.8	1.0	2.4
Other auxiliary activities	17.1	-0.2	5.7	4.4	-0.3	5.4	4.7
Recreation and tourism	13.8	0.0	0.9	0.7	0.1	4.7	3.6
Christmas trees	11.7	0.1	0.2	0.2	0.4	1.2	0.9
Forest nursery	6.5	0.0	0.3	0.2	-0.2	3.4	2.9

The results in table 2 are presented twofold: the figures in the left part refer to the entire sample, irrespective whether the individual cost centre is being addressed at all. The results in the three columns to the right characterize only those cases, where costs or revenues were recorded. Water is a typical example for the delimitation of proceeds, which are not directly related to forestry. As there are no specific inputs, one may hardly speak of a separate line of production.

The positive signs of CCV given in % of AAC indicate deficits requiring a respective share of the cutting potential for offsetting the losses. Especially renting of buildings and hunting appear to be a financial burden for the enterprises at least on average and in the long run. The sum of -4.5 % (-7.7 %) indicates, that auxiliary activities as a whole seem to contribute positively to the net profit of the enterprise. It has to be kept in mind, however, that these records are all but comprehensive.

As regards small scale farm forestry with up to 200 ha, the national farm accountancy data network provides representative information based on a quota sample of more than 2200 farms. For the period from 1997 to 2011, non-wood revenues contributed some 3.4 % to the forestry revenues, subsidies accounting for another 1.4 %. In individual years, these shares are affected by the considerable volatility of timber revenues, however. The imputed real (deflated) values indicate a rather significant decline in terms of non-wood revenues. On contrary, subsidies remained more or less constant until recently. The increase in 2009 and 2010 may be explained by the state reacting on a series of severe damages, bark beetle attacks following large-scale windthrow.

The network of farm forests allows for some further analysis. From 1991 onwards, non-timber revenues are differentiated into minor forest products, reimbursements and subsidies. Since 1999 also charges are recorded as a specific type of revenue. These returns may be directly related to the forest area. In addition, a specific cost centre for hunting serves for documenting respective costs and revenues related to the forestry part of the farm. However, in most cases agriculture is the main business of the farm and apart from hunting no further auxiliary activities are recorded in this network. Table 3 gives the average results for non-timber revenues for the period from 2002 – 2011 (real values with basic year 2012).

Tab. 3: Statistics for non-timber revenues in the network of farm forests (averages 2002-2011)

item	minor forest products	charges	reimburse-ments	subsidies	total
Frequency in % of cases	21.7	3.8	15.3	72.7	1097 cases
Share of non-timber proceeds (%)	30.3	4.8	10.3	64.6	100.0 %
Contribution to total forestry revenues (%)	1.1	0.3	0.6	3.5	5.3 %

Average value per case (€)	1151	1556	1100	1091	1120 €/item
Average value per ha (%)	4.97	1.19	2.51	15.79	24.46 €/ha

91.7 % of the cases in this cross-section time series analysis comprise revenues for hunting with an average of 22.70 €/ha. These are associated with hunting licenses on the one hand and reimbursements for damages due to browsing and debarking on the other. Conversely, only some 9.0 % record also costs for hunting, averaging some 6.81 €/ha. This results in a quite distorted picture of hunting as an auxiliary activity. Even in those 8.0 % of cases, where inputs as well as outputs occur in the same year, the average turnover ratio is as high as 45.8 % and the net profit is 5.23 €/ha.

4. Discussion and Conclusions

The results derived from accountancy data networks, their significance and validity have to be assessed prudently. This is not only a pre-condition for sound international comparisons (Sekot et al. 2011) but is also a requirement for the interpretation at the level of the individual network (Sekot 2007). For instance, ratios expressing a certain category of revenues in percent of total forestry revenues or relating them to timber revenues may be affected by the volatility or even trends of timber revenues. In periods of extraordinarily high timber revenues, be it due to high level of prices and/or fellings, respective figures may indicate a marginal significance of any other sources of revenues.

The established monitoring schemes were designed to investigate the performance of timber production. In contrast to the German system, where at least some of the so-called product categories may be associated with specific uses of forests, the Austrian networks are not suited specially for addressing the issue of multiple use forestry in any detail. Only certain non-timber proceeds such as compensation for nature reserves might be identified and analysed in terms of diversification and multiple use forestry. However, the total contribution of minor forest products, charges and reimbursements to the earnings of the forest enterprise appears to be relevant, but is not substantial. Apart from hunting, auxiliary activities are not captured systematically, respective cost centres rather serving for delimitating forestry and non-forestry items among costs and revenues than documenting additional ventures in terms of diversification. Furthermore, respective activities are not necessarily related to forestry in terms of forest resources serving as productive agents. Hence, the results are neither representative nor definitely associated with multiple-use forestry but provide just some indication in regard to the profitability of such ventures.

In case the economics of diversification and multiple use forestry are to be documented more comprehensively, at least a specific refinement of the existing accountancy networks would be required. However, farms or forest enterprises may not suffice as the only units of investigation for tackling all kinds of activities related to multiple use forestry. Especially bigger ventures are likely to be established as separate legal entities and may involve a multiplicity of forest owners or other partners. Another crucial question is the delimitation of multiple use forestry as such: Which activities are to be considered as forestry-based in view of a continuum as regards the share of forest resources serving as productive agent? Obviously, clear definitions and strict protocols are required for effectively designing respective research also in this respect (Niskanen & Sekot 2001).

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Differentiated Valuation of Forest Services by Their Relationships to the Market and Its Implementation in the Czech Republic

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Abstract: *The article focuses experimentally on differentiated valuation of forest services' socio-economic importance by their relationships to the market. The methodology of respective forest services' valuation is based on a present situation and conditions in the Czech Republic (CR) regarding the prevailing methods of majority forest services' valuation in EU. Availability and quality of input data play an important role, too. Certified methodology designed in the frame of a research project supported by the National Agency for Agricultural Research was used for the valuation. The following forest services' valuation was performed: timber production, hunting and game management, non-timber forest production and collection, soil-protection, hydrological, air protection –* CO_2*, sequestration, health-hygienic, cultural and educational. Total value of forest services in CR compared to sustainable grass land services reaches 49.3 billion CZK annually, and 2.475 billion capitalized value, compared to arable land services 90.8 billion CZK annually and 4.538 billion capitalized value, and compared solid soil cover services 63.6 billion CZK annually and 3.180 billion CZK capitalized value.*

Keywords: forest services, public socio-economic importance, valuation, Czech Republic

1 Introduction

Forest services form a complex socio-economic systems. There are different forest services' systems in individual countries, their structure is not and cannot be stabilised because it is formed considering different objectives and purposes regarding individual localities, times, cultural and socio-economic conditions. Forest services' systems are always purpose-built.

Obviously, the forest services are not uniform in terms of their socio-economic content. They differ in socio-economic essence of their impact and in their role in the society. Methods of forest services valuation vary also by socio-economic background of the respective society, by purpose of pricing and by data availability. Different ways of forest services valuation were used by individual countries were used e.g. by Merlo, Croitoru (2005). Also Blum (2004) presented different possibilities of forest services valuation.

System of pricing of socio-economic importance of forest services for the society, regarding the aspects mentioned above, was derived in the Czech Republic in 2002 (Sisak, Svihla, Sach, 2002), adapted in 2010 (Sisak et al, 2010) and applied as a case study to the area of forests administered in the frame of total CR.

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There were identified and valued the following basic forest services generally differentiated by their socio-economic content (Sisak et al 2010) in the CR:

a) market forest services (production functions, internalities)
   - timber production service
   - hunting and game management service

b) non-market environmental forest services (externalities)
   - with mediated market impact (with measurable market, i.e. economic, impacts)
     - non-wood forest production services
     - soil-protective services (site soil erosion protection, protection against eroded soil deposits in water streams and reservoirs)
     - hydrological (water management) forest services (protection against maximum runoffs and minimum runoffs in water streams, water quality in water streams, reservoirs and resources)
     - air protective forest services (protection of air quality, climate, CO_2, NO_x sequestration)
   - without measurable market impact
     - health-hygienic forest services (recreational and health influencing)
     - cultural-educational (nature protective, educational, scientific and institutional) services.

2 METHODOLOGY

Methods of socio-economic valuation of forest services are differentiated by their diverse socio-economic essence and impact on the society (mentioned above), purpose of their employment in the society and input data availability (Sisak, Svihla, Sach, 2002, Sisak et al, 2011).

The forest is a dynamic and renewable environmental source. Therefore, derived pecuniary values are differentiated into the annual and capitalised forms reflecting the fact that forest services can work, can be damaged, or even lost in respective localities temporary or perennially. Capitalised values were derived from year values by capitalising them using 2% interest rate. This interest rate is the so called forest interest rate usually applied for similar cases in the Czech theory and practice in the respective legislation (Sisak et al 2011).

2. 1 Timber production forest service

Timber production forest service proceeds through the market. The public socio-economic importance and value of market services (for the society) is much broader and higher than the value for private persons like owners and tenants. The public value of market services consists not only of net income or rent important for a forest owner but also of value of working places, wages and salaries of employees, of values of means of production used in production processes, taxes paid to public budgets, and of all other outputs of market forest services used in the society. The value of timber production for the society was experimentally derived from the current values of timber market sales.

2.2 Hunting and game management service

Hunting and game management forest service, even if generally of recreational relaxation nature, proceeds through the market in the CR. Therefore, from valuation point of view, it is of similar socio-economic essence as timber production service. This service can be valued by the same methods as the previous timber production forest service. The socio-economic value of hunting, game and deer production forest service for the society was experimentally derived from the values of incomes embracing game and all other commodities and services from hunting and game management. The values were calculated for open hunting areas, which are prevailing in the CR.

2.3 Non-timber production service of the forest

Non-timber production service is of non-market essence in the CR. Everybody can enter forests and pick up products such are mushrooms, berries, medicinal plants and some other products free of charge irrespective of kind of forest land possession. These products attain the character of externalities of a mediated market nature. The volume of their harvest and their social significance is surprisingly high in the CR. The mean socio-economic value of non-market production services of the forest for the society was experimentally derived from the shadow market values (current prices) of main non-wood forest products collected by forest visitors.

2.4 Hydrological (water management) forest services

Hydrological (water management) forest services consist of reducing maximum runoff in water streams, enhancing minimum runoff in water streams and protecting water quality (especially against contaminations with nitrogen oxides in water reservoirs an water streams). Such forest services influence market relations, they have a mediated market character. Socio-economic valuation of the hydrological forest services is based on the “costs-of-prevention approach”. The costs were calculated for technical measures like retention reservoirs and other constructions and technical equipment substituting the respective hydrological forest services, and reducing maximum runoff in water streams, enhancing minimum runoff in water streams and reducing the content of nitrogen oxides in water streams and reservoirs.

2.5 Soil protection forest services

Soil protection forest services represent protection against soil loss by water and wind erosion (especially introskeleton erosion on respective localities), and protection of water streams and reservoirs against deposits of eroded soil parts. The services are of the same socio-economic essence as the hydrological forest services. They influence market relationships; they have a mediated market character. Socio-economic valuation of the soil protection forest services was based on the “costs-of-compensation approach”, which means that the value was calculated by costs of measures compensating or removing damage caused by the loss of its protective function (extra costs of reforestation of the land affected by soil erosion; additional costs of removing the soil deposits from the respective water streams and reservoirs).

2.6 Air protection forest service – CO_2 sequestration

Air protection forest services, especially CO_2 sequestration, have similar socio-economic character to hydrological and soil protection forest services. They influence market relations as trade with CO_2 permits is developing. Socio-economic valuation of CO_2 sequestration was based on average unit price of international trade with CO_2 permits in Europe and average year amount of CO_2 sequestered in timber increment. The price was based on published data on Greenhouse Gas Market by the International Emission Trading Association IETA.

2.7 Health-hygienic (recreational, health) forest services

Health-hygienic forest services reflect the fact that people use forest environment for recreational, relaxation and health purposes. They are of intangible, non-market nature. For expressing the socio-economic value of health-hygienic forest services, the so called expert approach was employed. Expert approach is quite well known and elaborated including attempts to apply it in practice in the CR. One of such valuation systems derived by Skypala (1988) is still used in the legislative practice (Forest Act No. 289/1995 in the parts dealing with a fee for the withdrawal of forestland designated for the fulfilment of forest services). Both annual value and capitalised value are distinguished..

Expert method was based on comparison of mean general socio-economic importance of the health-hygienic forest services to the mean general socio-economic importance of timber production forest service. Czech experts in forest services from important institutions in the CR were questioned about their preferences regarding relative socio-economic importance of the respective services and timber production service. The resulting expert ratio was used for mean general value of health-hygienic forest services derived from the timber production forest service value by the respective rate. Local values were differentiated by forest frequentation. Sisak et al (2010).

Valuation of non-market forest services based on the "consumer-surplus approach" and on the "willingness-to-pay" calculations is still not generally exploited in the CR. Their results are not satisfying, influenced by the fact forests have always been freely accessible to everyone free of charge, forests and recreational possibilities are not felt by people as something scarce in area of the CR.

2.8 Cultural-educational forest services (nature conservational, educational, scientific and institutional)

Cultural and educational environmental forest services manifest the fact that forest environment represents one of the least changed environmental components by human activities in the CR. The forest environment is an irreplaceable source of knowledge of the nature and its evolution, relationships of natural environment and society. The services are important for science, research, education, they represent objects of activities pursued by various scientific, educational and cultural institutions. Like the health-hygienic forest services the cultural-educational forest services are of an intangible non-market essence.

For expressing the socio-economic value of cultural-educational environmental forest services the expert approach was employed using comparative method, i.e. comparing their general mean socio-economic importance to the general mean socio-economic importance of timber production service. Local differentiation was based on the landscape zoning that represents different qualities and grades of nature protection.

3 RESULTS

In the CR, the socio-economic values of individual forest services vary to a great extent by respective forest site and forest stand, by environmental, social, cultural and economic factors in individual areas. Values were originally derived in Czech Crowns (CZK) and then transformed into EUR by an average currency rate 1:25. Values are expressed in two forms – average annual values and capitalised values. Capitalised values are calculated from average annual values (considered as perpetually repeated) by formula: average annual values/forest interest rate. The interest rate was taken from actual interest rate used in the basic forestry legislative documents. Results are presented in Tables 1 and 2, and in Picture 1.

Tab. 1: Average unit forest services values in the CR in comparison with grass land, arable land and solid soil cover [EUR/ha] (alternative without production use of soil)

Forest services	Grass land		Arable land		Solid soil surface	
	Annual	Capitalized	Annual	Capitalized	Capitalized	Annual
Timber production	312	15,594	312	15,594	312	15,594
Game management and hunting	0	0	0	0	170	340
Non-timber forest products	53	2,630	53	2,630	53	2,630
Maximum runoffs	26	1,314	32	1,615	97	4,844
Minimum runoffs	22	276	33	1,660	167	8,360
Water quality	143	7,161	623	31,155	0	0
Introskelet erosion		7,536		7,536	0	0
Soil deposits in water streams and reservoirs	0	1	53	2,641	0	0
Air protective – CO2 sequestration	40	2,000	40	2,000	40	2,000
Halth-hygienic	130	6,493	130	6,493	144	7,215
Cultural-educational	47	2,336	135	6,747	173	8,650

Tab. 2: Total forest services values in the CR in comparison with grass land, arable land and solid soil cover [mil. EUR] (alternative without production use of soil)

Forest services	Grass land		Arable land		Solid soil surface	
	Annual	Capitalized	Annual	Capitalized	Annual	Capitalized
Timber production	801	40,045	801	40,045	801	40,045
Game management and hunting	0	0	0	0	18	904
Non-timber forest products	130	6,509	130	6,509	130	6,509
Maximum runoffs	68	3,412	84	4,194	252	12,580
Minimum runoffs	56	2,794	86	4,311	434	21,711
Water quality	372	18,597	1,618	80,910	0	0
Introskelet erosion	-	360	-	360	0	0
Soil deposits in water streams and reservoirs	0	3	137	6,460	0	0
Air protectove – CO2 sequestration	103	5,136	103	5,136	103	5,136
Halth-hygienic	321	16,071	321	16,071	357	17,856
Cultural-educational	121	6,067	350	17,522	449	22,464
Total	1,973	98,995	3,631	181,517	2,544	127,207
Average (EUR/ha)	760	38,120	1,398	69,880	980	49,000

4 CONCLUSIONS

Results of employment of forest services valuation system derived experimentally for the Czech Republic show the valuation system can be applied for valuing socio-economic importance of forest services for the society in concrete localities and cases. The results prove big socio-economic importance of forest services for the society in the respective area.

It is true that monetary valuation of socio-economic importance of forest services for the society is a considerably difficult and complex theoretical and practical issue. Forest services are not uniform considering their socio-economic impact on the society and their relationship to the market. The system of valuation methods used for different forest services should reflect the socio-economic impact on the society but also socio-economic and cultural background of the society and input data availability.

Valuation of market services is based on the mean year income from respective markets (timber sale, hunting and game production). Valuation of hydrological forest services was done by costs of prevention, soil protecting services by costs of compensation, CO_2 sequestration by shadow prices of trade with CO_2. Valuation of health-hygienic and cultural-scientific forest services of a non-market essence was performed by expert approach using comparative method, i.e. comparing their socio-economic importance to the socio-economic importance of market services (timber production).

In valuation of forests services, especially of a non-market nature, is and always will be a considerable share of subjective factors (as no objectification of prices through the real market mechanism exists). Nevertheless, the obtained values can be applied for different purposes in practice. The application and mutual comparability of such values depends to a great extent on consensus in the frame of respective community as a whole. Results of valuation are important for decision making in forest management in the area and will also be used in calculations of socio-economic effectiveness of multipurpose forest management by the managerial staff of the Forest Plant Zidlochovice and by managerial staff of the state enterprise Forests of the Czech Republic.

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DEVELOPMENT OF THE NUMBER OF ENTREPRENEURS IN THE FORESTRY SECTOR IN THE CZECH REPUBLIC

Zbyněk Šmída[1]

Abstract: *The paper considers the development of entrepreneurs in the forestry sector in the Czech Republic. The aim of the paper is to quantify the number of business entities currently operating in the forestry sector in the Czech Republic and compare the numbers in May 2004 and July 2012. In recent years, considerable changes, mostly economic and legislative influence the economic environment of forestry enterpreneurs. In the nineties there was a significant reduction in the role of the state and shifting most of decision-making related to business activities to separate private entities market. Nowadays, there is shift in the institutional development of Forests of the Czech Republic, state enterprise, which has significant impact on the development of forestry enterpreneurs. Classification of business entities is made according to the rules of the Czech Statistical Office in the classification of economic activities (CZ-NACE) 02 – Forestry and logging. The subjects are categorised by legal form, its seat and the number of workers employed by the enterpreneurial subject. The comparison is made in the surveyed years.*

Keywords: Czech Republic, forestry, business entities, forestry contractors, CZ-NACE, legal form, number of staff, development

1. INTRODUCTION

From the point of view of the industrial nature of country like the Czech Republic and the population density, forests have an exceptional significance as a part of the environment and as a source of renewable, environmentally friendly raw material. With felling approximately 1 m^3 per inhabitant per year, forests not only fully cover domestic production and improve foreign trade, but also keep employment through forestry enterprises together with wood processing companies and what is most important – keep employment in remote rural areas.

In recent years, including relation to the economic development of society as whole, considerable changes in the economic environment of business entities evolved. In the nineties there was a significant reduction in the role of the state and moving most of decision-making related to business activities into separate entities market. The forest industry was in 1992 in the process of the transformation of former state forest enterprises. After significantly drop in the proportion of state ownership and increasing the share of private ownership, the establishment of new private enterprises and privatized former state enterprises, then there were changes in economic and legislative environment. In the light of these developments, there is a renewed discussion and analysis of the current situation in the forestry sector not only between operational foresters, but also on the top social and political levels.

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The important player on the forestry market is the company Forests of the Czech Republic, state enterprise which in the last years changes the policy and that has significant impact on the whole forestry sector – forestry contractors and forestry business entities. The development influences the employment market in the rural areas.

Ministry of Agriculture (2011) says about employment market, that forest owners and contractors in the forestry sector are carrying out further reductions in the number of reduction in the number of employees. The most significant decline become in the last ten years. The largest drop in the number of employees was reported from the private sector.

The paper considers the development of entrepreneurs in the forestry sector in the Czech Republic. The aim of the paper is to quantify the number of business entities currently operating in the forestry sector in the Czech Republic and compare the numbers in May 2004 and July 2012. Classification of business entities is made according to the rules of the Czech Statistical Office in the classification of economic activities (CZ-NACE) 02 – Forestry and logging. The subjects are categorised by legal form, its seat and the number of workers employed by the enterpreneurial subject. The comparison is made for the surveyed years.

1. MATERIAL AND METHODS

Input data for analysis were obtained primarily from the author's information database and the available electronic resources, mainly Business Register, which draws on data from the Czech Statistical Office (ČSÚ 2012), and further information database company Creditinfo Czech Republic (CREDITINFO 2012).

According to the classification of economic activities (CZ-NACE) is classified in Section A Agriculture, forestry and fishing; subsection 02 - Forestry and logging. Sectoral characteristics of Czech forestry is based on the survey, further information provided by the Ministry of Agriculture, for example, through annual reports on forest management companies (data, such as number of employees, wages in forestry, logging, etc.). Complex, but basically the only official collection of information on forestry, are regularly published Reports on the state of forests and forestry of the Czech Republic for the year (published periodically since 1994) - the so-called "Green Report" (ÚHÚL 2012).

ŠMÍDA (2004) publicated the analysis of business entities operating in the NACE 02 and then evaluated the financial statements of selected business entities by the methods of financial analysis.

In agriculture, the basic document reports on Agriculture, and in particular the work of the Institute of Agricultural Economics and Information (ÚZEI 2012) as a contact place of the FADN (Farm Accountancy Data Network). The resulting data and a database is generally used among other things to identify the strengths and weaknesses of the sector, industry trends, intra-corporate benchmarking, evaluation of efficiency of enterprises, industry as a whole, etc.

Historically there was an investigation under certain professional institutions (KUPČÁK, ŠMÍDA 2004), authors created sectoral averages of basic economic indicators of enterprises in forestry. DUDÍK (2004) and ŠIŠÁK (2007) in connection with the financing of forestry from public sources mentioned the importance of collecting the economic information on forestry, the data analysis results can be used e.g. for the formulation of new subsidies in forestry which will cover just the area of forests that require effective support. ŠIŠÁK (2007) in connection with the financing of forestry from public sources points out that there should be ensured inter-agency coordination of resources and assessment of the effectiveness of funding at national or regional level, according to an effective system.

Classification of Economic Activities (CZ-NACE)

One of the main requirements of statistical work is the existence of a system that allows to properly handle a wide range of statistical data for the purpose of presentation and analysis (EUROSTAT 2008). NACE is the acronym for the statistical classification of economic activities used in the EU. More information about the structure of the international system of economic classifications can be found in the methodological manual NACE (EUROSTAT 2008).

Sort by legal forms

For the purpose of this paper was analyzed a total of 27 legal forms of business entities grouped into the following 12 categories: A natural person doing business under the Trade Act unincorporated (TA), A natural person doing business under the Trade Act registered in the TA, Self-employed farmer registered in the Business Register (BR), Unregistered, agricultural entrepreneurs - individuals Unregistered, A natural person doing business under other laws Unregistered, a public company, a limited liability company, limited partnership, joint stock company, cooperative, an organization, a foreign person, state enterprise, public research institutions, associations (association, union, society, club, etc.), organization of the state, branch, community (local authority), other.

Description of methodology

Businesses falling under Section 02 Forestry and logging are categorized in two ways - those that exhibit this activity as their principal business activity (activity forms the largest part of the total value added – CZ-NACE 02-prevailing) and those that included the activity in their list of activities by obtaining a trade license belonging to section 02 Forestry and logging – (CZ-NACE 02-secondary). This data selection is further analyzed, data are sorted out by legal form, number of employees and the region of the economic entity.

2. RESULTS AND DISCUSSION

During the processing of a robust set of data were obtained the following outputs:

Sort by legal forms

Table 1 shows the number of enterprises created by groups of legal forms and categories CZ-NACE 02 - prevailing a CZ-NACE 02 - secondary. In the total numbers there is significant decrease in the number of business entities CZ-NACE 02-prevailing, up from 31 614 in 2004 to 17 268 in 2012.

Tab. 1 CZ-NACE 02 - Prevailing, secondary: Breakdown of subjects by goups of legal form (quantity)

Legal form	CZ-NACE 02			
	prevailing		secondary	
	May 2004	July 2012	May 2004	July 2012
Natural person under the Trade Act (TA) unincorporated	20 854	15 595	21 912	27 172
Natural person doing business under the TA is incorporated	484	539	588	1 395

Self-employed farmer incorporated in the Business Register (BR), unincorporated in the BR, agricultural entrepreneur - natural person unincorporated in the BR	9 313	320	13 913	3 647
Natural person doing business under other laws unincorporated in the BR	6	34	371	105
Public company	249	38	58	94
Limited company	29	798	967	3 639
Limited Partnership	396	3	2	5
Joint-stock company	2	74	99	334
Cooperative	37	74	120	281
Allowance organization	57	31	47	48
Foreign person	44	88	107	168
State enterprise, Public research institution, the Association (federation, association, society, club, etc.), a government department, branch, community (local authority), other	94	34	52	136
Total number of subjects	**31 565**	**17 628**	**38 236**	**37 024**

Sort by number of employees

As the basic criterion for categorization of enterprises is considered the size of a business by number of employees which is shown in Table 2.

Tab. 2 CZ-NACE 02 - Prevailing, secondary: Breakdown of subjects by number of employees (quantity)

Number of employees	CZ-NACE 02 - prevailing		CZ-NACE 02 – secondary	
	May 2004	July 2012	May 2004	July 2012
not specified	6 887	10 717	7 741	17 716
0	23 041	6 147	27 900	15 591
1–5	1 390	521	1 986	2 449
6–9	96	79	178	369
10–19	111	73	210	353
20–24	19	21	36	106
25–49	39	40	87	224
50–99	12	16	45	125
100–199	11	7	39	58
200–249	3	0	7	3
over 250	5	7	7	30
Total	**31 614**	**17 628**	**38 236**	**37 024**

Classification by seat in region

As a further criterion for the analysis of business entities is used distribution according to the region of the businesses (Table 3).

Tab. 3 CZ-NACE 02 - Prevailing, secondary: Number of subjects According to regions (in 2012)

Region	CZ-NACE 02	
	prevailing	secondary
The City of Prague	374	1 692
Central Bohemia Region	1 501	3 571
South Bohemian Region	2 236	4 550
Plzeň Region	1 944	3 771
Karlovy Vary Region	1 101	1 792
Ústí Region	630	1 551
Liberec Region	967	1 754
Hradec Králové Region	1 150	2 233
Pardubice region	771	1 547
Vysočina Region	1 446	3 511
Southern Moravian Region	1 238	2 803
Olomouc Region	1 427	2 612
Zlín Region	1 171	2 442
Moravian-Silesian Region	1 672	3 195
Total CZ	**17 628**	**37 024**

3. SUMMARY

Currently, the estimation of future trends of number of business entities operating in forestry is definitely a difficult task, which is related to the issue of continuing political and legislative and economic direction in forest management. Crucial role in the develompent plays the state enteprise Forests of the Czech Republic, S.E. The description of the development and analysis of the factors influencing the development of forestry sector is the question of further research. The objective of the paper was primarily the analysis of the actual number of businesses involved in forestry.

The paper divides businesses in forestry in the two data sets by CZ-NACE 02 Forestry and logging – prevailing and CZ-NACE 02 Forestry and logging - secondary, according to the legal form, number of employees and the seat in region of the business. The analyzed data shows that the number of businesses in the Czech Republic, which have their activities reported to the activities of CZ-NACE 02-secondary is 37 024. In comparison with 2004, there is a minor change. The number of businesses in the CZ-NACE 02-prevailing is 17 628 for the year 2012. Compared to 2004, this means reducing the number of about 1,700 businesses a year. The question is to what extent the subjects in this direction are updating their reporting to the competent authorities (Czech Statistical Office, Tax Office, the Trade Licensing Office, etc.) and to what extent this information reflects reality in forestry – development in the forestry sector.

The question of the economic viability of forestry is the current issue and its importance deserves more attention from society. Businesses in forestry are an integral part of development in the regions. Due to these developments, there is a renewed discussion and analysis of the current situation of the forestry sector - not only among operational foresters, but also on the top social and political levels.

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FUELWOOD AS AN INDICATOR OF INCONSISTENCIES IN A NATIONAL FOREST POLICY: A CASE STUDY IN TWO FRENCH REGIONS

Antoine Tabourdeau [1]

Abstract: *In France, since 2005, national energy policies have been started to promote fuelwood. The point of the paper is to investigate how fuelwood is a boundary object which forces traditional forest actors to change their management by confronting them with new actors. Three groups are involved in elaborating new policies for fuelwood: forestry, energy and territorial actors. The aim of the policies is to develop what is presented both as an opportunity to enhance harvesting economics and to develop a renewable and local energy, necessary to achieve the European Union climate and energy package targets for 2020. However, in France it appears that these actors have considerable difficulties to work together, even with the intervention of public authorities. These difficulties are reinforced by decentralization processes which had been at work for the last 25 years.*

Historically centralized, forest policy has been impacted by the increasing importance given to environmental and agricultural problems, the growing power of European over national policies and the introduction of new public policy instruments. Hence, the importance of the State has been decreased and sectoral forest actors empowered. Priority was given to timber during the 19th and 20th centuries. Therefore, forest actors consider fuelwood as the ultimate promotion for wood products. To the contrary, the top-down approach of energy actors considers energy as the foremost issue, supported by national policies promoting renewable energies to meet the EU 2020 targets. The tension between these decentralization processes and the top-down approach of energy actor suggest that scale is a key issue between these actors. This issue was studied by an important geographic literature for the last 30 years (Herod 2011).

Methodologically, the research uses semi-structured interviews conducted with different stakeholders in two French regions (Rhône-Alpes and Auvergne) and information collected in meetings of actors from local to national scale.

The paper starts with the changes implied in forest governance by the development of fuelwood. Secondly, the cohabitation between different users and different sizes of heating system is analysed, then briefly illustrated through two case studies. Finally, we discuss the importance of scale and how fuelwood highlights specific scalar structuration.

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1. FOREST AND ENERGY: TOWARDS A NEW GOVERNANCE?

1.1. Forest sector: what changes implied by fuelwood?

Biomass accounts for about 10% of the world energy consumption. Energy from forest areas offers the advantage of not being in competition with food uses, contrary to biofuels grown in agricultural areas.

Our work showed that three dimensions are involved at least in the development of the fuelwood sector: forest, energy and local development. Each one of these dimensions implicates different actors with different know-how and facing difficulties to work together.

History of fuelwood: from log to pellets

Historical studies on forest (Léonard 2000) showed that different uses of forest resource existed throughout history. The Middle Ages in Western Europe was a turning point with an important increase in the use of forest products. Forest was supplying both food and raw material for building and energy. Forest landscape was then more open and less dense than it is today in Western Europe. Forest was used for fruit picking or cattle feeding by peasants, and for hunting by the lords (Boutefeu 2005). The latter began to regulate forest areas by imposing rights of access.

Energy use was important too and an intensive exploitation was made of the forest, which led different government to promulgate laws in order to prevent a sufficient volume to be harvested for timber at regional and national level in the 13th and 14th centuries.

It is during the 16th and 17th centuries that the wood became prominent as energy source before being replaced by coal in the 19th century, then fuel and gas during the 20th century. In developed countries, its importance decreased in the energy mix: in France, it represented about 20% of household consumption in 1960 but only 4% in 2000. Timber gained priority over the other promotions of the resource, which it kept until now, due to its better added value.

However, fuelwood regained importance with the development of chips and pellets on the one hand, and more efficient heating systems on the other hand and in a context of reinforcement of renewable energies.

Forest sector in France is in tension and faces difficulties to rely on an abundant resource.

New uses: forest in difficulty

Concerns started to rise in the 1980s and 1990s about climate change and sustainable development, leading to a growing commitment towards renewable energies. Even if not the most broadcasted renewable energy, fuelwood is one of the most developed. In France, it is ahead of all the others for the heat, and 2nd for electricity behind waterpower. This is partly due to the important part of rural households still using a secondary boiler, because of the right to use municipal wood.

However, since the early 1990s, initiatives and policies have been elaborated to promote a more efficient use of fuelwood, mainly based on chips and pellets, but also on more efficient log boilers. Chimneys and classical stoves have an efficiency rate inferior to 20%, whereas new log boilers fit norms requesting an efficiency rate of 50 to 60%.

75% of the French forest is private and characterised by a majority of smallholders, 3.8 million owning 30% (Bianco 1998). The public forest is already fully harvested by the national forest office, so increasing fuelwood volumes requires harvesting private forest as shown in different scientific reports (Cemagref 2007). However, this is restrained by the important parcelling. Moreover, forest management has often been neglected by an important part of the owners: neither thinnings nor exploitation plans have been done, which implies there is no forest roads to access the forest.

Energy sector

The use of biomass goes along with a rising demand of energy. The world consumption was 250 million of tonne of oil equivalent (toe) at the end of the 18th century; it grew to 1 Gtoe by the beginning of the 20th century and it was of 2 Gtoe in 1950. Now, at the beginning of the 21st century, it is of 12 Gtoe (Criqui 2013).

Energy and climate changes stakes are closely linked since the GHG emissions are for the most part due to the use of fossil fuels. For the last decade, international and engagements have been made. In Europe, one of the most important was the EU climate and energy package. This package was adopted by the European Parliament in December 2008 and focuses on three main targets for 2020, called "three 20 targets": an increase of 20% in renewable energy use, an increase of 20% in energy efficiency and a 20% reduction of greenhouses gases.

France's target is to reach 23% of renewable energies, whereas it was of 11.7% in 2009 (Commissariat général au développement durable 2009), whose two-third were already provided by biomass. To achieve this goal, it will be necessary to increase by 55% the volume of wood, from 38 million tons per year to 59 million.

Territory

Fuelwood gives the opportunity to develop local employment and to promote a local resource. at national scale it is difficult to promote rules which can adapt to different contexts (Andersson and Ostrom 2008). Hence the importance of territorial dimension was thought to be the scale where the "nestedness" of actors can be integrated with local specificities. Different tools were elaborated during the last two decades.

Among these tools were the Forest Charters for Territories, which completed different policies to promote forest set up at regional scales by the French national planning agency (DATAR). Fuelwood is presented to reduce the vulnerability at local scale.

These different aspects underline that the forest is a complex system mixing ecological, technical, social, and psychological aspects (Arnould 2002), sometimes compared to the stage of a theater because of the intertwined relationships between the actors (Boutefeu 2007). The development of fuelwood has to deal with this complexity.

It can be concluded that there is no dedicated fuelwood policy. Current policies depend on different environmental or energy policies at national scale. As an example, we previously showed how biomass was an important part in renewable energy policies, but in the same time the division of the French Agriculture Ministry was tasked to assess the biomass importance for the carbon credits system. This lack of dedicated policies impacts the coordination of the actors from the different sectors at subnational scales.

In the second part, we will focus on two case studies in order to evaluate these issues.

2. CO-HABITATION BETWEEN DIFFERENT SIZES OF PROJECT

National project: difficulties for small plants?

From our interviews and participation in different meetings and the analysis of policies, we were able to identify three main steps in the development of fuelwood.

First, during the 1980s and the early 1990s, new heating systems were mainly set at a very local scale, in order to develop fuelwood supply chains.

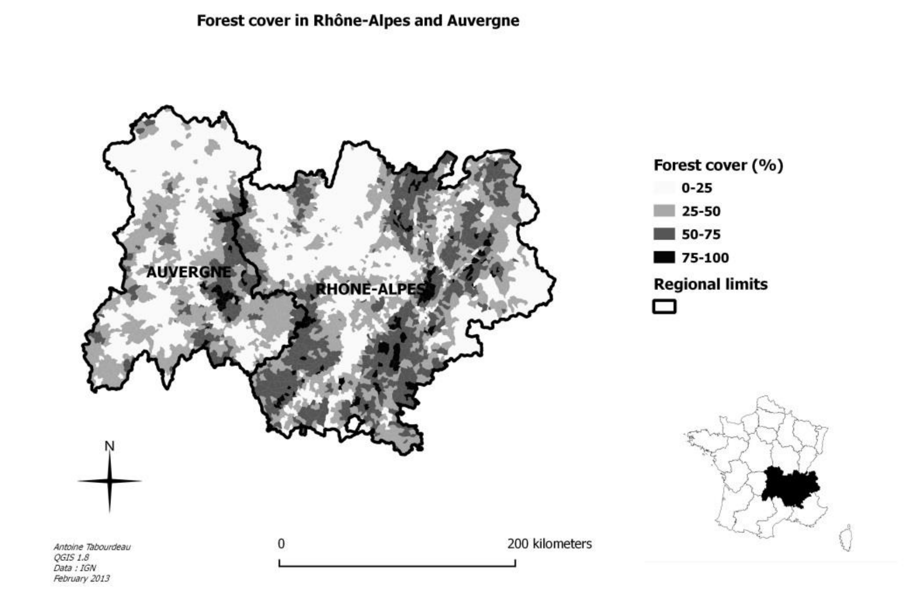
Then, starting from the mid-1990s, different policies were developed to foster wood-based heating systems. These policies took place at regional scale first, with Fuelwood and Local Developments Plans held by the French governmental agency for environment and energy (ADEME). The aim of these policies was to coordinate and help the actors to launch heating systems, without granting them with incentives.

The third phase started in the mid-2000s with new policies aiming at developing renewable energies. The biomass was concerned and, considering the difficulties to access the resource with the regional and local approaches, a national plan was set in 2004 so that energy suppliers could get involved with Combined Heat and Power (CHP) projects, providing at least 2 megawatt hour (MWh). The interest of having large scale project is to allow economies of scale. The incentives for the CHP projects were based on feed-in tariffs for the electricity.

Thus, these CHP projects faced important difficulties in supplying. These issues explain that the cost of fuelwood has been underestimated by energy providers. Hence, numerous plants could not materialize. A lack of knowledge in forest management from energy providers appears to be one of the reasons why these big projects failed: as we underlined in our first part, the heterogeneity of the local contexts cannot be taken into account, hence the heterogeneity of the wood cost. Since energy providers plan 20 years investments based on a fixed cost of the resource, if this cost increases, as our interviews showed us in different cases, the cost-effectiveness of the operation is at stake. Yet, the harvesting cost claimed by the foresters are mainly based upon estimation derived from already harvested and easily-accessed areas, and not from not-yet harvested areas, hence harder to access.

It implies important uncertainties in the cost of the resource and tensions with smaller projects which aimed at using the same resource.
We will study the case of two French regions, Auvergne and Rhône-Alpes (figure 1).

Figure 1. Auvergne and Rhone-Alpes cover forest



Case study in Auvergne

Auvergne is an example of the development of small supply chains and important CHP projects. The same three steps development than previously described at national scale could have been observed, with a first step of local initiatives, then coordination in the 1990s and early 2000s and finally the apparition of national-supported projects. In Auvergne case, it is only in 2010 that four regional CHP projects have been held in national biddings.
Three kinds of supply chains have been identified: public, industrial and person directed chains (Amblard and Taverne 2010). These supply chains are assessed by a special group,

created especially for the CHP projects, called Biomass Committee. The Biomass Committee is in charge to assess the supply plan of the projects and gives a recommendation if the projects do not appear to threaten the access of other users to the resource. The Biomass Committee exists in every French region. It was a demand of the forest subdirection at the Agricultural Ministry to centralise the management of the supply issues. It includes members of regional delegations of different administration: the national agency for environment and energy (ADEME), the Food, Agriculture and Forest administration and the Regional Council. The assessment of the Biomass Committee is not based on any database but only on the expertise of each of its members. The problem is that this expertise can considerably vary from one region to the other. A second problem is the lack of integration of other region data since each Biomass Committee assesses only its own region CHP projects but the supply-chain is not restricted to the regional boundaries, so resource can be both provided from other regions and to other regions, depending on the demand. Some stakeholders would hope that a national database allowing assessing the resource and protecting smaller projects can be created. A recent national report recommends the creation of such a database.

Case study in Rhône-Alpes

Rhône-Alpes region is characterised by the presence of the Alpine range in the East part of the region. These specific alpine constraints highlight how intricate are the different dimensions of fuelwood. Actually, in an uneven environment, forest plays different roles, with protection and recreational functions. The literature underlines the ambivalence of the forest between the economic function and the natural patrimony (Galochet 2006) and the vulnerability to climate change (Brun 2008).

The 42% alpine forest cover is higher than the national average but the relief does not allow an easy access to the resource. New techniques are experimented like cable skidding. Unlike other alpines countries like Switzerland or Austria, patch cutting is not commonly used. However, there is a very low ratio of forest roads, due to the important number of smallholders.

The difficulties met in the Alps highlight the importance of having reliable data about the resource. A regional database is currently developed under the supervision of the national agency for environment and energy. The data provided are based on the response of the person in charge of each project, which they do not always wish to do.

The information structuration process reveals tensions not only between the different users but also between different scales.

3. RE-PROCESSING SCALES?

Asymmetries of information

We examined how data about wood resource is processed. This allows us to suggest that asymmetries of information between the actors could be responsible for the tensions and the failure of some projects. Indeed, different tools to provide information about the availability of the resource can be used. Thus, these tools do not provide the same accuracy of information and cannot be freely used by every actor, as shown in Table 1, either because buying the data is too expensive for some actors or because of it is kept secret by some industrial actors.

Tab. 3: Existing tools for assessing available volumes

Name	Type	Responsible	Scale	**Access**
National institute of geographical and forest information (IGN)	Assessment of available volumes	IGN	national	**For every user but expensive**
Resource study	Assessment of available volumes	Cemagref (public research institute)	national	**Free for every user**
Regional database	Assessment of available volumes	Regional associations and energy administration	regional	**For administration and monitoring**
Supply plan for CHP projects (national bid)	Assessment of available volumes and costs	Energy provider	regional	**For energy providers and administration only**
Territorial Supply Plan	Assessment of available volumes and costs	National Federation of Forest Municipalities	local	**Results available for every user but assessment method kept secret**

This table underlines that sharing information about the availability of resource reveals power issues about controlling the access to the resource. The only tools shared by all the users are national and with a low accuracy. This causes tensions between users when different projects are planned in the same area. Other tensions are revealed when big projects are planned at a larger scale than others and make contracts with every provider, forcing smaller projects to pay more for the resource.

Scale: a key issue

These asymmetries of information stress the fact that fuelwood lacks control and monitoring from one scale to the other: the information gathered at some level, for instance by local forest or territorial actors, are not used by other actors, for instance energy actors.

Andersson and Ostrom (2008) argued that in natural resource management both highly centralized and decentralized systems are problematic. A polycentric system with higher or lower levels of governance provides institutional back-ups and reduces likelihood of perverse incentives.

Geographers worked on scale, based on Foucault's theory (Planel 2012), to show that power is not located in a place or at a given governance level. To the contrary, scale is a dynamic which organize space and is the result of the relation between the users. These processes of scalar structuration are continually reworked (Brenner 2001).

Hence, our work suggests that fuelwood is an illustration of how scalar processes play an important part in the forest management. The nestedness of forest actors with other users such as energy providers appears to be underestimated and could explain why renewable energy targets based on biomass are not achieved.

4. CONCLUSION

This papers aims to underline that fuelwood involves difficulties regarding not only the forest sector but the energy sector and local planning too. There is no policy specifically dedicated to the energy provided by biomass, since the different existing policies are intertwined with different administrations. In this regard, fuelwood implies different management scales

The paper evaluates how uncertainties are stressed by the lack of local data on the accessibility of wood resource whereas, at national scale, this resource is considered to be abundant. Results show that this lack was the basis for tensions between small plants often supported by local public authorities and larger projects supported by national energy groups. The arguments oppose, on the one hand, the higher greenhouse gas impacts of the larger plants, due to the transportation, and, on the other hand, the higher cost of smaller plants. The paper concludes that these differences unveil asymmetries of information between the actors at different scales. We suggest that energy transition issues can cause profound changes in governance for the forest sector and points lacks in scientific knowledge about life-cycle assessment. It is assumed that the difficulties to increase the value of the non-timber wood highlight the weaknesses of the forest sector economics.

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DELIBERATING HOW TO RESOLVE THE MAJOR CHALLENGES FACING CHINA'S FOREST TENURE REFORM AND INSTITUTIONAL CHANGE

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Abstract: *China's latest rural forest reforms have made headways by further devolving the use rights of collectively owned forestland and relaxing government control over private operations. However, there have been policy inconsistencies and conflicts, such as the harvest restriction and the takings of devolved forestland without fair compensation. This paper attempts to elucidate the theoretical and practical considerations needed for resolving these challenges, which, we argue, hinge on a clear understanding of the advances of institutional economics in areas like property right, collective action, and transaction cost, and a proper incorporation of the primary features of forest ecosystems and forestry as well as the rural society of China. We hope that this effort will contribute to the continued discussion and more effective execution of the tenure reform and institutional change in China and elsewhere.*

Keywords: Tenure reform, property rights, collective action, governance

1. INTRODUCTION

China has been undertaking a new round of forest tenure reform and institutional change since 2003 (Xu 2010, Wang et al. 2007), which has even been recently profiled in a *Science* news-focus article (Hvistendahl 2012). Indeed, some major transformations have taken place in devolving the resource use rights to individual or small groups of rural households, and improving the policy environment for private forestry. The basic rationale for these reforms is that the incentive structure of forestland use will be greatly improved if the corresponding responsibilities, rewards, and authorities can be closely aligned, which will then lead to enhanced forest conditions and human wellbeing over time (SFA 2011). These are unprecedented steps in the developing world and represent a fundamental move toward building a forest sector that is consistent with the premises of a market economy and sustainable forestry (Hyde et al. 2003, Yin et al. 2003).

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[4] This discussion is based on Yin et al. (2013), which has assessed the recent forest tenure reform and institutional change in China.

However, as identified in a recent article by Yin et al. (2013),[4] there have been several major policy inconsistencies and conflicts. They include the harvest restriction and stumpage taxation, the lack of flexibility and creativity in local implementation, the presence of unclear and disputed land boundaries, and the takings of individuals' forestland without fair compensation. The authors insist that if not dealt with in an effective manner, these challenges can dampen any improvement in the incentive structure and prospects for future growth. Thus, a lot more needs to be properly implemented and many adjustments must be made to enhance the efficiency and productivity of the forest ecosystems (SFA 2011, Liu and Yao 2011). The goal of this paper is to examine these challenges to facilitate the policy deliberation and execution. In the next section, thus, we will examine some of the issues through the lens of institutional economics. In section 3, we will turn our attention to issues related to forest ecosystems and forestry in rural China.

2. DELIBERATING THE CHALLENGES FROM THE INSTITUTIONAL PERSPECTIVE

2.1 Seeing devolution in light of privatization

When resource economists look into devolution in forestry or other natural resource sectors, they often cite "Toward a Theory of Property Rights" by Demsetz (1967) as a theoretical basis, which sought to explain the rise of private-individual property rights as a natural, evolutionary response to increasing demand for scarce resources (Besley 1995, Qin et al. 2011). But few are aware of the criticism of Demsetz's reasoning. For instance, Eggertsson (1990, p. 254) has called it "the naïve theory of property rights," because (1) it is oblivious to the failure of some private ownership regimes to conserve scarce resources over time (Hurst 1984); and (2) it neglects the effectiveness of alternative property arrangements that have evolved to manage natural resources successfully throughout the world (Ostrom 1990).

Cole and Ostrom (2011) further remarked that there is a vast array of property systems, including combinations of private-individual, common, and public property rights that apply differentially to various natural resources on the basis not only of supply relative to demand, but also of many other variables, including the structure of underlying institutions, ecological conditions, and culture (Ellickson 1993). Moreover, specific property regimes that prove viable and sustainable in one set of social-ecological circumstances may prove nonviable or unsustainable in another (Ostrom 2007).

Perhaps even fewer resource economists are aware of Williamson's (2000) stern warning—privatization is not an all-purpose solution—and sturdy insistence that "privatizing needs to go beyond the ex ante award stage to include an examination of possible ex post implementation problems and, in consideration of the *differential hazards,* to proceed selectively" (pp. 609-610).

This discussion offers some valuable insights regarding China's forest tenure reform and institutional change. What are the contractual safeguards following devolution? Does China have judicial independence and a competent and transparent regulatory system? If the answers to these questions are not affirmative, then the outlook and prospects of its success will hardly be certain. It is true that collective forests in China were poorly managed, and devolution has been pushed on the basis of efficiency and productivity (Yin and Newman 1997, Hyde et al. 2003). But is it necessary to devolve most of the collective forests? Even if devolution is undertaken, should most of the forests be devolved to individual households? Without confronting these questions, it is risky to hand forestland over to individual users.

2.2 Learning from the "bundle of rights" theory

Moreover, resource economists often think of property rights in a narrow sense as ownership—the right to completely and exclusively control a resource, or they may throw around the word "right" casually and without clear definition (Cole and Grossman 2002). However, they have rarely conducted active inquiry into the institutional details of tenure reforms. In the context of natural resource management, scholars have broadly adopted the "bundle of rights" enunciated by Schlager and Ostrom (1992), which include: *Access*—the right to enter a defined physical property; *Withdrawal*—the right to obtain the "products" of a resource; *Management*—the right to regulate internal use patterns and transform the resource by making improvements; *Exclusion*—the right to determine who will have an access right and how that right may be transferred; and *Alienation*—the right to sell or lease all the above rights.

While researchers in China have been aware of the "bundle of rights" doctrine and often enumerated it in their discussion of the forest devolution, the exact rights in the bundle they specify may be different, incomplete, or even partially trivial. Much of what these analysts intend to express is that the basic rights of withdrawal, management, and alienation have been subject to restriction, which need be changed as part of the reforms. In comparison, many have not recognized or expressed that the rights of exclusion and alienation may also have been compromised by the pervasive boundary disputes and policy uncertainty. This, coupled with restrictions on withdrawal via harvest regulation and stumpage tax, can reduce the expected value of the devolved forestland, which will diminish the interest of individuals in forest investment and management.

In addition, Schlager and Ostrom (1992) reminded us that (1) all rights have complementary duties (Hohfeld 1913); and (2) that full ownership or the sole authority to use or dispose of a resource may not be the only form of property rights regime making long-term investments in the improvement of resource conditions. These ideas pertain to any attempt to decentralize forestland use, and we must question what meaningful rights have actually been devolved to local users, given the perverse takings and regulations.

2.3 Tracing property rights to their origins

Further, it should be pointed out that the particular property rights are shaped by the governance structure at multiple levels (Ostrom 2007). When individuals interact in repetitive settings that directly affect physical outcomes, they are in an operational situation. Operational rules are changed by collective-choice actions, which are undertaken within a set of collective-choice rules that specify who may participate in changing operational rules and the level of agreement required for their change. These collective-choice rules are in turn made within constitutional rules that affect who will make policy decisions using a particular type of rules and procedures. These three levels of the governance hierarchy link together through the rules-in-use that structure the interactions between individuals (and organizations) at each level (Ostrom 2010).

So, it is useful to trace the sources of different rights and explore how decision making at one level of the governance hierarchy is impacted by processes at other levels. The rights of management, exclusion, and alienation are collective-choice rights. Individuals who hold management right have the authority to determine how, when, and where harvesting from a resource may occur, and whether and how the structure and form of a resource may be changed. Those who hold the right of exclusion have the authority to define the qualifications that individuals must meet in order to access a resource. Exercising a right of alienation means that an individual sells or leases the rights of management and exclusion as well as access and withdrawal.

The above discussion helps shed light on how operational-level decisions, such as where to plant what trees and when to cut them, are often constrained by decisions made by agencies far away, and why this is problematic if the responsibility is not matched with necessary authority locally and if the agencies do not know the field situations well enough or do not have competent personnel to direct local operations. Further, because multiple levels and branches of the government are involved in collective-choice and constitutional-level actions, like titling, programming, and taxation, there can be conflicts and inconsistencies of rules, leading to incompatible and often perverse incentives.

2.4 Enforcing the tenure changes

Property rights must be backed by effective, socially sanctioned enforcement institutions, one of which is the judicial system (Ellickson 1993). While the tenure reform and property rights change have been embodied in laws, China still does not have an independent judicial system and that system has seldom gotten involved in enforcing the new laws, settling land disputes, determining the legality of certain alleged "illegal" loggings, or adjudicating the cases of land taking and contract defaulting (Coase and Wang 2012). Instead, these matters are routinely handled by the executive system. Consequently, there have been widespread incidences of arbitrariness and corruption, let alone the lack of transparency and public participation.

Thus, in a way, a key indicator of China's development of a market economy lies in a greater role played by an independent court system and private enterprises, including business associations, as government agencies gradually exit from controlling business affairs and professional matters, and concentrate on their regulatory and coordinating responsibilities (Coase and Wang 2012, Lin 2012).

3. Deliberating the challenges from the perspective of China's forestry

3.1 Understanding the rationale for cooperation

Factoring in the essential characteristics of forestry is crucial to successful forest reform and development. Given the rough terrain and the lack of sophistication in silvicultural operations in most parts of rural China, the worry about loss of economies of scale or increase of transaction costs (Ho 2006), induced by forest devolution and parcelization, albeit reasonable, may not be borne out. That is, small forest holdings, featuring manual and small-machine operations, can be efficient and sustainable (Yin and Newman 1997). Further, a bulk of the current small holdings may well be consolidated in the near future, provided the transferability of individual forestland use rights (Yin et al. 2013).

While it is understandable, therefore, the current push for massively establishing forest coops in the immediate aftermath of devolution seems ill-conceived and premature. First, it is essential to get the basic rules and constraints right, without which farmers will not have much incentive and confidence in the policy initiative and institutional environment; and thus, the government's attempt to make them work together may not effect (Hyde et al. 2003, CAPRi 2010). Second, it must be known that under what circumstances collective actions can achieve common interests. Specific context and concrete evidence are required before any commitment to building forest coops is made.

3.2 Providing ecosystem services efficiently

Due to the variability in biophysical conditions and accessibility and the multiplicity of ecosystem services and societal needs, classified management of commercially and environmentally oriented forests, which is also called zoning (Lambin and Meyfroidt 2011, Chomitz 2007), seems sound (Bowes and Krutilla 1989). Among other advantages, by intensifying land use, plantation forests can meet increased demands for timber, fiber, and biomass products on a limited land base and thereby relieve a large amount of land currently used for commercial purposes for conservation instead (Hyde 1980). On the other hand, biodiversity hotspots and other unique heritage sites should be protected anyway. So, it makes sense to develop a regional-level system of classified resource management with leeway and variation embedded at the sub-regional level (Yin 1998).

However, the present configuration of classified management in China is flawed. By carrying out zoning within the local units of management based on bureaucratic decree, it has failed to leave sufficient room for markets and communities to function in allocating resources according to the local conditions and needs. In particular, once a forest is classified for ecological purpose(s), normal commercial activities are severely constrained or even completely forbidden. This strategy has disrupted the operation of many forest enterprises. If not significantly modified, it might eventually hinder the attainment of optimal ecosystem services (Yin et al. 2010).

3.3 Resolving the deforestation vs. disengagement conundrum

Worldwide, a critical obstacle to successfully decentralizing forest management is the concern about possible deforestation and forest degradation induced by devolution (Hyde et al. 2003). And history has shown that if the reform measures are not designed and carried out in a creative and systematic way, farmers may respond adversely by quickly liquidating the valuable trees allotted to them (Yin and Newman 1997). On the other hand, if tight regulation is imposed on their logging and other operations, they may view the reforms as being unserious or ill-construed, and thus not worth their positive response in terms of tree planting, stand management, and forest protection (Yin and Newman 1997). The experience of China and other countries has proved that how to resolve this conundrum—deforestation and forest degradation if loosening up control vs. disengagement in forestry if tightening up control during the devolution process—may determine the fate of the reform effort (Hyde et al. 2003).

4. CLOSING REMARKS

Executed properly, China’s forest tenure reforms will bring about major changes to China’s rural economy and forest ecosystems. At the same time, there have been multiple policy challenges, which we argue, if not handled properly, can dampen improvement in the incentive structure and outlook for future development. Instead of directly proposing a set of simplistic solutions to these complex challenges, here we have focused on laying the much-needed “groundwork” for their gradual but steady resolution. We have argued that confronting these challenges crucially hinges on a clear understanding of the theories and practices of property-rights and collective actions, the multi-layered and complex governance structure, and the basic premises of a market economy. Further, we have insisted that the primary features of forest ecosystems and China’s rural forestry must be aptly reflected in the design and implementation of the forest tenure reforms.

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CONSIDERING FOREST MANAGEMENT SCENARIOS IN THE LIGHT OF MULTIFUNCTIONALITY, PARTICIPATORY DECISION MAKING, INTERDICIPLINARITY AND UNCERTAINTY: CASE STUDY OF FOREST PANOVEC, SLOVENIA

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Abstract: *The aim of the paper is to rank the forest management scenarios proposed in the frame of multifunctional forestry which considers numerous forest functions, sustainability and different, sometimes conflicting, viewpoints of stakeholders or social groups. Multiple criteria, participatory and fuzzy methodologies sourcing from theoretical arsenal of operations research are included in a decision support model for determining the optimal scenario of sustainable forest management. The multifunctionality in forest management is captured by analytic hierarchy process (AHP). Participatory and interdisciplinary decision making are accomplished by group AHP method. In order to gather the judgments (priorities, preferences, opinions) expressed by decision makers from different (interdisciplinary) fields some knowledge from the domain of communication and organization has to be acquired. Finally, for tackling the complexity and uncertainty of the real world decision problems interval judgments are used. The presented decision support model based on group AHP with interval judgments is applied to forest area Panovec, Slovenia where, for illustration, four scenarios and four decision makers are taken into account.*

Keywords: forest management scenarios, multifunctional forestry, several decision makers, uncertainty, interdisciplinarity, group AHP (analytic hierarchy process), interval judgments, forest area Panovec, Slovenia

1. INTRODUCTION

The aim of the paper is to rank the forest management scenarios proposed in the frame of multifunctional forestry which considers numerous forest functions, sustainability and different, sometimes conflicting, viewpoints of stakeholders or social groups. Recently, strategic documents and programs on forest management worldwide and in Europe especially, emphasize timber and non-timber forest production, associated above all with financial returns, and ecological, social, natural, cultural, educational, research, hydrological, protection and other aspects (Resolution on National Forest Programme, 2008).

Therefore, the multiple criteria (Diaz-Balteiro and Romero, 2008), participatory (Nordström et al., 2012) and fuzzy methodologies (Sahoo et al., 2006) sourcing from theoretical arsenal of operations research (Cochran et al., 2011) are included in a decision support system for determining the optimal concept of sustainable forest management (Weintraub et al., 2007).

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The multifunctionality in forest management is captured by analytic hierarchy process (AHP), (Saaty, 2006). AHP is a well-known approach for solving multi-criteria decision making problems. It is very flexible since it *enables combining empirical data and subjective judgments, and also intangible and immeasurable criteria.*

Participatory and interdisciplinary decision making are accomplished by group AHP method (Escobar and Moreno-Jimenez et al., 2007). In order to gather the judgments (priorities, preferences, opinions) expressed by decision makers from different (interdisciplinary) fields some knowledge from the domain of communication and organization has to be acquired (Green et al., 2007). Because the exact values sometimes cannot express the subjectivity and the lack of information of decision maker, or the complexity and uncertainty of the real world decision problems interval judgments are used (Arbel and Vargas, 2007).

The decision support model based on group AHP with interval judgments is applied to forest area Panovec, Slovenia where four scenarios and four decision makers are taken into account (Zadnik Stirn, 2003, 2004).

2. METHODOLOGY USED – DECISION SUPPORT MODEL

The decision support model is developed in four phases, each using a specific methodology.

In the first phase of developing the model we need to describe the problem in details, i.e. to define the state-of-art. Regarding forest management problems we must define above all:

- stakeholders interested in the decision making process regarding the management of the forest area, and who have appropriate knowledge about the problem under discussion
- the feasible management decisions which could be carried out in the treated forest area
- goals of management, i.e., objectives, indicators which measure the objectives, possible outcomes of the decisions.

The Delphi method is proposed to be used for defining the scenarios, goals and stakeholders. Delphi may be characterized as a method for structuring a group communication process so that the process is effective in allowing a group of individuals to deal with a complex problem. To accomplish this "structured communication" there is provided: some feedback of individual contributions of information and knowledge; some assessment of the group judgment or' view; some opportunity for individuals to revise views; and some degree of anonymity for the individual responses. There are many different views on what are the "proper," "appropriate," "best," and/or "useful" procedures for accomplishing the various specific aspects of Delphi. The Delphi process today exists in several distinct forms. The most common is the paper-and-pencil version. In this situation a small monitor team designs a questionnaire which is sent to a larger respondent group. After the questionnaire is returned the monitor team summarizes the results and, based upon the results, develops a new questionnaire for the respondent group. A newer form of Delphi replaces the monitor by a computer which has been programmed to carry out the compilation of the group results. Usually, Delphi undergoes four distinct phases. The first phase is characterized by exploration of the subject under discussion. The second phase involves the process of reaching an understanding of how the group views the issue, i.e., where the members agree or disagree and what they mean by relative terms such as importance, desirability, or feasibility. If there is significant disagreement, then that disagreement is explored in the third phase to bring out the reasons for the differences and possibly to evaluate them. The last phase, a final evaluation, occurs when all previously gathered information has been initially analyzed and the evaluations have been fed back for consideration (Linstone and Turoff, 1975).

In the second phase the stakeholders assess and rank the forest management scenarios (alternatives, scenarios) according to the management goals (criteria) using the analytic hierarchy process (AHP). AHP facilitates to approach the complexity of uncertainty of real world multi-criteria problems. It is based on a hierarchical structure of criteria, sub criteria, and scenarios/alternatives. It compares in a pair-wise way on 1-9 ratio scale the objects (criteria, sub criteria, alternatives) on the same level regarding the object on the next higher level. Pairwise comparisons are gathered in a comparison matrix $A=(a_{ij})_{n\times n}$

In order to calculate the priority (preference) vector ω from matrix A eigenvector method (EV), (Saaty, 2006) is used: $A\omega=\lambda_{\max}\omega$,

[1]

where $\lambda_{\max}$ is the maximal eigenvalue of matrix A.

In the third phase we are solving the problem of aggregating the individual judgements, i.e., the individual comparison matrices generated by individual stakeholders, into a group matrix, respectively into a group priority vector. This aggregation is carried out by means of group AHP. The problem in group AHP is assigned as: let m be the number of decision makers (DMs) and let n be the number of compared elements (criteria or alternatives); further let $A_k=\left(a_{ij}^{(k)}\right)_{n\times n}$, $k=1,\ldots,m$ be the DMs pair-wise comparison matrices, and let $w^{(k)}=\left(w_1^{(k)},\ldots,w_n^{(k)}\right)$, $k=1,\ldots,m$ be priority vectors derived from A_k. A group matrix A^{group} is derived from A_k, $k=1,\ldots,m$ with one of the group methods. In this paper a group priority vector $w=(w_1,\ldots,w_n)$ is derived from A^{group}, respectively from A_k, $k=1,\ldots,m$ by the weighted geometric mean DEA method (WGMDEA) (Grošelj et al., 2011). WGMDEA is a group method, based on data envelopment analysis, which uses weighted geometric mean for aggregation of individual judgments and linear programming for deriving the group priority vector. We applied WGMDEA method (2), since it is easily solved (using LP software) and it provides good results comparing to some other group AHP methods. The solution of linear program (2) for all w_i, $i=1,\ldots,n$ gives the group priority vector:

$$\max w_0=\sum_{j=1}^{n}\left(\prod_{k=1}^{m}\left(a_{0j}^{(k)}\right)^{\alpha_k}\right)x_j$$

$$\textit{subject to}\ \sum_{j=1}^{n}\left(\sum_{i=1}^{n}\prod_{k=1}^{m}\left(a_{ij}^{(k)}\right)^{\alpha_k}\right)x_j=1,$$

[2]

$$\sum_{j=1}^{n}\left(\prod_{k=1}^{m}\left(a_{ij}^{(k)}\right)^{\alpha_k}\right)x_j\geq nx_i,\ i=1,\ldots,n,\ x_j\geq 0,\ j=1,\ldots,n.$$

In the fourth phase we tackle the complexity and uncertainty of the decision problems, the subjectivity, and the lack of information of decision makers (stakeholders) which can sometimes be hardly expressed with the exact values. Interval judgments can be more suitable in such cases. Two main methodological problems emerge when dealing with interval comparison matrices in group AHP.

a) Aggregation of individual crisp judgments into the group interval matrix must be performed. The method MEDINT is used. The aggregated interval group matrix A^{group} is defined as (3). Details are described in (Grošelj and Zadnik Stirn, 2011).

$$A^{group} = \begin{bmatrix} 1 & \left[\prod_{k=1}^{m}\left(c_{12}^{(k)}\right)^{w_k^L}, \prod_{k=1}^{m}\left(c_{12}^{(k)}\right)^{w_k^U}\right] & \cdots & \left[\prod_{k=1}^{m}\left(c_{1n}^{(k)}\right)^{w_k^L}, \prod_{k=1}^{m}\left(c_{1n}^{(k)}\right)^{w_k^U}\right] \\ \left[\prod_{k=1}^{m}\left(c_{21}^{(k)}\right)^{w_k^L}, \prod_{k=1}^{m}\left(c_{21}^{(k)}\right)^{w_k^U}\right] & 1 & \cdots & \left[\prod_{k=1}^{m}\left(c_{2n}^{(k)}\right)^{w_k^L}, \prod_{k=1}^{m}\left(c_{2n}^{(k)}\right)^{w_k^U}\right] \\ \vdots & \vdots & \ddots & \vdots \\ \left[\prod_{k=1}^{m}\left(c_{n1}^{(k)}\right)^{w_k^L}, \prod_{k=1}^{m}\left(c_{n1}^{(k)}\right)^{w_k^U}\right] & \left[\prod_{k=1}^{m}\left(c_{n2}^{(k)}\right)^{w_k^L}, \prod_{k=1}^{m}\left(c_{n2}^{(k)}\right)^{w_k^U}\right] & \cdots & 1 \end{bmatrix}$$

[3]

b) Determining (calculating) the weights from interval comparison matrix what was already studied in many ways. We propose here the approach of separating A^{group} into two crisp comparison matrices (4): $A_L^{group} = \left(a_{ij}^L\right)$ and $A_U^{group} = \left(a_{ij}^U\right)$ (Lan et al., 2009), where

$$a_{ij}^L = \begin{cases} l_{ij}, & i < j \\ 1, & i = j \\ u_{ij}, & i > j \end{cases}, \qquad a_{ij}^U = \begin{cases} u_{ij}, & i < j \\ 1, & i = j \\ l_{ij}, & i > j \end{cases}.$$

[4]

$$\omega_i = \left[\omega_i^L, \omega_i^U\right] = \left[\min\left\{\omega_i^{A_L}, \omega_i^{A_U}\right\}, \max\left\{\omega_i^{A_L}, \omega_i^{A_U}\right\}\right]$$

For ranking interval weights the matrix of degrees of preference with elements p_{ij} is used:

$$p_{ij} = P\left(\omega_i > \omega_j\right) = \frac{\max\left\{0, \omega_i^U - \omega_j^L\right\} - \max\left\{0, \omega_i^L - \omega_j^U\right\}}{(\omega_i^U - \omega_i^L) + (\omega_j^U - \omega_j^L)}, \quad i,j=1,\ldots,n, \; i \neq j$$

(5)

The preference ranking order is then provided using row-column elimination method.

3. CASE STUDY - FOREST AREA PANOVEC, SLOVENIA

A case study of a natural resource (forest, meadows, trails) area Panovec in Slovenia is used to illustrate the above presented decision support model. In the existing state of Panovec (Papež, 2001), the forest-learning trail is supposed to be under renovation, some new recreational and educational areas are to be created, a new guide to the forest learning trail is to be published with the aim of inviting more visitors. Additionally, an evaluation of the space is to be undertaken in terms of defining limits on recreational and other management activities. Different plans, evaluations, financial, ecological and social studies were examined, and a list of feasible tasks (targets, problems) which should be carried out in Panovec, was generated in the serious expertise with the stakeholders, using Delphi methodology. By matching the tasks/decisions the location, level of operation, effects on the environment, and financial possibilities were considered (Zadnik Stirn, 2003, 2004). For the case study in this paper we took into account:

- four stakeholders: environmentalist (representative of the research institution and public, as well as NGOs), representative of the educational institutions, farmer/forester (owner), representative of the local community (government); these stakeholders are in continuation assigned as A, B, C and D, respectively;
- three main goals: economic, ecological and social oriented;
- four decisions/scenarios/alternatives: d_1 may be interpreted as economically oriented because it sustains the economic development of Panovec; d_2 is assigned as ecologically oriented because it maintains the environmental sustainability of Panovec, above all its biodiversity, d_3 is educationally oriented as it supports the issues developed with the aim to educate the visitors about the nature, and d_4 which may deliver support for development

through implementing local development strategies, stimulating the cooperation and connection of local action groups.

Further, the decision makers generated four pair-wise comparison matrices for four strategies. Their matrices are assigned as A, B, C, D. The priorities of decision makers, gained by the EV method (1) are presented in Table 1. The ranking differs between the decision makers.

$$A=\begin{bmatrix}1 & \frac{1}{4} & \frac{1}{3} & 2\\ 4 & 1 & 2 & 3\\ 3 & \frac{1}{2} & 1 & 2\\ \frac{1}{2} & \frac{1}{3} & \frac{1}{2} & 1\end{bmatrix},\quad B=\begin{bmatrix}1 & 3 & 1 & 1\\ \frac{1}{3} & 1 & \frac{1}{3} & \frac{1}{2}\\ 1 & 3 & 1 & 2\\ 1 & 2 & \frac{1}{2} & 1\end{bmatrix},\quad C=\begin{bmatrix}1 & \frac{1}{2} & 3 & 8\\ 2 & 1 & 4 & 6\\ \frac{1}{3} & \frac{1}{4} & 1 & 3\\ \frac{1}{8} & \frac{1}{6} & \frac{1}{3} & 1\end{bmatrix};\quad D=\begin{bmatrix}1 & 2 & 1 & 2\\ \frac{1}{2} & 1 & \frac{1}{4} & 1\\ 1 & 4 & 1 & 1\\ \frac{1}{2} & 1 & 1 & 1\end{bmatrix}$$

Tab. 1: The priorities and the ranks of the four strategies for four decision makers

	A		B		C		D	
	priorities	ranks	priorities	ranks	priorities	ranks	priorities	ranks
alternative 1	0.140	3	0.302	2	0.337	2	0.320	2
alternative 2	0.465	1	0.110	4	0.483	1	0.140	4
alternative 3	0.280	2	0.358	1	0.127	3	0.339	1
alternative 4	0.116	4	0.230	3	0.053	4	0.201	3

In the next step, we calculated the group priorities using WGMDEA and interval method MEDINT. WGMDEA: Geometric mean matrix A^{WGMM} and the priorities awere calculated by (2) and are gathered in Table 2.

$$A^{WGMM}=\begin{bmatrix}1 & 0.931 & 1 & 2.378\\ 1.075 & 1 & 0.904 & 1.732\\ 1 & 1.107 & 1 & 1.861\\ 0.420 & 0.577 & 0.537 & 1\end{bmatrix},$$

MEDINT: The matrices *A*, *B*, *C* and D are aggregated in the A^{group} according to (3).

$$A^{group}=\begin{bmatrix}1 & [0.3150, 2.6207] & [0.4807, 2.0801] & [1.2599, 5.0397]\\ [0.3816, 3.1748] & 1 & [0.2752, 3.1748] & [0.6300, 4.7622]\\ [0.4807, 2.0801] & [0.3150, 3.6342] & 1 & [1.2599, 2.6207]\\ [0.1984, 0.7937] & [0.2100, 1.5874] & [0.3816, 0.7937] & 1\end{bmatrix}$$

Then A^{group} is separated into two matrices A_L^{group} and A_U^{group} by (4) and priorities, gathered in matrix P, are calculated by (5).

$$P=\begin{bmatrix}- & 0.623 & 0.539 & 0.830\\ 0.377 & - & 0.420 & 0.881\\ 0.461 & 0.580 & - & 0.820\\ 0.170 & 0.119 & 0.180 & -\end{bmatrix}$$

The preference order of alternatives for WGMDEA and MEDINT method is: $w_1 > w_3 > w_2 > w_4$. It is given in Table 2.

Tab. 2: WGMDEA and MEDINT method results for 4 alternatives and 4 decision makers

	WGMDEA		MEDINT	
	priorities	ranks	priorities (intervals	ranks
alternative 1, (ω_1)	0,294	1	[0.154, 0.459]	1
alternative 2, (ω_2)	0,274	3	[0.201, 0.311]	3
alternative 3, (ω_3)	0,287	2	[0.159, 0.411]	2
alternative 4, (ω_4)	0,145	4	[0.071, 0.234]	4

4. CONCLUDING REMARKS

In the application, discussing the management of forest area Panovec, Slovenia, the offered group AHP methodology was used. The main goal was the selection of the optimal strategy (alternative) for Panovec development regarding several objectives and above all several stakeholders. The results obtained by WGMDEA and MEDINT methods were compared. Results show that the stakeholders (decision makers) support economic development, modernization and innovations in forestry which should contribute to improved employment possibilities, increased productivity, and added value in forestry. The selected alternative can contribute to enchanced Management plan of the area. It can serve as the basis for establishment of strategic and operational management goals of the area. On the second place the stakeholders have put the educationally oriented scenario, while ecology and local issues are on the third and fourth (last) place.

The underlying premise of the presented mechanism is the importance of bringing public in the most wide meaning, i.e., owners, NGO's, institutions, etc., into the process of developing environmental and resource management policies that affect public's lives as well as their economic well-being. The implementing of this mechanism that successfully engages different stakeholders in the decision making process provides long term benefits beyond specific decisions regarding economic, environmental and social development of natural resources and the environment. The effort undertaken prior to the decision being made, results in reduced effort to justify the decision ex-post.

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ANALYSIS OF VIRTUAL ENVIRONMENT FORM FOR INNOVATIONS IN RESEARCH AND TEACHING AT THE UNIVERSITY OF FORESTRY.

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Abstract: *Within the University of Forestry was established a laboratory for new information technology. The laboratory will be used to support the development of information and technological structure of the University as a complete virtual environment for research and training in priority interdisciplinary areas.*
The task is to analyze the possibilities of virtual reality (VR technology) and simulation modeling to support the training and research in the field of biological resources, product modeling, interior space, exterior environment, monitoring and reproduction of the environment in order to develop a comprehensive system for interdisciplinary research and education, including virtual and remote experimental elements, interconnections between courses, seminars and testing systems.
Forestry is an area where the accuracy of scientific predictions and performance management strategy are essential for success. It increases the need of tools that can model future forest resources and visualize the dynamics of forest ecosystems and processes over time. This explains the increased attention to VR in decision-making processes, concerning forestry.

Key words: virtual reality, information technologies, forest ecosystems, management strategy

1. INTRODUCTION

Virtual reality is especially suited to help in solving problems in the following areas of forestry: time dependence, irreversibility of decisions, spatial and quantitative changes and multifunctional forest management.
Time dependence: Management decisions in forestry have significant temporal dependence. Period of return for exploitation of forests is from 12 years for tropical species, to 100-150 years for the northern forests. Visualization can help to evaluate the alternatives for modeling the changes in the forest with no time limitations. Modeling of forest growth is carried out in accordance with complex algorithms combining multiple forest models.
Irreversibility of decisions: Using VR allows assessing of the consequences of each alternative, before it actually happens.
Spatial and quantitative change: Structural characteristics of natural forests usually show considerable multidimensional variation. Depending on the nature of the forest, through usage of VR can be modeled, visualized and measured diameter, height, crown height, age and growth of quality perimeter, etc.

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Multifunctional purpose: Forestland should provide not only wood, but also other (non-monetary) benefits such as recreation, aesthetics, wildlife, environmental and bio-diversity. Modern researches are focused on keeping the residents of wildlife, forest recreation and modeling of biodiversity indicators. Besides that, planning and multifunctional forest management is a widespread concept, which uses numerical methods for calculating and optimizing the various benefits of silvicultural activities.

Development of laboratory for new information technology and its transformation into a virtual environment / laboratory will meet the objectives, mission and vision of UF as a scientific and educational institution with priorities in research and technology for sustainable management and usage of biological resources in Bulgaria.

2. MAIN OBJECTIVES AND RESEARCH TASKS

Bulgaria's forests are perceived by the Bulgarian society as part of the national wealth and national identity. Their economic, social and environmental functions are essential for the sustainable development of society and the improvement of living conditions. Objective conditions require the establishment of an effective system for multipurpose forest management and development of modern forestry.

The vision for development of the forestry sector:
"Bulgarian Forest is a national treasure. Resources of forest ecosystems retain and enrich their ecological, social and economic functions to improve the quality of life. Forests are managed professionally, based on the achievements of a highly developed science in stable forest sector with broad public support, and mutual respect and integration of the interests of all parties involved.

The main objectives of the national forest strategy are as follows:

- Effective sustainable management and multifunctional forest management, aimed at developing a sector, which is economically viable and contributing to the development of society and the rural areas in particular.
- Bring the objectives and means of sustainable development of the forestry sector in line with the international criteria and obligations taken.
- Creating conditions for provision of national and international financial resources and support for development of the sector.

Forests perform multiple and interrelated social, economical and environmental functions, sometimes both and at the same place. Preservation of this versatility requires a balanced management approach.

Modern information systems are an important tool for effective management, in order to provide accurate and timely information on the status of forests, forest resources to meet the needs of the state, the private sector, the society, NGOs and international institutions, and achievement of better efficiency and competitiveness of the sector as a whole.

Information about the resources and forest condition is essential to ensure the largest possible socio-economic and environmental benefits at all levels of decisions on forests. Moreover, the EU is obliged to report to the UN Framework Convention on Climate Change and the Convention on Biological Diversity, which require reliable and consistent forest information systems. Currently, forest information is stored on several different levels:

Forest inventories: national forest inventories store most of the information about forest resources. This information is not harmonized and therefore its benefit at EU level is limited. Through various projects, the Commission examines the options for:

- *Extending* the scale of systems for forest inventory, where besides the forestry, to include the improved indicators and criteria for sustainable forest management, adopted by the MCPFE[21], as well as socio-economic information.
- *Harmonization* of national forest inventories[22], to allow the information in them to be comparable.

Integrated Administrative and Control System (IACS, co-financed by EU funds for rural development) is used to manage and control not only the direct payments, but also some measures of the strategy for development of the rural areas related to specific areas (e.g. agro-environment forestry measures).

Monitoring of forest condition: under EU law from 1987 to 2006, when the Regulation focused on Forests (Forest Focus[23]) stopped to be applicable, Member States monitor the condition of forests in accordance with the "scheme of large scale and intensive observation. „Since 2007, there is no legal basis at EU level, for forest monitoring[24]. Only the project "FutMon[25]", within the "Life +", is supported, with a view to develop future monitoring concepts.

Monitoring of forest fires: The European Forest Information System (EFFIS) is a voluntary approach, considered by the Member States, the Commission and the European Parliament as an important tool for monitoring of forest fires in Europe.

Forest classification: The European Environment Agency has developed a system for determining the types of forests[26] that could be used to assess forest at European level, based on environmental criteria, but so far, only a few Member States have tested it in their forest information systems. Implementation of this system will require considerable technical efforts and resources.

The European Forest Data Centre (EFDAC), created by the Commission, uses existing forest information and monitoring databases within EU, integrates the European platform for information and communication on Forests (EFICP[27]) and is based on several Commission initiatives[28]. EFDAC aims to become a center of information management for the forests in Europe. It currently includes detailed geographical data, collected under the previous EU regulations, as well as the results of completed projects.

One such project, which employs members of the university community, and particularly related to the work of the laboratory for new IT is the "INTEGRAL" project, which enables integrated and future-oriented management of European forest landscapes, combining the activities of 20 partners from 14 European countries. Project was launched a year ago at the Swedish University of Agronomic Sciences in Uppsala, and its total duration is till 2015. Major highlight is the ecological and socio-economic role of European forests. The study will be applied to 20 different landscape complexes in 10 countries. For Bulgaria as representative landscape complexes were selected Teteven and Jundola and partner on Bulgarian side is the University of Forestry in Sofia.

Yundola Training and Experimental Forest Range "D. Avramov„ lays on 5,211 hectares, with 91% of it is covered by forests. Over the years, a number of studies have been

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[21] http://www.mcpfe.org/system/files/u1/List_of_improved_indicators.pdf
[22] Report E43 program COST. http://www.metla.fi/eu/cost/e43/
[23] Regulation (EO) 2152/2003
[24] http://www.icp-forests.org/
[25] Regulation (EO) № 614/2007
[26] http://www.eea.europa.eu/publications/technical_report_2006_9
[27] EFICP http://eficp.jrc.ec.europa.eu/EFICP/
[28] INSPIRE, SEIS и GMES

conducted, and this project will explore new management policies, with better balance between social needs and diversity of forest ecosystems. Collected empirical data will serve as a model for the European Information System "Sybila", which will be adapted to the conditions in Bulgaria, at the end of the project.

The selected 10 representative landscape complexes will be subject to a long-term (20-40 years) analysis. For each landscape complex, including Yundola, will be developed four different scenarios - from pessimistic to optimistic. Lately the climate change theme is very popular, and therefore each of the options will be tested in the worst possible combination of factors.

The project ends in 2015, in order to have enough time to experiment and to consider the differential impact on all parties involved. Thanks to the analysis will be predicted the changes that would occur if given the various policy options in the woods. With particular strength is the issue of ecosystem functions and services: currently the dominating activities were the forest operations and the extraction of timber and non-timber forest products, but recently the forest is seen as hydrogen storage, preserved biodiversity and environment in which it exists. In this line of thoughts, wood will remain the main occupation, but is also worked on water protection and water retention functions of the forest, its use as a place for recreation and relaxation to restore animal populations. All of this will be analyzed in the long run with different management systems, in particular the VR technology for research and training of students in UF.

3. CONCLUSIONS AND FUTURE WORK

The established laboratory for innovation in research and training will support research, development and implementation activities for the development, application and development of complex scientific and educational innovations in the use of forests and forest resources. Will perform tasks in the research, development and transfer of technology for virtual modeling in scientific experiments and virtual learning.

The realization of the tasks will be accomplished through activities related to the creation of an environment for investigation of the options for using streaming media for research and educational purposes, creating interactive software models, integrating them into the lab and implementation in educational activities of the university faculties.

Virtual environment / laboratory for innovation in research and teaching, which is used by VR visualization allows interdisciplinary research – on one hand, provides the first effective tool for professionals in these fields, on the other hand allows sharing them with non-experts in the field and their involvement in the process of research and decision making.

Virtual environment / laboratory equipped with appropriate tools for simulation modeling - video, digital media, the Internet will allow capturing of videos and thus will provide the activities to achieve situational and strategic types of knowledge.

Proposed innovative learning methods by using simulation modeling have the following expected results:

- Improving the skills for using all available information and environments;
- Improving the dynamic abilities for decision-making by:
  - Interpretation and evaluation of situations;
  - Generation of possible solutions and decision-making;
  - Generation of Action Plan;
  - Evaluation of the results.
- Preparing students for lifelong learning;

- Modern information technology support for scientific researches of PhD students, young and established researchers.

Results expected from proposed innovative methods relate to improving the skills of using all available information and a variety of environments, improving the dynamic ability for decision making, preparing for the concept of lifelong learning and modern information technology support of scientific researches of PhD students, young and established researchers in the field of forestry and forest resources

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ECONOMIC COMPETITIVENESS OF FOREST BIOMASS ENERGY

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Abstract: *This paper analyzes the economic competitiveness of forest biomass energy compared with fossil fuel-based energy by reviewing literature. The main geographical focus of the paper is Scandinavian countries. It is found that under current market conditions, the former, mainly due to its high production costs, is not competitive with the later. Improving technologies regarding forest biomass procurement and energy conversion could make it more attractive economically. Incentivizing forest biomass procurement, energy production and use, and taxing fossil fuels for carbon emissions could also do the same. Long-term prospect of forest biomass energy with policy measures such as carbon tax under future carbon price development scenarios is still highly uncertain. Moreover, accounting for the carbon emissions of forest biomass energy itself could further restrict the effect of such measures.*

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SENSITIVITY OF CLIMATE CHANGE TURKEY FORESTS

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Abstract: *The wealth of Biological Diversity - Turkey is more than elevation difference in the availability of different types of vegetation and brought the climate. Our Forests unlike almost all of the natural forest in Europe. Approximately 9,000 of 12,000 plant species found on the continent of Europe, there are in our country, and our country has endemic breeds in these plants, as well as 3,000. As a result of the negative impacts of climate change on our country in this world is just for exposure to endemic species will be able to see the damage. In addition, forest resources, water resources and biodiversity, in clean be harming wildlife.*

The Sensitivity to Erosion - Turkey's climate, topography, geology, hydrology, vegetation, pastures and forest areas with the characteristics of the population faces risk of desertification, given the structure of Turkey. Approximately 80% of the territory in Central Turkey, severe and very severe erosion. IPCC assessment reports, changes in ecosystem structure and functions prescribed by the at climate will cause change. Turkey, both linked to the Mediterranean climate region of the climate properties, as well as due to the high and rugged topography, very sensitive against deforestation.

Increased forest Disease and Pests - In addition, with the increasing temperature on insect and other pests will rise and fight against problems in these forests there will harmfully. In addition, the weak fall, trees, forests, thunderstorm, snow, avalanches and other abiotic effects also involved in resistance, and as a result increasing the amount of broken and overturned on the trees of the forest, if the body of the other pests becoming against flimsy. This adversely affects the biological diversity and carbon sequestration, the gene reserves our forest capacity will can impress in a negative way.

Forests Are Fire Sensitive Areas - The IPCC's latest report found in the countries of the Mediterranean climate zone indicates the maximum may be impacted by climate change. The presence of our country's forest, corresponding to approximately 60% of 12 million ha is situated in a Mediterranean climate zone of fire.
Hot and dry depending on the length of the circuit, and an increase in the frequency, intensity and duration can increase the forest fires foresight Mediterranean, Aegean and Marmara regions in the transaction and forest condition first as sensitive about 12 million ha. forest area will gain even more importance for combating forest fires.
These regions are predominantly coniferous pine forests; the influence of the wind and other factors that result in wider areas of the fires spread as soon as possible.

Living on the edge of the forest and Excess of the population - Turkey has approximately 7.5 million high rural poverty dimensions in the forests of the forest village people sleeve and is therefore more affected by socio-economic pressures. In the case of damage to forest ecosystems to climate change that adversely affected by forestry activities living in the forest, and the forests above the peasant social pressure will increase.

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FOREST INSTRUMENTS TO TRANSIT TO SUSTAINABLE DEVELOPMENT

Patrice A. Harou [1] - Dietmar Rose [2] - Antonello Lobianco [3]

Abstract: *Forests have been managed under the concept of multiple uses since the sixties. However, timber was supposed to pay for providing the non-market, ecological and social benefits. Today, in certain forests, non-timber products such as annual hunting fees dwarf timber income. In the future, non-timber ecological and social services could find markets also. We want to transit toward a more sustainable economic development. Should we speed up the transition process by offering public incentives to reward owners for providing goods and services for which they may not be rewarded financially today but for which a market could appear or be created in the future? A method for tailoring possible forest instruments for this transition period will be presented and the way to operationalize the method discussed. The method relies on the dual financial and economic analyses of forest investments.*

Two tools will be introduced. One is a generic cash flow program cum sensitivity analysis that can be downloaded from the EFI web site. The second is a web based program with many of the same features to carry out forestry investment analyses and that can serve also as a central data bank for forestry investments requiring eventually public help

Keywords: cost-benefit analysis, environmental valuation, social valuation, forestry instruments

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ASSESSING FOREST MANAGEMENT STRATEGIES AMID BIOLOGICAL AND POLICY UNCERTAINTY: A CASE STUDY OF BOTTOMLAND HARDWOOD MANAGEMENT IN WEST TENNESSEE, USA

Donald G. Hodges [1]

Abstract: *The watersheds of West Tennessee were once characterized by extremely productive bottomland hardwood forests that supported a thriving forest products industry. Due to historic stream channel and riparian habitat alterations associated with land use change over the past century, a large number of these streams have been impacted by excessive siltation. Today, these watersheds still include remnants of the bottomland forests, which now are critical for their timber, as well as the variety of ecosystem services they provide. Moreover, significant local attention is being devoted to developing ecosystem restoration strategies and sustainable management plans for west Tennessee rivers and the associated ecosystems. Appropriate attention must be placed on evaluating natural resource policies and developing management strategies that support floodplain restoration and economic and community development. In order to develop a more complete understanding of the functions and values of floodplain forests, this study explores how land management activities affect the flow of traditional wood products and ecosystem services from both public and private lands in the region. After developing the theoretical framework for incorporating the uncertainty inherent in ecosystem service provision and markets, as well as that posed by a changing policy environment, different forest management scenarios will be examined to determine how these uncertainties affect financial returns to managing bottomland hardwood forests for multiple goods and services.*

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TOWARDS INTERNALIZATION OF FOREST ENTERPRISES' AKTIVITY EXTERNALITIES: WEST UKRAINE CASE STUDY

Maksymiv L. [1], Pelyno L. [1]

Abstract: *Paper deals with a evaluation of externalities that arise in a process of forest ecosystems functioning and their internalization for the purposes of managerial accounting for forest enterprises. Therefore procedure of externalities regulation by FSC standards was analysed. It was found that FSC rules require elimination of negative externalities impacts both caused by forest enterprises and by other entities. On the other hand, the standards require generation of positive effects that local population demands.*
Major externalities associated with forest enterprises' activities are identified in the paper. Significant impacts were identified together with experts. Correspondence to indicator which reflects investments in improvement and support of forest ecosystems and biodiversity conservation was analyzed. Regression analysis of capital investments dependence on these activities revealed close correlation between the amount of capital investments and intensity of cuttings aimed in formation and improvement of forests, including sanitary clear cutting.

Keywords: forest ecosystem, externalities, internalization of externalities, forest enterprises, managerial accounting.

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COOL – COMPETING USES OF FOREST LAND IN GERMANY AT THE INTERFACE BETWEEN THE UTILIZATION OF ENERGY WOOD AND DIFFERENT FOREST FUNCTIONS

Dörte Marie Peters [1]

Abstract: *Forests are object of various anthropocentric demands: Besides serving as resource base for both material and energetic utilization they shall contribute to climate protection and be available as recreation area. Moreover, they are meant to serve as natural habitats which need to be preserved due to their high biodiversity. Expectations towards forests hence express economic, ecological and social values of different interest groups. These various interests compete for forest area and for the resource wood. To date, the competition between material and energetic utilization of wood is conspicuous and an intensification of that competition and a resulting wood supply bottleneck are predicted.*

These diverse and competing demands shall be balanced by means of sustainable forest management (SFM). SFM has therefore gained high popularity during the last decades – however, approaches towards the sustainable managed forest are still imprecise and lack consistency. This is one of the reasons why different actors interpret SFM in different ways. These different understandings of the notion and concept of sustainability in turn have an impact on conflicts between the different utilization demands.

This complex area of conflict within the field of energy wood is investigated at the Chair of Forest and Environmental Policy at University of Freiburg. The research is embedded in the European research project COOL – Competing uses of forest land (www.cool-project.org). All project partners analyze the different forest management approaches within the five participant countries Finland, Norway, Slovenia, Spain and Germany. Based on this analysis, the comparison between the countries shall contribute to the development of coherent forest management strategies on national and European level that cope with an increasing demand for energy wood while not undermining other forest functions.

The presentation shows central fields of conflict that emerge at the interface between the utilization of energy wood and other forest functions and presents first empirical results of the project with a focus on the situation in Germany.

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EFFECTS OF MANAGEMENT ON ECONOMIC PROFITABILITY OF FOREST BIOMASS PRODUCTION AND CARBON NEUTRALITY OF BIOENERGY USE IN NORWAY SPRUCE STANDS UNDER THE CHANGING CLIMATE

Piritta Pyörälä [1]- Heli Peltola [1]- Harri Strandman [1]- Kilpeläinen Antti [2]- Asikainen Antti [3] - Kirsti Jylhä [4]- Seppo Kellomäki [1]

Abstract: *The climate change is expected to greatly affect the functioning and dynamics of boreal forest ecosystem and sustainability and economic profitability of forest biomass production. In this respect, we analyzed the effects of forest management and climatic change on the economic profitability of forest biomass production and carbon neutrality of bioenergy use in Norway spruce (Picea abies L. Karst) stands in Finnish conditions. For this purpose, we employed a forest ecosystem model and life cycle assessment (LCA) tool. In particular, we studied the effects of thinning, nitrogen fertilization and rotation length on: i) the production of timber and energy biomass, and its economic profitability (net present value), ii) carbon stock in the forest ecosystem and carbon balance in forestry, and iii)* CO_2 *emissions from the use of biomass in energy production. Results showed that the current Finnish baseline management with and without nitrogen fertilization resulted in the highest mean annual timber production and net present value (NPV) for long rotations (60 to 80 years), regardless of climate scenario. Mean annual production of energy biomass was enhanced by maintaining 20-30% higher stocking over rotation compared to the baseline management, and/or by use of nitrogen fertilization. Such management gave lower* CO_2 *emissions per unit of energy compared to the baseline management, as the carbon stock in the forest ecosystem and the carbon balance in forestry increased. Under the gradually changing climate decreased forest biomass production for long rotations, especially if 80 years rotation length was applied. This reduced also carbon stock in the forest ecosystem and carbon balance in forestry. The annual mean NPV will be highest if 50- to 70-year rotations lengths are used. However, the carbon neutrality of bioenergy production and utilization could also be increased compared to the use of coal if maintaining 20-30% higher stocking and by using fertilization resulted regardless of climate scenario. Overall, the economic profitability and the carbon neutrality were on average, the highest if the baseline management with nitrogen fertilization and longer rotations lengths was used. But maintaining a 20% higher stocking over rotation with use of nitrogen fertilization and longer rotation lengths showed also higher the economic profitability and the carbon neutrality. However, it was not possible to simultaneously maximize the economic profitability and the carbon neutrality.*

Keywords: Forest biomass, intensive management, carbon balance, carbon neutrality, climate change, economic profitability of biomass production

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ECONOMIC EFFICIENCY OF REFORESTATION PROJECTS: MALE POLISSYA (NORTHERN UKRAINE) CASE STUDY

Lyudmyla Zahvoyska [1] - Iuliia Shvediuk [1]

Abstract: *Turbulent tenths of the 21st century explicitly revealed a crucial role of forest ecosystems in sustaining human wellbeing as well as ecosystem fragility to human activity impacts. Deforestation in interaction with other nine global sustainability mega-forces, like climate change, energy, material and water resources scarcity, ecosystem decline etc. (KPMG, 2012) will affect future of every business in next twenty years. These interconnected mega-forces strongly interact therefore implementation of an adequate and effective forestation policy one can expect improvement of the global environment that allow us to keep human activity within planetary boundaries (Rockström et al., 2009).*

Meanwhile deforestation is predicted as 13 percent decline from 2005 to 2030. Ukraine as a forest-deficit country with favorite climate conditions and rich soil needs well ground forestation decisions reflected financial and economic efficiency of forestation projects.

The paper will present a cost-benefit analysis of reforestation projects in Male Polissya (Northern Ukraine) region with a focus on efficiency of reforestation alternatives applied to sites of pine (Pinus Sylvestris). These forest sites were formed by two forestation alternatives: natural and artificial (planting of trees). Valuation methods, simulation techniques and fuzzy set paradigm will be applied to reveal and take into account numerous benefits and uncertainty associated with forestry projects.

Keywords: reforestation, cost benefit analysis, total economic value, simulation, fuzzy logic.

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VALUATION THE *ATTALEA FUNIFERA* MART. (ARECACEAE), TRADITIONAL UTILISATION: A CASE STUDY OF THE ATLANTIC FOREST-BRAZIL.

Maria Aparecida José de Oliveira [1] - Laurence Granchamp [2] - Lídia Maria Cardel [3] - Miriam Heredia Osorio [4]

Abstract: *This study is an interdisciplinary approach encompassing the popular and scientific knowledge to understand the relationship between man and the environment. The leaves and fruits the Attalea funifera are used by traditional communitiesas the mainraw material for handicraft. The increased use of this resource was mainly due to the creation of the local handicraft market. People from local communities, reported that the leaves of this palm are used to extract the fiber to make various crafts, in this study, we sought to determine to what extent these social uses of the plant can affect the production and population structure of this species. More specifically this study is an investigation in biology and social sciences, combining two issues: the intensification and ways to exploit this resource. The results indicate a larger number of adults and seedlings, and a reduction in the number of youngleaves. The species is without stem, has capacity for regeneration. One hypothesis is that the reduction in young leaves may be associated with the extraction practices. In this region through sustainable management, it is possible to use this service ecosystem, so as not to to change the population of this species and assess the local artisanal practice, a social resource that has been reappropriated, especially by women, in support of a new identity social.*

Keywords: arecaceae, service ecosystem, population structure, rural communities.

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CONTENT ANALYSIS OF MASS MEDIA IN FORESTRY SECTOR IN THE CZECH REPUBLIC

Anna Švehlová [1]

Abstract: *The present thesis deals with monitoring of public communication media forming media image of forestry in the Czech Republic. The thesis describes the media history and present in the Czech Republic and abroad with a focus on the media reporting on forestry issues. The reports are analyses with regard to their frequency, authors and themes. The main emphasis is laid on public service media, the Czech Radio and the Czech Television. The thesis uses standard methods of quantitative content analysis.*
The purpose of the present thesis is to provide a comprehensive assessment of media image of forestry in the Czech Republic in the period 2007 to 2011 and compare the media image with regard to compliance with the objectives of the forestry policy and the National Forestry Programme for the period to 2013.

Keywords: forestry, forest management, content analysis, media, mass media, media image

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