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Diploma Thesis

EVALUATION OF SOCIO-ECONOMIC IMPORTANCE OF FOREST SERVICES ON SELECTED AREAS IN THE UNIVERSITY FOREST ENTERPRISE KOSTELEC n. C.LESY

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Declaration

I declare that I elaborated this diploma thesis by myself and I did mention all the literary and internet sources I used for the compilation of the thesis.

In Prague 23rd April 2008

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Petr Vacík

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CONTENT

1. ABSTRACT

Forest has always played various and multiple roles in the life of a man and society. Apart from an existence value of itself, nature (i.e. forest, landscape, environment…) has a great importance for humankind, which is addicted to it as to a resource of his life needs. On the contrary, a man is the only one species actively – and in a large scale - influencing his environment. Human civilization has become a considerable part of global ecosystem and is able to change its surroundings – damage it, improve or preserve.

Valuation of various properties of nature can help to find the balance between civilization demands and maintenance of viable ecosystem. Because of sustainable future development, effective decision-making and planning and better landscape management it is needful to know what the nature (i.e. forest) value from different points of view is, what the price of its various functions and properties is or how to compensate a potential damages.

There have been developed several approaches or systems of valuation. All of them are more or less subjective and their results differ according used method. This thesis uses the system of *socio-economic valuation of forest services differentiated by their diverse socio-economic essence and impact on the society, purpose of their employment in the society and input data availability* [9]. A few years ago there has been introduced the manual [3] *Metodika socialne-ekonomickeho hodnoceni funkci lesa* (Methodology of socio-economic valuation of forest services) and the thesis is proceeding according the newest issue (2006) of that handbook, trying its practicability and usefulness for forestry professionals.

2. INTRODUCTION: DIVISION OF FOREST SERVICES

The forest is a complex structure including a huge amount of various qualities. Most of these properties are very simple and basic and are indifferent to human needs. But some of them create bigger or more complex units interesting and important for society. These units of properties can be called functions or services.

In the past an accelerating of the wood production function of forests has been prevailing only. But in a few last decades emphasis spread toward other aspects of forest (and environment as a whole) using. Forest began to be perceived not only as a mere storage of wood but also as a system of significant ecological properties and place of rest and relax which is needful for human being.

It became obvious that these (non-production) services of forest and environment have to be expressed in some scale of importance, preferably in monetary form. It is because monetary expression enables comparison of various properties – substantial or even abstract.

It is suitable to say that any object of interest has value or importance *per se* but only in relation to valuating subject. Value of forest is permanently changing in time and region according to preferences of valuating subject (researcher) and accelerated functions.

Forest services are divided according to use or benefits they bring into few groups. The divisions differ, so it is needful to briefly introduce system used in this thesis [10] :

1. market forest services (production functions, internalities)

    - timber production service
    - hunting and game management service
    - other market services

2. non-market environmental forest services (externalities)

    A. 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)

B. without measurable market impact
   - health-hygienic forest services (recreational and health influencing)
   - cultural-educational (nature protective, educational, scientific and institutional) services.

Only the wood production and hunting are fully market functions. Non-wood production and protective functions are mediated market, they are of tangible nature and it is possible to express them as costs of prevention or compensation or in a "shadow market" prices (production of berries, mushrooms…). Other services are non-market and have non-material, non-economic, intangible social character. But any division can perfectly reflex the reality. For instance, apart from mediated market character the non-wood production has recently non-economic significance as a recreational function. This nature of forest services makes the evaluation very difficult and always subjective.

In valuing socio-economic importance of the forest it is necessary to distinguish the term "service", related to a real and demanded value of the forest for the society, from the term "property" of the forest. We can find multiple partial mechanical, physical, technical, chemical, and biological properties of the forest. Nevertheless, not all forest properties, qualities, can be considered services, their socio-economic importance is meaningful to be expressed, i.e. valued, but only those satisfying actively required and sought-after socio-economic needs of the society (be this represented by any social group).

Only then, if the properties of the object are demanded actively by the society, if there is deficit of them and if they have an obvious comprehensive socio-economic (and not only partial like physical, chemical, etc.) dimension, impact on the society, they become services and uses to the society. So they attain socio-economic (social) importance. [1]

3. LITERATURE ANALYSES

Out of the society and their socio-economic needs the category of socio-economic value has not any sense. The society has formed the categories of value and price for its needs. These categories, methods, contents, and forms of assessment and valuation change with the history and evolution of the society. Here is nobody except people to value the degree of forest services importance in the landscape and on the globe by their requirement and demands both in monetary and non-monetary forms. Out of the man the category of social or socio-economic value and price does not exist objectively. [1]

The question is an acceptability of degree of subjectivity, degree of an informative value of results and acceptation of given approaches for concrete purpose. Valuation of socio-economic benefit or importance of given object for society has to be based not on supply of benefit only but even on demand for these benefits and it is cardinal view for valuation of importance for society. [10]

Methodological individualism is the fundamental paradigm followed in the valuing (environmental) benefits. Economic theory cannot provide any support for the approach that tries to derive a monetary value without being based on a subjective theory of value and individual preferences. This approach corresponds to the anthropocentric view of value. On the contrary, the mainstream economic theory cannot provide any technique to value environmental goods and services following an eco- or bio-centric view. Moreover, economic theory, and non-market valuation in particular, cannot provide any tool or technique in order to express a monetary value of something that is not perceived by an individual. Environmental benefits and losses can be associated with either marketed or non-marketed goods. Their valuation represents a scientific discipline nowadays widely and dynamically spreading within environmental economics supported by other disciplines such as sociology, psychology, ecology, epidemiology, or toxicology. [2]

Because of social nature of value and price categories and their difficult substantiality, rationally, the methods of their calculations are (and have to be) finally the domain of social (i.e. sociologic and economic) sciences. The methods should not be a subject of technical or biological branches while they must consider inputs and approaches of these sciences, which can

be a very suggestive and useful contribution for purposes of the valuation. [7]

[2] In principle, we can identify several groups of approaches for deriving environmental degradation, damage or benefits in monetary terms. These approaches can be based on:

- market or quasi-market prices
- arbitrary monetary value set by legislation (juridical value)
- expert opinion or judgment (comparative methods)
- eliciting willingness-to-pay (WTP) or willingness-to-accept (WTA) by applying some of the non-market valuation methods

The non-market forest services of intangible nature (recreational, nature protective) can be valued in various ways of which the so called expert comparing method is more promising than methods stemming from the willingness-to-pay approach under present conditions in the Czech Republic. [1]

The valuation of socio-economic impact of non-market forest services on the society universally by a uniform method - comparing the value of non-market forest services to the value of wood-production forest service (both with the stumpage price or price of annual timber increment) regardless their actual different social economic contents (mediated market - non-market) is rationally untenable for a longer term. Also valuation of non-market forest services only by the level of potential offer without principal consideration of measure of their use by the society - i.e. irrespective of social demand, which conditions the social value at the locality – is inadequate. [1]

In valuation of forests services of a non-market character there will always be an enormous share of subjective factor as no even partial objectification of prices through the real exchange, real market mechanism. There are relatively a lot of concrete procedures leading to expression of importance of non-production services, out of which namely social forest services. Anyway, the methods of social forest services valuation feature a lot of subjective so-called ”expert estimates” influenced by many subjective, hypothetical, assumed, fictive factors.

If the results of such assessments are used as official (threshold and sanction) prices then it is true they represent not only a professional issue (from the view of socio-economic disciplines), but it also is a political issue about enforcement of certain interests of certain policies. Then the final spectrum of adopted assessment methods and their results follows from certain lobbying

and certain consensus for intended purpose. For all of that from the view of social rationality the methods have to stem from expert knowledge and conclusions of socio-economic disciplines. [1]

According to a substantiated methodology of the evaluation of a forest's functions in the public interest, a conclusion has been reached that the anti-erosion function, for instance, represents a value 2.2 times higher than wood production. The water-protection function is worth only 40% of the production function, but the recreational function is at least 3.5 times higher than wood production. According to this method, the total of all the decision functions of public interest reaches a value which is 9 times higher than that of the production function. Of course, such invaluable forest functions such as oxygen production, nitrogen control, protection against harmful radiation etc. could not be included into the calculations. [URL5]

Non-market forest value achieved on average 803.8 thousand CZK/ha in the CZR in 1998, which is more than 2.5 times higher than the official value of forests based on wood production function. [1]

For expressing the socio-economic value of health-hygienic and cultural-educational environmental forest services expert approach was employed using comparative method, i.e. comparing their general mean socio-economic importance to the general mean socio-economic importance of market services. Based on the set of experts the ratios 0.33 and 0.28 were derived respectively in the frame of the CR. [4]

4. THE AIM OF THE THESIS

Prices of socio-economic forest services on selected localities are outputs of the thesis. Feature characteristics of the localities differ (presence of tourist trail, different species composition…), so results vary to a different extent, too. It is interesting to watch how these individual characteristics influence values of the forest services, i.e. how important the forest services are from human point of view.

The thesis is also aimed on functionality of the forest services valuation methodology published in the manual [3] "*Metodika socialne-ekonomickeho hodnoceni funkci lesa*" (Methodology of socio-economic valuation of forest service). Practicability and usability of the methodology for foresters and professional public is verified and analyzed. The manual is still improving and developing, and potential suggestions and comments will help to increase comprehensibility, applicability and effectiveness of the methodology.

5. METHODS

The thesis uses the differentiated system of socio-economic valuation of forest services (so called Prague method) and proceeds according the manual [3] *Metodika socialne-ekonomickeho hodnoceni funkci lesa*. Most of the input data (mean prices in CR, coefficients, etc) used for calculation are taken from there. Individual services are *differentiated by their diverse socio-economic essence and impact on the society, purpose of their employment in the society and input data availability* [15]

The proper computation is focused on socio-economic importance of: [3]

Wood productive function assessed by the mean year incomes from timber sale in the period 1999-2003

Hunting and game management assessed by the mean year incomes from the respective activities in the period 1999-2003

Non-wood productive function assessed by the shadow market prices of main non-wood forest product collected by forest visitors in amounts in the period 1999–2003

Hydrological-protective function assessed by the cost of prevention and divided into three partial functions

- Reduction of maximum runoff in water streams
- Enhancement of minimum runoff in water streams
- Protection of water quality

Soil-protective function assessed by the cost of compensation and divided into two partial functions

- Protection against soil losses caused by introskeleton erosion
- Protection of streams and reservoirs against deposits of eroded soil parts

Air-protective function assessed on the base of average unit price of international trade with CO_2 permits in Europe and year amount of CO_2 sequestrated in timber increment

Health-hygienic (recreational) function assessed by the expert comparative method comparing their socio-economic importance to the importance of market services

Cultural-educational (scientific, conservational, institutional) functions assessed by the expert comparative method comparing their socio-economic importance to the importance of market services

The socio-economic values of forest services are divided simulating conversion from forestland to perennial bushy grassland (i.e. society of weed, bracken and, eventually, shrubs) without production use. It means the values are based generally on differences of services values between the two mentioned land cover types.

Given areas are not large, so some forest services are not influenced (or just minimally) by process of the conversion. Game management is not limited because relatively small open space within large forestland does not limit a life space of forest game or endanger it. On the contrary, the game can profit from a forest glade, which can serve as a new pasture. Except the largest plot 436 C17 prices of forest game management are not computed. These prices are within all the plots uniform and reach [3]: 170 CZK/ha (annual value) and 8 500 CZK/ha (capitalised value).

Another service, which is just slightly damaged, is soil-protective one. According to the opinion of paedologists the compact grass societies protect the soil as well as trees and forest stands. In the case of small areas also some hydrological function (runoffs) are just minimally influenced but the extent of an interest area is the question. The extent of given locality is crucial factor for former mentioned functions too.

Because the forest is [3] *a dynamic and generally renewable resource*, the final value is presented in a form of annual even capitalised value. Final results are rounded to a whole numbers.

Capitalised prices are computed from average year prices as if they were perpetually repeated. Formula is similar as for calculation of nonrecurring capitalized fee for the withdrawal of forestland designated for the fulfilment of forest functions (deforestation tax). (So called) forest interest rate for calculation of capitalised price is 2% (according Forest Act 289/1995 and ordinance 55/1999).

6. BASIC DESCRIPTION OF THE AREA

This chapter is focused on the rough description of the region, its natural condition and social importance. Detailed local conditions – base for proper calculation – are described in chapter "7. Results".

All the evaluated plots are situated at Voderadske buciny national natural reserve in Central Bohemia, approximately 35 km east of the capital Prague. Voderadske buciny extend on area 658 ha and are considered as one of the finest destination for tourism round about the capital. It is easy to get there by suburban bus.

Natural reserve was established in 1955. It represents a vast complex of mixed forest on the right bank of Jevansky creek. Natural acidophilous (*Luzulo-Fagetum*) and herb-rich (*Asperulo-Fagetum*) beech stands with typical flora and fauna, and occurrence of periglacial erosion caused by frost are the main subject and reason of protection. Area is a supraregional biocentre of Territorial system of ecological stability (USES).

Species composition of stands corresponds with acidic geological base with prevailing granite and is little influenced by human activity. Beech stands are mixed mainly with oak (*Quercus sp.*) and hornbeam (*Carpinus betulus*). In the past fir (*Abies alba*) was common, but – on account of former forestry management – its volume has been reduced. In the past it was also possible to find autochthonous hurst ecotype of Norway spruce (*Picea abies*) within gorges, which is well adapted for lower altitudes (so called "Posazavsky" spruce). Unfortunately most of the present spruce stands, which have been planted between 1880 and 1920, are of unknown origin and it is unsuitable ecotype for local condition. The reason for mass planting of spruce was development of paper-mill industry and huge demand for its wood. Old larch (*Larix decidua*) stands are very aesthetic and recently quality from forester's view but this species is not indigenous in the area.

Acidophilous beech stands with a few typical species (*Avenella flexuosa, Luzula luzuloides, Hieracium murorum*) and herb-rich beech forests (*Dentaria enneaphyllos, Dentaria bulbifera, Gallium odoratum, Mercurialis perennis*) are prevailing forest societies there. Furthermore dry

even wet acidophilous oak stands and Hercynian oak-hornbeam forests are common. Creek surroundings and waterlogged places are covered by alder stands. On steep slopes ravine forests and maple (*Acer pseudoplatanus, A. platanoides*) stands with *Aruncus vulgaris* and *Allinaria officinalis* within the herb etage are presented. Rarely acidophilous fir societies occur.

Present species composition is relatively natural but is still hardly influenced by large area management, which was used until 1935. Although most of area is commercial forest nowadays, management and economy of natural reserve is subordinated to protective purposes and some areas are left to natural regeneration and succesion. Those stands serve as an educational and research object of Faculty of forestry and wood sciences of Czech university of life sciences (FLD CZU).

The forest complex of old beech stands serve as a refugium of various piedmont and mountain species of plants and animals (rich soil fauna, forest moths, amphibians). Area is also considerable mycological locality represented by many fungi species. Some ones are very rare (*Elaphocephala iocularis*) or have endemic occurrence (*Galerina pallida*).

In Voderadske buciny an archeological sites are presented too. It is possible to find there a remains of medieval villages perished in 13^{th} -17^{th} century.

Described region has an upland character – it is extending on Mnichovicka pahorkatina highlands and Jevanska plateau. The average altitude is ranging between 350 – 500 meters above sea level, the highest peak Kobyla is 501 meters high. Region belongs into Natural forest area PLO 10 Stredoceska pahorkatina.

Locality has an interesting geomorphology with corries and stony debris caused by erosion. Most of area is formed by porphyric „ricanska" and „jevanska" granites. Cambisoil is prevailing soil type.

In 2003 the University Forest Enterprise in Kostelec nad Cernymi Lesy has reestablished the educational trail Voderadske buciny in natural reserve. The original one has been founded there in 1967 and 20 years after, in 1987, has been firstly repaired. Nowadays the trail is 6,5 km long and there is 18 informative desks along it.

Beside the educational service, the locality is nice place for picking the mushrooms, recreational walking or sport. There are cycle-ways and there are also good conditions for cross-country skiing in the winter. In the near ponds the swimming or fishing is possible as well.

Below the dam of Jevansky pond there is situated sewerage plant. Jevansky creek below the dam marks the lower bound of water protection zones (second level of protection - II). Along the creek are monitored floodplain zones but most of them do not endanger human settlements.

Forests of natural reserve are managed by University Forest Enterprise - UFE. UFE was

established in 1935 and it administers area of 6899 ha in a present. It has its own management, which is controlled directly by university rector.

In Voderadske buciny there were chosen five different plots representing forest stands with various feature characteristics. These feature characteristics influence socio-economic value of the stands so the results of the measurement should show how the final price depends on these features.

7. RESULTS

This chapter is a practical part of the thesis. In sub-chapter "7.1. Calculations and partial results" are computed prices of socio-economic services on individual plots. Sub-chapter "7.2. Final results" presents a summary and gives final results in a form of tables and charts.

7.1. Calculations and partial results

Table 1: Local conditions common to all the plots

Altitude	390 – 480 meters a.s.l.
Forest vegetation tier (LVS)	3 Oak-beech
Natural forest area (PLO)	10 Stredoceska pahorkatina
Cadastral territory	Cerne Voderady
Forest category	Protected forest
Degree of protection	National natural reserve
Territorial system of ecological stability (USES)	Supraregional biocentre
Soil texture	Loamy-clay (medium heavy)
Watershed area	24.305 km^2
Forestland within w. area	50 -70 %
Mean regional volume of NO_3 in grassland water	18 mg/l
Mean volume of NO_3 in forestland water for PLO 10	7.19 mg/l
Mean regional specific water runoff	0.04 l/s.ha
Local potential water erosion	0.51 – 1.00 mm/yr

7.1.1. Plot 434 F5

Table 2: Local condition within the plot 434 F5

Number		434 F5
Area (ha)		2.87
Forest type		4B1 – herb-rich beech forest
Age (yrs)		50
Stand density		10
Species composition	Beech *Fagus silvatica*	95%
	Maple *Acer pseudoplatanus*	5%
Degree of naturalness		2
Degree of damage		I

Most of the plot 434 F5 is situated on northeast slope, smallish part is lying on slight south slope. The main tree species are indigenous beeches and maples and there are also spruces (*A.alba*), larches (*L.decidua*) and hornbeams (*C.betulus*) scattered within the stand. Part of the area (0.3 ha) lies within 50 meters distance from the tourist trail.

According to the map of health condition of Czech forest in 2006 [URL7] the given stand is slightly damaged (degree of damage: I).

Danger of soil losses for forest type 4B1 is low. Danger of either floods or stream desiccation is low because area is not so large and even it was deforested the runoff from whole forest would not be influenced. Below the plot there is a natural spring of drinkable water.

Wood production

Basic socio-economic price of wood production in CR is 7,375 CZK/ha (annual) and 368,750 CZK/ha (capitalised). [3]

Corrective coefficient for calculation [3]:

Coefficient of forest type 4B (herb-rich beech forest): 1.60

Calculation

Annual price = 7375 x 1.60 = 11,800 CZK/ha

Capitalised price = 368 750 x 1.60 = 590,000 CZK/ha

Total annual price for the area = 11 800 x 2.87 = 33,866 CZK
Total capitalised price for the area = 590 000 x 2.87 = 1,693,300 CZK

Hunting and game management

Conversion of the area to perennial grassland does not limit life space of forest game and does not endanger it. On the contrary, the game could profit from new pasture. Both game management even hunting are not influenced by the process of conversion, so it is not necessary to calculate price of given service. (see page 10)

Non-wood production

The plot is not berries-type of forest (forest type 4B). Basic socio-economic price of non-wood production within non-berries forests is 987 CZK/ha (annual) and 49,350 CZK/ha (capitalised). [3]

There are no corrective coefficients for calculations. It is possible to accept basic prices set by the manual [3].

Annual price = 987 CZK/ha
Capitalised price = 49,350 CZK/ha

Total annual price for the area = 987 x 2.87 = 2,833 CZK
Total capitalised price for the area = 49 350 x 2.87 = 141,635 CZK

Reduction of maximum runoff in water streams

Basic socio-economic price of individual qualitative characteristics of hydrological function the reduction of maximum runoff in water streams is 910 CZK/ha (annual) and 45,000 CZK/ha (capitalised). [3]

Corrective coefficients for calculation [3]:
Mean coefficient for the reduction of maximum runoff: 1.23
Coefficient for conversion to grassland (according the texture of soil): 0.7
Coefficient of the age and stand density: 0.89

Coefficient of value of forestland within watershed: 0.8
Coefficient of flood-prevention necessity: 0.5
Coefficient of health and quality of forest stand: 1.0

Calculation
Annual price = 910 x 1.23 x 0.7 x 0.89 x 0.8 x 0.5 x 1 = 279 CZK/ha
Capitalised price = 45000 x 1.23 x 0.7 x 0.89 x 0.8 x 0.5 x 1 = 13,793 CZK/ha

Total annual price for the area = 279 x 2.87 = 801 CZK
Total capitalised price for the area = 13 793 x 2.87 = 39,586 CZK

Enhancement of minimum runoff in water streams

Basic socio-economic price of individual qualitative characteristics of hydrological function the enhancement of minimum runoff in water streams for conversion to perennial grassland is 540 CZK/ha (annual) and 26,900 CZK/ha (capitalised). [3]

Corrective coefficients for calculation [3]:
Coefficient of prevention of desiccation necessity: 0.5
Coefficient of health and quality of forest stand: 1.0

Calculation
Annual price = 540 x 0.5 x 1 = 270 CZK/ha
Capitalised price = 26900 x 0.5 x 1 = 13,450 CZK/ha

Total annual price for the area = 270 x 2.87 = 775 CZK
Total capitalised price for the area = 13 450 x 2.87 = 38,603 CZK

Protection of water quality

Basic socio-economic price of individual qualitative characteristics of hydrological function the protection of water quality is 9,300 CZK/ha (annual) and 465,000 CZK/ha (capitalised). [3]

Because of near spring of drinkable water and water protection zones along Jevansky creek the local importance of water runoff is increased but just slightly because the area is not so large

to hardly influence water quality.

Corrective coefficients for calculation [3]:

Coefficient of N-NO_3 difference (K1) = (18 – 7.19) : 20 = 0.5405

Coefficient of regional specific water runoff (K2) = 0.04 : 0.04 = 1

Coefficient K3 (according the local importance of water runoff)= 0.7

Calculation

Annual price = 9300 x 0.5405 x 1 x 0.7 = 3,519 CZK/ha

Capitalised price = 465000 x 0.5405 x 1 x 0.7 = 175,933 CZK/ha

Total annual price for the area = 3519 x 2.87 = 10,100 CZK

Total capitalised price for the area = 175 932 x 2.87 = 504,927 CZK

Protection against soil losses by introskeleton erosion

Danger of soil losses caused by introskeleton erosion for forest type 4B (herb-rich beech forest) is very low. It is not necessary to compute a price of this soil-protective function because it is insignificant. [14]

Protection of streams and reservoirs against deposits of eroded soil parts

Age of stand, species composition and stand density are irrelevant factors for calculation because plot is not endangered by introskeleton erosion and values are almost identical. Annual price for conversion to perennial grassland is 1 CZK/ha. Capitalised price is 50 CZK/ha. [3]

Locality is not situated within a perimeter of water-supply reservoir. There are no corrective coefficients for calculations. It is possible to accept basic prices set by the manual [3].

Annual price = 1 CZK/ha

Capitalized price = 50 CZK/ha

Total annual price for the area = 1 x 2.87 = 3 CZK

Total capitalised price for the area = 50 x 2.87 = 144 CZK

Protection of air, sequestration of CO_2

Average socio-economic value of air-protective function the sequestration of CO_2 in Czech republic is 1,000 CZK/ha (annual) and 50,000 CZK/ha (capitalised). [3]
Coefficient for forest type 4B (herb-rich beech forest) [3]: 1.60

Calculation
Annual price = 1000 x 1.60 = 1,600 CZK/ha
Capitalised price = 50000 x 1.60 = 80,000 CZK/ha

Total annual price for the area = 1600 x 2.87 = 4,592 CZk
Total capitalised price for the area = 80 000 x 2.87 = 229,600 CZk

Health-hygienic (recreational) services

The plot is accessible by public – annual price is 2,573 CZK/ha and capitalised one is 128,650 CZK/ha. Approximately one tenth of given area is situated within 50 meters distance from tourist trail (annual price 7,521 CZK/ha, capitalised price 376,050 CZK/ha). [3]

The area was – for purpose of computation – divided into two parts: part one (P1 = 0.3 ha) within and part two (P2 = 2.57 ha) out of 50 meters distance from tourist trail, which were calculated separately. Results of these partial calculations were finally added up.

Annual price (P1) = 7,521 CZK/ha
Capitalised price (P1) = 376,050 CZK/ha
Annual price (P2) = 2,573 CZK/ha
Capitalised price (P2) = 128,650 CZK/ha
Total annual price for the area = (7521 x 0.3) + (2573 x 2.57) = 8,869 CZK
Total capitalised price for the area = (376 050 x 0.3) + (128 650 x 2.57) = 443,446 CZK

Mean annual price (434 F5) = 8869 : 2.87 = 3,090 CZK/ha
Mean capitalised price (434 F5) = 443 446 : 2.87 = 154,511 CZK/ha

Cultural-educational (scientific, conservational, institutional) services

The plot 434 F5 is a part of national natural reserve (annual price 7,095 CZK/ha, capitalised price 354,750 CZK/ha) and, at the same time, part of supraregional biocentre of Territorial system of ecological stability (annual price 5,380 CZK/ha, capitalised price 269,000 CZK/ha), forest used for educational and research purposes (annual price 3,742 CZK/ha, capitalised price 187,100 CZK/ha) and commercial forest (annual price 2,183 CZK/ha, capitalised price 109,150 CZK/ha). [3]

These characteristics cover each other; former two ones are actually a different degrees of nature protection, third one is derived from them (most of protected areas are at the same time used for scientific or educational purposes) and fourth one is just a basic category that is covered by the others, more important. Because it is necessary to avoid the duplicity of services, only the highest price is valid; lower ones are not relevant.

For calculation it is appropriate to consider the plot 434 F5 as a part of national natural reserve with annual price 7,095 CZK/ha and capitalised price 354,750 CZK/ha. For conversion to grassland 73% of the commercial forest price is subtracted from the result. [3]

Correction of calculation [3]

Coefficient for degree of naturalness 2: 2.0

73% from 2 183 = 1593.6

73% from 109 150 = 79 679.5

Calculation

Annual price = (7095 x 2) – 1593.6 = 12,596 CZK/ha

Capitalised price = (354 750 x 2) – 79 679.5 = 629,821 CZK/ha

Total annual price for the area = 12 596 x 2.87 = 36,151 CZk

Total capitalised price for the area = 629 821 x 2.87 = 1,807,585 CZK

7.1.2. Plot 434 F8

Table 3: Local condition within the plot 434 F8

Number		434 F8
Area (ha)		2.55
Forest type		4B1 – herb-rich beech forest
Age (yrs)		75
Stand density		10
Species composition	Beech *Fagus silvatica*	40%
	Oak *Quercus petraea*	40%
	Hornbeam *Carpinus betulus*	20%
Degree of naturalness		1 - close-to-nature species composition
Degree of damage		I

The plot 434 F8 is situated along the tourist trail, approximately one half of its area (1.2 ha) lies within 50 meters distance from the trail. Most of the plot is situated on northeast slope, smallish part is lying on slight south slope. The stand is composed of indigenous beeches, oaks and hornbeams.

According to the map of health condition of Czech forest in 2006 [URL7] the given stand is slightly damaged (degree of damage: I).

Danger of soil losses for forest type 4B1 is low. Danger of either floods or stream desiccation is low because area is not so large and even it was deforested the runoff from whole forest would not be influenced. Near the plot there is a natural spring of drinkable water.

Wood production

Basic socio-economic price of wood production in CR is 7,375 CZK/ha (annual) and 368,750 CZK/ha (capitalised). [3]

Corrective coefficient for calculation [3]:

Coefficient of forest type 4B (herb-rich beech forest): 1.60

Calculation

Annual price = 7375 x 1.60 = 11,800 CZK/ha

Capitalised price = 368 750 x 1.60 = 590,000 CZK/ha

Total annual price for the area = 11 800 x 2.55 = 30,090 CZK
Total capitalised price for the area = 590 000 x 2.55 = 1,504,500 CZK

Hunting and game management

Conversion of the area to perennial grassland does not limit life space of forest game and does not endanger it. Both game management even hunting are not influenced by the process of conversion, so it is not necessary to calculate price of given service. (see page 10)

Non-wood production

The plot is not berries-type of forest (forest type 4B). Basic socio-economic price of non-wood production within non-berries forests is 987 CZK/ha (annual) and 49,350 CZK/ha (capitalised). [3]

There are no corrective coefficients for calculations. It is possible to accept basic prices set by the manual [3].

Annual price = 987 CZK/ha
Capitalised price = 49,350 CZK/ha

Total annual price for the area = 987 x 2.55 = 2,517 CZK
Total capitalised price for the area = 49 350 x 2.55 = 125,843 CZK

Reduction of maximum runoff in water streams

Basic socio-economic price of individual qualitative characteristics of hydrological function the reduction of maximum runoff in water streams is 910 CZK/ha (annual) and 45,000 CZK/ha (capitalised). [3]

Corrective coefficients for calculation
Mean coefficient for the reduction of maximum runoff: 1.23
Coefficient for conversion to grassland (according the texture of soil): 0.7

Coefficient of the age and stand density: 0.98
Coefficient of value of forestland within watershed: 0.8
Coefficient of flood-prevention necessity: 0.5
Coefficient of health and quality of forest stand: 1.0

Calculation
Annual price = 910 x 1.23 x 0.7 x 0.98 x 0.8 x 0.5 x 1 = 307 CZK/ha
Capitalised price = 45000 x 1.23 x 0.7 x 0.98 x 0.8 x 0.5 x 1 = 15,188 CZK/ha

Total annual price for the area = 307 x 2.55 = 783 CZK
Total capitalised price for the area = 15 188 x 2.55 = 38,729 CZK

Enhancement of minimum runoff in water streams

Basic socio-economic price of individual qualitative characteristics of hydrological function the enhancement of minimum runoff in water streams for conversion to perennial grassland is 540 CZK/ha (annual) and 26,900 CZK/ha (capitalised). [3]

Corrective coefficients for calculation [3]:
Coefficient of prevention of desiccation necessity: 0.5
Coefficient of health and quality of forest stand: 1.0

Calculation
Annual price = 540 x 0.5 x 1 = 270 CZK/ha
Capitalised price = 26900 x 0.5 x 1 = 13,450 CZK/ha

Total annual price for the area = 270 x 2.55 = 689 CZK
Total capitalised price for the area = 13 450 x 2.55 = 34,298 CZK

Protection of water quality

Basic socio-economic price of individual qualitative characteristics of hydrological function the protection of water quality is 9,300 CZK/ha (annual) and 465,000 CZK/ha (capitalised). [3]

Because of near spring of drinkable water and water protection zones along Jevansky creek

the local importance of water runoff is increased but just slightly because the area is not so large to hardly influence water quality.

Corrective coefficients for calculation [3]:

Coefficient of N-NO_3 difference (K1) = (18 – 7.19) : 20 = 0.5405

Coefficient of regional specific water runoff (K2) = 0.04 : 0.04 = 1

Coefficient K3 (according the local importance of water runoff)= 0.7

Calculation

Annual price = 9300 x 0.5405 x 1 x 0.7 = 3,519 CZK/ha

Capitalised price = 465000 x 0.5405 x 1 x 0.7 = 175,933 CZK/ha

Total annual price for the area = 3519 x 2.55 = 8,973 CZK

Total capitalised price for the area = 175 932 x 2.55 = 448,627 CZK

Protection against soil losses by introskeleton erosion

Danger of soil losses caused by introskeleton erosion for forest type 4B1 is very low. It is not necessary to compute a price of this soil-protective function because it is insignificant. [14]

Protection of streams and reservoirs against deposits of eroded soil parts

Age of stand, species composition and stand density are irrelevant factors for calculation because plot is not endangered by introskeleton erosion and values are almost identical. Annual price for conversion to perennial grassland is 1 CZK/ha. Capitalised price is 50 CZK/ha. [3]

Locality is not situated within a perimeter of water-supply reservoir. There are no corrective coefficients for calculations. It is possible to accept basic prices set by the manual [3].

Annual price = 1 CZK/ha

Capitalized price = 50 CZK/ha

Total annual price for the area = 1 x 2.55 = 3 CZK

Total capitalised price for the area = 50 x 2.55 = 128 CZK

Protection of air, sequestration of CO_2

Average socio-economic value of air-protective function the sequestration of CO_2 in Czech republic is 1,000 CZK/ha (annual) and 50,000 CZK/ha (capitalised). [3]

Coefficient for forest type 4B (herb-rich beech forest) [3]: 1.60

Calculation

Annual price = 1000 x 1.60 = 1,600 CZK/ha

Capitalised price = 50000 x 1.60 = 80,000 CZK/ha

Total annual price for the area = 1600 x 2.55 = 4,080 CZK

Total capitalised price for the area = 80 000 x 2.55 = 204,000 CZK

Health-hygienic (recreational) services

The plot is accessible by public – annual price is 2,573 CZK/ha and capitalised one is 128,650 CZK/ha. Approximately one half of given area (1.2 ha) is situated within 50 meters distance from tourist trail (annual price 7,521 CZK/ha, capitalised price 376,050 CZK/ha). [3]

The area was – for purpose of computation – divided into two parts: part one (P1 = 1.2 ha) within and part two (P2 = 1.35 ha) out of 50 meters distance from tourist trail, which were calculated separately. Results of these partial calculations were finally added up.

Annual price (P1) = 7,521 CZK/ha

Capitalised price (P1) = 376,050 CZK/ha

Annual price (P2) = 2,573 CZK/ha

Capitalised price (P2) = 128,650 CZK/ha

Total annual price for the area = (7521 x 1.2) + (2573 x 1.35) = 12,499 CZK

Total capitalised price for the area = (376 050 x 1.2) + (128 650 x 1.35) = 624,938 CZK

Mean annual price (434 F8) = 12 499 : 2.55 = 4,901 CZK/ha

Mean capitalised price (434 F8) = 624 938 : 2.55 = 245,074 CZK/ha

Cultural-educational (scientific, conservational, institutional) services

The plot 434 F8 is a part of national natural reserve (annual price 7,095 CZK/ha, capitalised price 354,750 CZK/ha) and, at the same time, part of supraregional biocentre of Territorial system of ecological stability (annual price 5,380 CZK/ha, capitalised price 269,000 CZK/ha), forest used for educational and research purposes (annual price 3,742 CZK/ha, capitalised price 187,100 CzK/ha) and commercial forest (annual price 2,183 CZK/ha, capitalised price 109,150 CZK/ha). [3]

These characteristics cover each other; former two ones are actually a different degrees of nature protection, third one is derived from them (most of protected areas are at the same time used for scientific or educational purposes) and fourth one is just a basic category that is covered by the others, more important. Because it is necessary to avoid the duplicity of services, only the highest price is valid; lower ones are not relevant.

For calculation it is appropriate to consider the plot 434 F8 as a part of national natural reserve with annual price 7,095 CZK/ha and capitalised price 354,750 CZK/ha. For conversion to grassland 73% of the commercial forest price is subtracted from the result. [3]

Correction of calculation [3]

Coefficient for degree of naturalness 1: 2.5

73% from 2183 = 1593.6

73% from 109 150 = 79 679.5

Calculation

Annual price = (7095 x 2.5) – 1593.6 = 16,144 CZK/ha

Capitalised price = (354 750 x 2.5) – 79 679.5 = 807,196 CZK/ha

Total annual price for the area = 16 144 x 2.55 = 41,167 CZK

Total capitalised price for the area = 807 196 x 2.55 = 2,017,989 CZK

7.1.3. Plot 433 C3a/2a

Table 4: Local condition within the plot 433 C3a/2a

Number		433 C3a/2a
Area (ha)		1.58
Forest type		4K7 – acidophilous beech forest
Age (yrs)		18 (2a)
		28 (3a)
Stand density		5
		5
Species composition	(2a) Beech *Fagus silvatica*	90%
	(2a) Spruce *Picea abies*	10%
	(3a) Beech *Fagus silvatica*	90%
	(3a) Spruce *Picea abies*	5%
	(3a) Alder *Alnus glutinosa*	5%
Degree of naturalness	(2a)	2
	(3a)	2
Degree of damage		I

Almost one half (0.7 ha) of the plot 433 C3a/2a lies within 50 meters distance from the tourist trail. Locality is situated on northeast slope. The stand is two-aged, composed of beeches, spruces and alders.

According to the map of health condition of Czech forest in 2006 [URL7] the given stand is slightly damaged (degree of damage: I).

Danger of soil losses for forest type 4K (acidophilous beech forest) is low. Danger of either floods or stream desiccation is low because area is not so large and even it was deforested the runoff from whole forest would not be influenced. Near the plot there is a little creek.

Wood production

Basic socio-economic price of wood production in CR is 7,375 CZK/ha (annual) and 368,750 CZK/ha (capitalised). [3]

Corrective coefficient for calculation [3]:

Coefficient of forest type 4K (acidophilous beech forest): 0.97

Calculation

Annual price = 7375 x 0.97 = 7,154 CZK/ha

Capitalised price = 368 750 x 0.97 = 357,688 CZK/ha

Total annual price for the area = 7154 x 1.58 = 11,303 CZK

Total capitalised price for the area = 357 688 x 1.58 = 565,146 CZK

Hunting and game management

Conversion of the area to perennial grassland does not limit life space of forest game and does not endanger it. Both game management even hunting are not influenced by the process of conversion, so it is not necessary to calculate price of given service. (see page 10)

Non-wood production

The plot is not berries-type of forest. Basic socio-economic price of non-wood production within non-berries forests is 987 CZK/ha (annual) and 49,350 CZK/ha (capitalised). [3]

There are no corrective coefficients for calculations. It is possible to accept basic prices set by the manual [3].

Annual price = 987 CZK/ha

Capitalised price = 49,350 CZK/ha

Total annual price for the area = 987 x 1.58 = 1,559 CZK

Total capitalised price for the area = 49 350 x 1.58 = 77.973 CZK

Reduction of maximum runoff in water streams

Basic socio-economic price of individual qualitative characteristics of hydrological function the reduction of maximum runoff in water streams is 910 CZK/ha (annual) and 45,000 CZK/ha (capitalised). [3]

Corrective coefficients for calculation [3]:

Mean coefficient for the reduction of maximum runoff: 1.23

Coefficient for conversion to grassland (according the texture of soil): 0.7
Coefficient of the age and stand density (2a): 0.77
Coefficient of the age and stand density (3a): 0.81
Mean coefficient of the age and stand density: 0.79
Coefficient of value of forestland within watershed: 0.8
Coefficient of flood-prevention necessity: 0.5
Coefficient of health and quality of forest stand: 1.0

Calculation
Annual price = 910 x 1.23 x 0.7 x 0.79 x 0.8 x 0.5 x 1 = 248 CZK/ha
Capitalised price = 45000 x 1.23 x 0.7 x 0.79 x 0.8 x 0.5 x 1 = 12,243 CZK/ha

Total annual price for the area = 248 x 1.58 = 392 CZK
Total capitalised price for the area = 12 243 x 1.58 = 19,345 CZK

Enhancement of minimum runoff in water streams

Basic socio-economic price of individual qualitative characteristics of hydrological function the enhancement of minimum runoff in water streams for conversion to perennial grassland is 540 CZK/ha (annual) and 26,900 CZK/ha (capitalised). [3]

Corrective coefficients for calculation [3]:
Coefficient of prevention of desiccation necessity: 0.5
Coefficient of health and quality of forest stand: 1.0

Calculation
Annual price = 540 x 0.5 x 1 = 270 CZK/ha
Capitalised price = 26900 x 0.5 x 1 = 13,450 CZK/ha

Total annual price for the area = 270 x 1.58 = 427 CZK
Total capitalised price for the area = 13 450 x 1.58 = 21,251 CZK

Protection of water quality

Basic socio-economic price of individual qualitative characteristics of hydrological function the protection of water quality is 9,300 CZK/ha (annual) and 465,000 CZK/ha (capitalised). [3]

Because of water protection zones along Jevansky creek the local importance of water runoff is increased but just slightly because the area is not so large to hardly influence water quality.

Corrective coefficients for calculation [3]:

Coefficient of $N\text{-}NO_3$ difference (K1) = (18 – 7.19) : 20 = 0.5405

Coefficient of regional specific water runoff (K2) = 0.04 : 0.04 = 1

Coefficient K3 (according the local importance of water runoff)= 0.6

Calculation

Annual price = 9300 x 0.5405 x 1 x 0.6 = 3,016 CZK/ha

Capitalised price = 465000 x 0.5405 x 1 x 0.6 = 150,800 CZK/ha

Total annual price for the area = 3016 x 1.58 = 4,765 CZK

Total capitalised price for the area = 150 800 x 1.58 = 238,263 CZK

Protection against soil losses by introskeleton erosion

Danger of soil losses caused by introskeleton erosion for forest type 4K is very low. It is not necessary to compute a price of this soil-protective function because it is insignificant. [14]

Protection of streams and reservoirs against deposits of eroded soil parts

Age of stand, species composition and stand density are irrelevant factors for calculation because plot is not endangered by introskeleton erosion and values are almost identical. Annual price for conversion to perennial grassland is 1 CZK/ha. Capitalised price is 50 CZK/ha. [3]

Locality is not situated within a perimeter of water-supply reservoir. There are no corrective coefficients for calculations. It is possible to accept basic prices set by the manual [3].

Annual price = 1 CZK/ha

Capitalized price = 50 CZK/ha

Total annual price for the area = 1 x 1.58 = 2 CZK

Total capitalised price for the area = 50 x 1.58 = 79 CZK

Protection of air, sequestration of CO_2

Average socio-economic value of air-protective function the sequestration of CO_2 in Czech republic is 1,000 CZK/ha (annual) and 50,000 CZK/ha (capitalised). [3]

Coefficient for forest type 4K (acidophilous beech forest) [3]: 0.9

Calculation

Annual price = 1000 x 0.97 = 970 CZK/ha

Capitalised price = 50000 x 0.97 = 48,500 CZK/ha

Total annual price for the area = 970 x 1.58 = 1,533 CZK

Total capitalised price for the area = 48500 x 1.58 = 76,630 CZK

Health-hygienic (recreational) services

The plot is accessible by public – annual price is 2,573 CZK/ha and capitalised one is 128,650 CZK/ha. Approximately one half of given area (0.7 ha) is situated within 50 meters distance from tourist trail (annual price 7,521 CZK/ha, capitalised price 376,050 CZK/ha). [3]

The area was – for purpose of computation – divided into two parts: part one (P1 = 0.7 ha) within and part two (P2 = 0.88 ha) out of 50 meters distance from tourist trail, which were calculated separately. Results of these partial calculations were finally added up.

Annual price (P1) = 7,521 CZK/ha

Capitalised price (P1) = 376,050 CZK/ha

Annual price (P2) = 2,573 CZK/ha

Capitalised price (P2) = 128,650 CZK/ha

Total annual price for the area = (7521 x 0.7) + (2573 x 0.88) = 7.529 CZK

Total capitalised price for the area = (376 050 x 0.7) + (128 650 x 0.88) = 376,447 CZK

Mean annual price (433 3a/2a) = 7529 : 1.58 = 4,765 CZK/ha

Mean capitalised price (433 3a/2a) = 376 447 : 1.58 = 238,258 CZK/ha

Cultural-educational (scientific, conservational, institutional) services

The plot 433 C3a/2a is a part of national natural reserve (annual price 7,095 CZK/ha, capitalised price 354,750 CZK/ha) and, at the same time, part of supraregional biocentre of Territorial system of ecological stability (annual price 5,380 CZK/ha, capitalised price 269,000 CZK/ha), forest used for educational and research purposes (annual price 3,742 CZK/ha, capitalised price 187,100 CZK/ha) and commercial forest (annual price 2,183 CZK/ha, capitalised price 109,150 CZK/ha). [3]

These characteristics cover each other; former two ones are actually a different degrees of nature protection, third one is derived from them (most of protected areas are at the same time used for scientific or educational purposes) and fourth one is just a basic category that is covered by the others, more important. Because it is necessary to avoid the duplicity of services, only the highest price is valid; lower ones are not relevant.

For calculation it is appropriate to consider the plot 433 3a/2a as a part of national natural reserve with annual price 7,095 CZK/ha and capitalised price 354,750 CZK/ha. For conversion to grassland 73% of the commercial forest price is subtracted from the result. [3]

Correction of calculation [3]

Coefficient for degree of naturalness 2: 2.0

73% from 2 183 = 1593.6

73% from 109 150 = 79 679.5

Calculation

Annual price = (7095 x 2.0) – 1593.6 = 12,596 CZK/ha

Capitalised price = (354 750 x 2.0) – 79 679.5 = 629,821 CZK/ha

Total annual price for the area = 12 596 x 1.58 = 19,902 CZK

Total capitalised price for the area = 629 821 x 1.58 = 995,116 CZK

7.1.4. Plot 436 C9

Table 5: Local conditions within the plot 436 C9

Number		436 C9
Area (ha)		1.43
Forest type		4K3 – acidophilous beech forest
Age (yrs)		89
Stand density		9
Species composition	Larch *Larix decidua*	35%
	Spruce *Picea abies*	20%
	Beech *Fagus silvatica*	20%
	Hornbeam *Carpinus betulus*	10%
	Maple *Acer platanoides*	10%
	Oak *Quercus petraea*	5%
Degree of naturalness		4
Degree of damage		II

The plot 436 C9 is a narrow strip touching the tourist trail by its shorter side. It means just about one tenth (0.15 ha) of its area lies within 50 meters distance from the tourist trail. Locality is situated on steep east slope.

The forest management plan indicates there is a research plot no.011 of FLD CZU within the plot. But that area was not found in reality. Consultation with Ing. Remes (Department of silviculture, FLD CZU) showed it is probably an error in forest management plan. Research area no.011 is situated within the stand 436 C17 and accidentally it was written also into plans of neighboring plots.

According to the map of health condition of Czech forest in 2006 [URL7] there is medium degree of damage (II) of the stand.

Danger of soil losses for forest type 4K (acidophilous beech forest) is low. Danger of either floods or stream desiccation is low because area is not so large and even it was deforested the runoff from whole forest would not be influenced.

Wood production

Basic socio-economic price of wood production in CR is 7,375 CZK/ha (annual) and 36,750 CZK/ha (capitalised). [3]

Corrective coefficient for calculation [3]:

Coefficient of forest type 4K (acidophilous beech forest): 0.97

Calculation

Annual price = 7375 x 0.97 = 7,154 CZK/ha

Capitalised price = 368 750 x 0.97 = 357,688 CZK/ha

Total annual price for the area = 7154 x 1.43 = 10,230 CZK

Total capitalised price for the area = 357 688 x 1.43 = 511,494 CZK

Hunting and game management

Conversion of the area to perennial grassland does not limit life space of forest game and does not endanger it. Both game management even hunting are not influenced by the process of conversion, so it is not necessary to calculate price of given service. (see page 10)

Non-wood production

The plot is not berries-type of forest. Basic socio-economic price of non-wood production within non-berries forests is 987 CZK/ha (annual) and 49,350 CZK/ha (capitalised). [3]

There are no corrective coefficients for calculations. It is possible to accept basic prices set by the manual [3].

Annual price = 987 CZK/ha

Capitalised price = 49,350 CZK/ha

Total annual price for the area = 987 x 1.43 = 1,411 CZK

Total capitalised price for the area = 49 350 x 1.43 = 70,571 CZK

Reduction of maximum runoff in water streams

Basic socio-economic price of individual qualitative characteristics of hydrological function the reduction of maximum runoff in water streams is 910 CZK/ha (annual) and 45,000 CZK/ha (capitalised). [3]

Corrective coefficients for calculation [3]:

Mean coefficient for the reduction of maximum runoff: 1.23

Coefficient for conversion to grassland (according the texture of soil): 0.7

Coefficient of the age and stand density: 0.97

Coefficient of value of forestland within watershed: 0.8

Coefficient of flood-prevention necessity: 0.5

Coefficient of health and quality of forest stand: 0.75

Calculation

Annual price = 910 x 1.23 x 0.7 x 0.97 x 0.8 x 0.5 x 0.75 = 228 CZK/ha

Capitalised price = 45000 x 1.23 x 0.7 x 0.97 x 0.8 x 0.5 x 0.75 = 11,275 CZK/ha

Total annual price for the area = 228 x 1.43 = 326 CZK

Total capitalised price for the area = 11 275 x 1.43 = 16,123 CZK

Enhancement of minimum runoff in water streams

Basic socio-economic price of individual qualitative characteristics of hydrological function the enhancement of minimum runoff in water streams for conversion to perennial grassland is 540 CZK/ha (annual) and 26,900 CZK/ha (capitalised). [3]

Corrective coefficients for calculation [3]:

Coefficient of prevention of desiccation necessity: 0.5

Coefficient of health and quality of forest stand: 0.75

Calculation

Annual price = 540 x 0.5 x 0.75 = 203 CZK/ha

Capitalised price = 26900 x 0.5 x 0.75 = 10,088 CZK/ha

Total annual price for the area = 203 x 1.43 = 290 CZK

Total capitalised price for the area = 10 088 x 1.43 = 14,425 CZK

Protection of water quality

Basic socio-economic price of individual qualitative characteristics of hydrological function the protection of water quality is 9,300 CZK/ha (annual) and 465,000 CZK/ha (capitalised). [3]

Because of water protection zones along Jevansky creek the local importance of water runoff is increased but just slightly because the area is not so large to hardly influence water quality.

Corrective coefficients for calculation [3]:

Coefficient of $N\text{-}NO_3$ difference (K1) = (18 – 7.19) : 20 = 0.5405

Coefficient of regional specific water runoff (K2) = 0.04 : 0.04 = 1

Coefficient K3 (according the local importance of water runoff)= 0.6

Calculation

Annual price = 9300 x 0.5405 x 1 x 0.6 = 3,016 CZK/ha

Capitalised price = 465000 x 0.5405 x 1 x 0.6 = 150,800 CZK/ha

Total annual price for the area = 3016 x 1.43 = 4,313 CZK

Total capitalised price for the area = 150 800 x 1.43 = 215,644 CZK

Protection against soil losses by introskeleton erosion

Danger of soil losses caused by introskeleton erosion for forest type 4K3 is very low. It is not necessary to compute a price of this soil-protective function because it is insignificant. [14]

Protection of streams and reservoirs against deposits of eroded soil parts

Age of stand, species composition and stand density are irrelevant factors for calculation because plot is not endangered by introskeleton erosion and values are almost identical. Annual price for conversion to perennial grassland is 1 CZK/ha. Capitalised price is 50 CZK/ha. [3]

Locality is not situated within a perimeter of water-supply reservoir. There are no corrective coefficients for calculations. It is possible to accept basic prices set by the manual [3].

Annual price = 1 CZK/ha

Capitalized price = 50 CZK/ha

Total annual price for the area = 1 x 1.43 = 1 CZK
Total capitalised price for the area = 50 x 1.43 = 72 CZK

Protection of air, sequestration of CO_2

Average socio-economic value of air-protective function the sequestration of CO_2 in Czech republic is 1,000 CZK/ha (annual) and 50,000 CZK/ha (capitalised). [3]
Coefficient for forest type 4K (acidophilous beech forest) [3]: 0.97

Calculation
Annual price = 1000 x 0.97 = 970 CZK/ha
Capitalised price = 50000 x 0.97 = 48,500 CZK/ha
Total annual price for the area = 970 x 1.43 = 1,387 CZk
Total capitalised price for the area = 48500 x 1.43 = 69,355 CZk

Health-hygienic (recreational) services

The plot is accessible by public – annual price is 2,573 CZK/ha and capitalised one is 128,650 CZK/ha. Approximately one tenth of given area (0.15 ha) is situated within 50 meters distance from tourist trail (annual price 7,521 CZK/ha, capitalised price 376,050 CZK/ha). [3]

The area was – for purpose of computation – divided into two parts: part one (P1 = 0.15 ha) within and part two (P2 = 1.28 ha) out of 50 meters distance from tourist trail, which were calculated separately. Results of these partial calculations were finally added up.

Annual price (P1) = 7,521 CZK/ha
Capitalised price (P1) = 376,050 CZK/ha
Annual price (P2) = 2,573 CZK/ha
Capitalised price (P2) = 128,650 CZK/ha

Total annual price for the area = (7521 x 0.15) + (2573 x 1.28) = 4.422 CZK
Total capitalised price for the area = (376 050 x 0.15) + (128 650 x 1.28) = 221,080 CZK

Mean annual price (436 C9) = 4422 : 1.43 = 3.092 CZK/ha
Mean capitalised price (436 C9) = 221 080 : 1.43 = 154.601 CZK/ha

Cultural-educational (scientific, conservational, institutional) services

The plot 436 C9 is a part of national natural reserve (annual price 7,095 CZK/ha, capitalised price 354,750 CZK/ha) and, at the same time, part of supraregional biocentre of Territorial system of ecological stability (annual price 5,380 CZK/ha, capitalised price 269,000 CZK/ha), forest used for educational and research purposes (annual price 3,742 CZK/ha, capitalised price 187,100 CZK/ha) and commercial forest (annual price 2,183 CZK/ha, capitalised price 109,150 CZK/ha). [3]

These characteristics cover each other; former two ones are actually a different degrees of nature protection, third one is derived from them (most of protected areas are at the same time used for scientific or educational purposes) and fourth one is just a basic category that is covered by the others, more important. Because it is necessary to avoid the duplicity of services, only the highest price is valid; lower ones are not relevant.

For calculation it is appropriate to consider the plot 436 C9 as a part of national natural reserve with annual price 7,095 CZK/ha and capitalised price 354,750 CZK/ha. For conversion to grassland 73% of the commercial forest price is subtracted from the result. [3]

Correction of calculation [3]

Coefficient for degree of naturalness 4: 1.0

73% from 2 183 = 1593.6

73% from 109 150 = 79 679.5

Calculation

Annual price = (7095 x 1.0) – 1593.6 = 5,501 CZK/ha

Capitalised price = (354 750 x 1.0) – 79 679.5 = 275,071 CZK/ha

Total annual price for the area = 5 501 x 1.43 = 7,867 CZK

Total capitalised price for the area = 629 821 x 1.43 = 393,351 CZK

7.1.5. Plot 436 C17

Table 6: Local conditions within the plot 436 C17

Number		436 C17
Area (ha)		10.21
Forest type		4B1 – herb-rich beech forest
Age (yrs)		179
Stand density		8
Species composition	Beech *Fagus silvatica*	97%
	Oak *Quercus petraea*	3%
Degree of naturalness		2
Degree of damage		IIIa

The plot 436 C17 is the biggest one from five of selected areas. It is situated along the tourist trail, approximately one tenth (1 ha) lies within 50 meters distance from the tourist trail. Locality is situated on steep east slope.

Within the plot there is scattered small amount of spruces, larches, hornbeams and pines. In southwest part a calamity gap occurs.

There is also a research plot no.011 (1 ha) of FLD CZU focused on natural regeneration of beeches. Furthermore, there is one specimen of selection tree of spruce (*P.abies*) within the stand.

According to the map of health condition of Czech forest in 2006 [URL7] there is heavy degree of damage (III) on most of the stand.

Danger of soil losses for forest type 4B (herb-rich beech forest) is low. Danger of floods is average because area is quite large. But it is situated within watershed with high percentage of forestland, so even it was deforested the runoff from whole forest would not be hardly influenced. Danger of stream desiccation is average.

Wood production

Basic socio-economic price of wood production in CR is 7,375 CZK/ha (annual) and 368,750 CZK/ha (capitalised). [3]

Corrective coefficient for calculation [3]:

Coefficient of forest type 4B (herb-rich beech forest): 1.60

Calculation

Annual price = 7375 x 1.60 = 11,800 CZK/ha

Capitalised price = 368 750 x 1.60 = 590,000 CZK/ha

Total annual price for the area = 11 800 x 10.21 = 120,478 CZK

Total capitalised price for the area = 590 000 x 10.21 = 6,023,900 CZK

Hunting and game management

Basic socio-economic price of hunting and game management is 170 CZK/ha (annual) and 8,500 CZK/ha (capitalised). For forests without intensified game management (pheasantries etc.) there are no corrective coefficients. [3]

Annual price = 170 CZK/ha

Capitalised price = 8,500 CZK/ha

Total annual price for the area = 170 x 10.21 = 1,736 CZK

Total capitalised price for the area = 8 500 x 10.21 = 86,785 CZK

Non-wood production

The plot is not berries-type of forest (forest type 4B). Basic socio-economic price of non-wood production within non-berries forests is 987 CZK/ha (annual) and 49.350 CZK/ha (capitalised). [3]

There are no corrective coefficients for calculations. It is possible to accept basic prices set by the manual [3].

Annual price = 987 CZK/ha

Capitalised price = 49,350 CZK/ha

Total annual price for the area = 987 x 10.21 = 10,077 CZK

Total capitalised price for the area = 49 350 x 10.21 = 503,864 CZK

Reduction of maximum runoff in water streams

Basic socio-economic price of individual qualitative characteristics of hydrological function the reduction of maximum runoff in water streams is 910 CZK/ha (annual) and 45,000 CZK/ha (capitalised). [3]

Regarding to more than 10 hectares of the plot the risk of flood is slightly increased but considering total area of forestland in given watershed a danger of potential flood is not serious.

Corrective coefficients for calculation [3]

Average coefficient for the reduction of maximum runoff: 1.23

Coefficient for conversion to grassland (according the texture of soil): 0.7

Coefficient of the age and stand density: 0.94

Coefficient of value of forestland within watershed: 0.8

Coefficient of flood-prevention necessity: 0.6

Coefficient of health and quality of forest stand: 0.6

Calculation

Annual price = 910 x 1.23 x 0.7 x 0.94 x 0.8 x 0.6 x 0.6 = 212 CZK/ha

Capitalised price = 45000 x 1.23 x 0.7 x 0.94 x 0.8 x 0.6 x 0.6 = 10,490 CZK/ha

Total annual price for the area = 212 x 10.21 = 2,159 CZK

Total capitalised price for the area = 10 490 x 10.21 = 107,098 CZK

Enhancement of minimum runoff in water streams

Basic socio-economic price of individual qualitative characteristics of hydrological function the enhancement of minimum runoff in water streams for conversion to perennial grassland is 540 CZK/ha (annual) and 26,900 CZK/ha (capitalised). [3]

Corrective coefficients for calculation

Coefficient of prevention of desiccation necessity: 0.6

Coefficient of health and quality of forest stand: 0.6

Calculation

Annual price = 540 x 0.6 x 0.6 = 195 CZK/ha

Capitalised price = 26900 x 0.6 x 0.6 = 9,684 CZK/ha

Total annual price for the area = 195 x 10.21 = 1,991 CZK

Total capitalised price for the area = 3228 x 10.21 = 98,874 CZK

Protection of water quality

Basic socio-economic price of individual qualitative characteristics of hydrological function the protection of water quality is 9,300 CZK/ha (annual) and 465,000 CZK/ha (capitalised). [3]

Because water protection zones along Jevansky creek the local importance of water runoff is slightly increased.

Corrective coefficients for calculation [3]:

Coefficient of $N\text{-}NO_3$ difference (K1) = (18 – 7.19) : 20 = 0.5405

Coefficient of regional specific water runoff (K2) = 0.04 : 0.04 = 1

Coefficient K3 (according the local importance of water runoff) = 0.6

Calculation

Annual price = 9300 x 0.5405 x 1 x 0.6 = 3,016 CZK/ha

Capitalised price = 465000 x 0.5405 x 1 x 0.6 = 150,800 CZK/ha

Total annual price for the area = 3016 x 10.21 = 30,793 CZK

Total capitalised price for the area = 150 800 x 10.21 = 1,539,668 CZK

Protection against soil losses by introskeleton erosion

Danger of soil losses caused by introskeleton erosion for forest type 4B1 is very low. It is not necessary to compute a price of this soil-protective function because it is insignificant. [14]

Protection of streams and reservoirs against deposits of eroded soil parts

Age of stand, species composition and stand density are irrelevant factors for calculation because plot is not endangered by introskeleton erosion and values are almost identical. Annual price for conversion to perennial grassland is 1 CZK/ha. Capitalised price is 50 CZK/ha. [3]

Locality is not situated within a perimeter of water-supply reservoir. There are no corrective coefficients for calculations. It is possible to accept basic prices set by the manual [3].

Annual price = 1 CZK/ha
Capitalized price = 50 CZK/ha

Total annual price for the area = 1 x 10.21 = 10 CZK
Total capitalised price for the area = 50 x 10.21 = 511 CZK

Protection of air, sequestration of CO_2

Average socio-economic value of air-protective function the sequestration of CO_2 in Czech republic is 1,000 CZK/ha (annual) and 50,000 CZK/ha (capitalised). [3]
Coefficient for forest type 4B (herb-rich beech forest) [3]: 1.60

Calculation
Annual price = 1000 x 1.60 = 1,600 CZK/ha
Capitalised price = 50000 x 1.60 = 80,000 CZK/ha

Total annual price for the area = 1600 x 10.21 = 16,336 CZK
Total capitalised price for the area = 80 000 x 10.21 = 816,800 CZK

Health-hygienic (recreational) services

The plot is accessible by public – annual price is 2,573 CZK/ha and capitalised one is 128,650 CZK/ha. Approximately one tenth of given area (1 ha) is situated within 50 meters distance from tourist trail (annual price 7,521 CZK/ha, capitalised price 376,050 CZK/ha). [3]

The area was – for purpose of computation – divided into two parts: part one (P1 = 1 ha) within and part two (P2 = 9.21 ha) out of 50 meters distance from tourist trail, which were calculated separately. Results of these partial calculations were finally added up.

Annual price (P1) = 7,521 CZK/ha
Capitalised price (P1) = 376,050 CZK/ha
Annual price (P2) = 2,573 CZK/ha
Capitalised price (P2) = 128,650 CZK/ha

Total annual price for the area = (7521 x 1) + (2573 x 9.21) = 31,218 CZK
Total capitalised price for the area = (376050 x 1) + (128 650 x 9.21) = 1,560,917 CZK

Mean annual price (436 C17) = 31218 : 10.21 = 3,058 CZK/ha
Mean capitalised price (436 C17) = 1560917 : 10.21 = 152,881 CZK/ha

Cultural-educational (scientific, conservational, institutional) services

The plot 436 C17 is a part of national natural reserve (annual price 7,095 CZK/ha, capitalised price 354,750 CZK/ha) and, at the same time part of supraregional biocentre of Territorial system of ecological stability (annual price 5,380 CZK/ha, capitalised price 269,000 CZK/ha), forest used for educational and research purposes (annual price 3,742 CZK/ha, capitalised price 187,100 CZK/ha) and commercial forest (annual price 2,183 CZK/ha, capitalised price 109,150 CZK/ha). Furthermore, there is a stable research plot of Department of silviculture of FLD CZU (annual price 4,834 CZK/ha, capitalised price 241,700 CZK/ha). [3]

These characteristics cover each other; former two ones are actually a different degrees of nature protection, third one is derived from them (most of protected areas are at the same time used for scientific or educational purposes) and fourth one is just a basic characteristic that is covered by the others, more important. Because it is necessary to avoid the duplicity of services, only the highest price is valid; lower ones are not relevant. But – stable research plot is a special case, which must be added extra. It is because it has its specific purpose and it is monitored in long term. Potential damage would interrupt and devalue whole research.

For calculation it is appropriate to divide the stand into research area (P1 = 1 ha) and the rest (P2 = 9.21 ha) and consider part P2 as a part of national natural reserve with annual price 7,095 CZK/ha and capitalised price 354,750 CZK/ha. Price of the research area P1 shall be higher of 4,834 CZK/ha annually and of 241,700 CZK/ha perpetually. For conversion to grassland 73% of the commercial forest price is subtracted from the result. [3]

Correction of calculation [3]

Coefficient for degree of naturalness 2: 2.0

73% from 2 183 = 1593.6

73% from 109 150 = 79 679.5

Calculation

Annual price (P1) = (7095 x 2.0) + 4 834 – 1593.6 = 17,484 CZK/ha

Capitalised price (P1) = (354750 x 2.0) + 241 700 – 79 679.5 = 871,521 CZK/ha

Annual price (P2) = (7095 x 2.0) – 1593.6 = 12,596 CZK/ha

Capitalised price (P2) = (354750 x 2.0) – 79 679.5 = 629,821 CZK/ha

Total annual price for the area = (17484 x 1) + (12596 x 9.21) = 133,493 CZK

Total capitalised price for the area = (871521 x 1) + (629821 x 9.21) = 6,672,172 CZK

Mean annual price (436 C17) = 133493 : 10.21 = 13,075 CZK/ha

Mean capitalised price (436 C17) = 6672172 : 10.21 = 653,494 CZK/ha

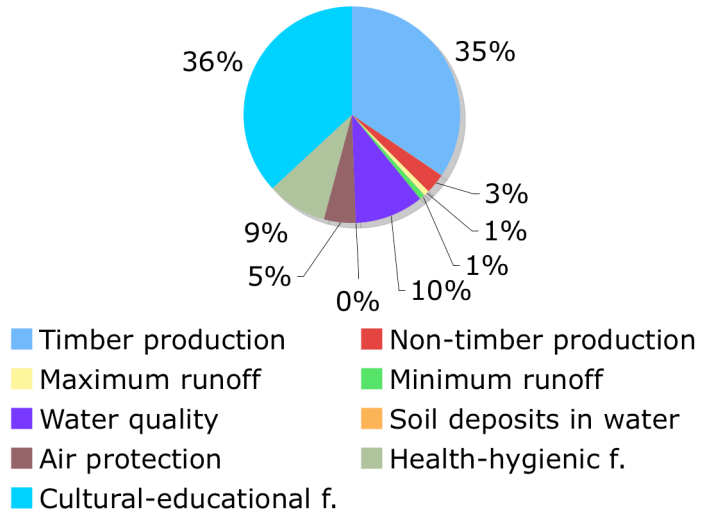
7.2. Final results

Plot 434 F5

Table 7 : Prices of forest services within the plot 434 F5

Forest service	Price (CZK/ha)	
	Annual	Capitalised
Timber production	11 800	590 000
Hunting and game management	0	0
Non-timber production	987	49 350
Hydrological – maximum runoffs	279	13 793
- minimum runoffs	270	13 450
- water quality in streams and reservoirs	3 519	175 933
Soil protection – introskeleton erosion	0	0
- soil deposits in streams, reservoirs	1	50
Air protection – CO_2 sequestration	1 600	80 000
Health-hygienic	3 090	154 511
Cultural-educational	12 596	629 821
Total per hectare	34 142	1 706 908
Total (for the area 2,87 ha)	**97 988**	**4 898 826**

Chart 1: **Percentage of forest services prices (plot 434 F5)**

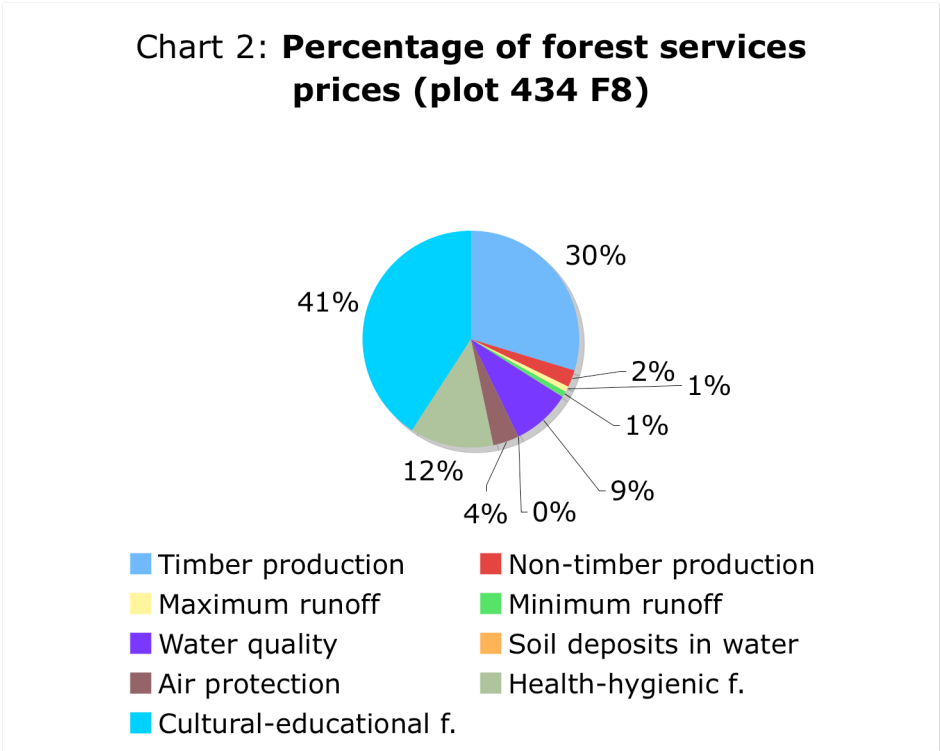


Plot 434 F8

Table 8 : Prices of forest services within the plot 434 F8

Forest service	Price (CZK/ha)	
	Annual	**Capitalised**
Timber production	11 800	590 000
Hunting and game management	0	0
Non-timber production	987	49 350
Hydrological – maximum runoffs	307	15 188
- minimum runoffs	270	13 450
- water quality in streams and reservoirs	3 519	175 933
Soil protection – introskeleton erosion	0	0
- soil deposits in streams, reservoirs	1	50
Air protection – CO_2 sequestration	1 600	80 000
Health-hygienic	4 901	245 074
Cultural-educational	16 144	807 196
Total per hectare	39 529	1 976 241
Total (for the area 2,55 ha)	**100 799**	**5 039 415**

Chart 2: **Percentage of forest services prices (plot 434 F8)**

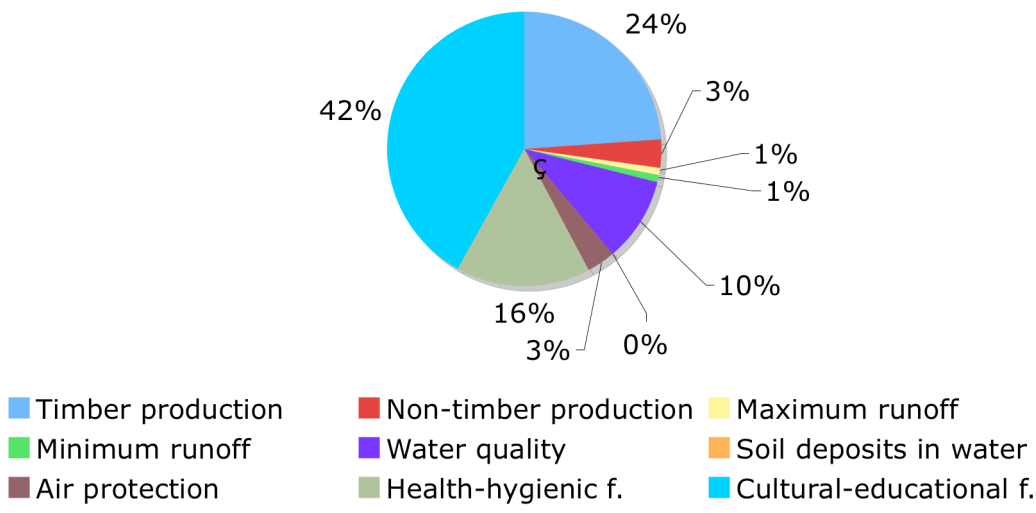


Plot 433 C3a/2a

Table 9 : Prices of forest services within the plot 433 C3a/2a

Forest service		Price (CZK/ha)	
		Annual	Capitalised
Timber production		7 154	357 688
Hunting and game management		0	0
Non-timber production		987	49 350
Hydrological	– maximum runoffs	248	12 243
	- minimum runoffs	270	13 450
	- water quality in streams and reservoirs	3 016	150 800
Soil protection	– introskeleton erosion	0	0
	- soil deposits in streams, reservoirs	1	50
Air protection – CO_2 sequestration		970	48 500
Health-hygienic		4 765	238 258
Cultural-educational		12 596	629 821
Total per hectare		30 007	1 500 160
Total (for the area 1,58 ha)		**47 411**	**2 370 253**

Chart 3: **Percentage of forest services prices (plot 433 C3a/2a)**

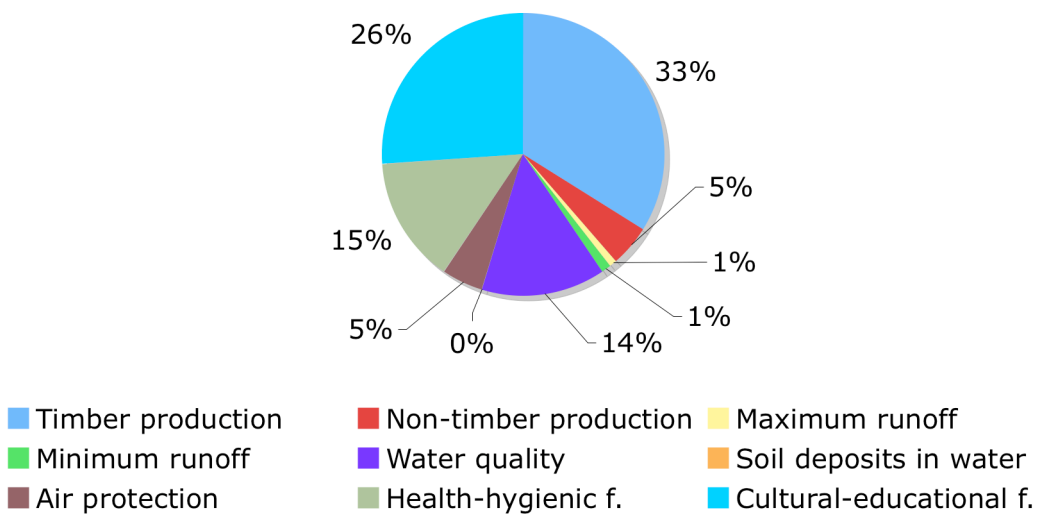


Plot 436 C9

Table 10 : Prices of forest services within the plot 436 C9

Forest service		Price (CZK/ha)	
		Annual	Capitalised
Timber production		7 154	357 688
Hunting and game management		0	0
Non-timber production		987	49 350
Hydrological	– maximum runoffs	228	11 275
	- minimum runoffs	203	10 088
	- water quality in streams and reservoirs	3 016	150 800
Soil protection	– introskeleton erosion	0	0
	- soil deposits in streams, reservoirs	1	50
Air protection – CO_2 sequestration		970	48 500
Health-hygienic		3 092	154 601
Cultural-educational		5 501	275 071
Total per hectare		21 152	1 057 423
Total (for the area 1,43 ha)		**30 247**	**1 512 115**

Chart 4: **Percentage of forest services prices (plot 436 C9)**

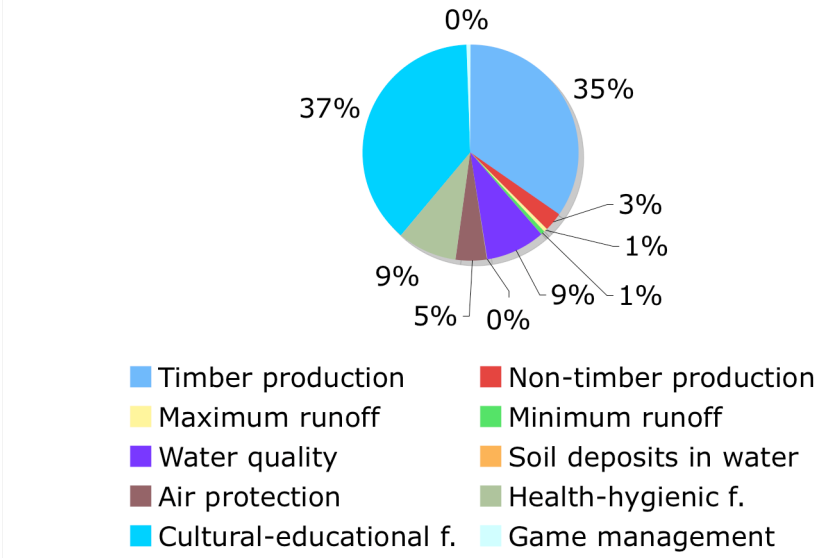


Plot 436 C17

Table 11 : Prices of forest services within the plot 436 C17

Forest service	Price (CZK/ha)	
	Annual	Capitalised
Timber production	11 800	590 000
Hunting and game management	170	8 500
Non-timber production	987	49 350
Hydrological – maximum runoffs	212	10 490
- minimum runoffs	195	9 684
- water quality in streams and reservoirs	3 016	150 800
Soil protection – introskeleton erosion	0	0
- soil deposits in streams, reservoirs	1	50
Air protection – CO_2 sequestration	1 600	80.000
Health-hygienic	3 058	152 881
Cultural-educational	13 075	653 494
Total per hectare	34 114	1 705 249
Total (for the area 10,21 ha)	**348 304**	**17 410 592**

Chart 5: **Percentage of forest services prices (436 C17)**



8. CONCLUSION

The aim of the thesis was to get socio-economic prices of selected forest stands and to investigate how it is – for student or non-trained professional – to proceed according the manual [3] "Methodology of socio-economic valuation of forest services".

8.1. Summary of the results

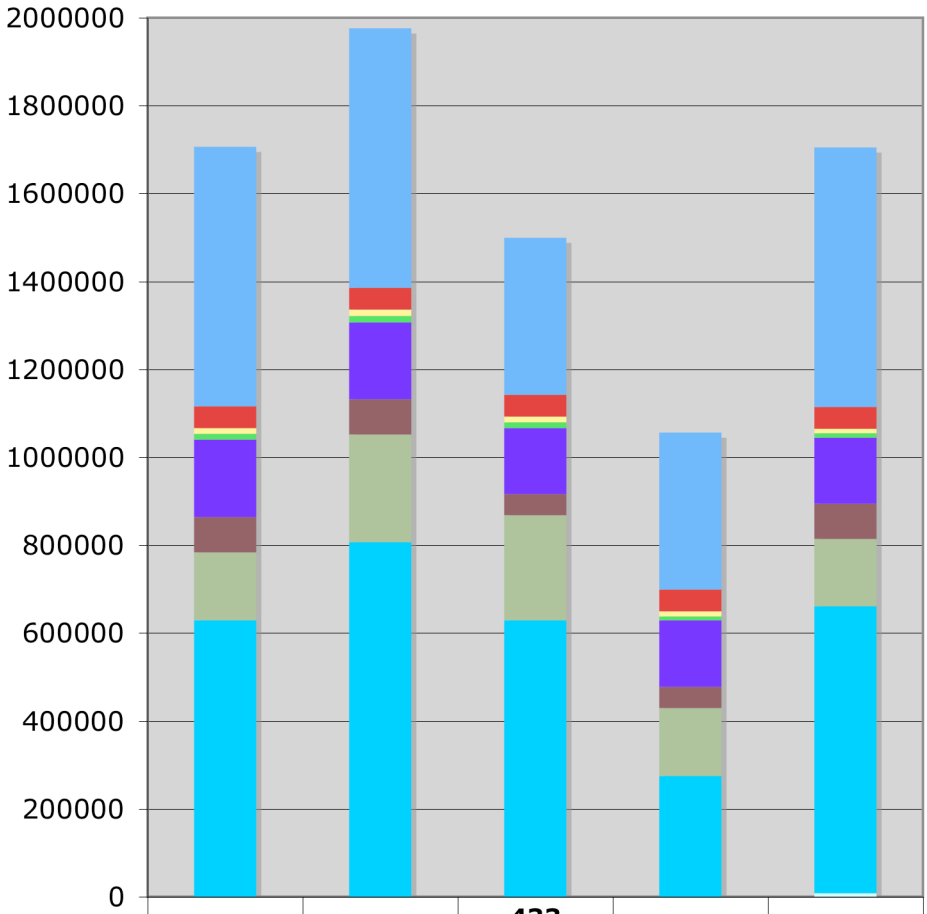
According to expectation the cultural-educational function is the most significant service influencing the final value of a given stands. It is simply because of national natural reserve with close-to-nature species composition, in which the plots are situated. Also research purposes (and mainly stable research plots) play very important role. From the chart 6 (page 52) it is obvious that the lowest price of cultural-educational function is reached within the plot 436 C9 on account of high percentage of allochthonous tree species (*Larix decidua, Picea abies*).

The timber production service is of the second highest importance. It is because of the fact the forest type 4B (herb-rich beech forest) is of high timber production quality. Again, the plot 436 C9 - and plot 433 C3a/2a – reaches the lowest prices. These two stands are of acidophilous beech forest type (4K) – with worse production potential than other plots.

Furthermore, the water quality protective service is of heightened significance. In the neighborhood of the plots 434 F5 and 434 F8 there is situated a spring of drinkable water and the runoffs from all the plots are caught by Jevansky creek, which marks the lower bound of water protection zones of second protection level.

Remaining services are, for given extent of plots areas, just minimally damaged by the conversion to grassland. For instance game management is not limited and its price was not computed on the most of the plots (see page 10). According to expectation even in the case of the largest plot 436 C17 the price of that service does not reach neither 1% of total socio-economic value of the plot.

Chart 6: Comparison of forest services prices within all the plots (capitalised value, CZK/ha)



	434 F5	434 F8	433 C3a/2a	436 C9	436 C17
Wood production	590000	590000	357688	357688	590000
Non-wood production	49350	49350	49350	49350	49350
Maximum runoff	13793	15188	12243	11275	10490
Minimum runoff	13450	13450	13450	10088	9684
Water quality	175933	175933	150800	150800	150800
Soil deposits in water	50	50	50	50	50
Air protection	80000	80000	48500	48500	80000
Health-hygienic f.	154511	245074	238258	154601	152881
Cultural educational f.	629821	807196	629821	275071	653494
Game management	0	0	0	0	8500
Introskeleton erosion	0	0	0	0	0

Chart 7: Percentage of forest services prices within all the plots

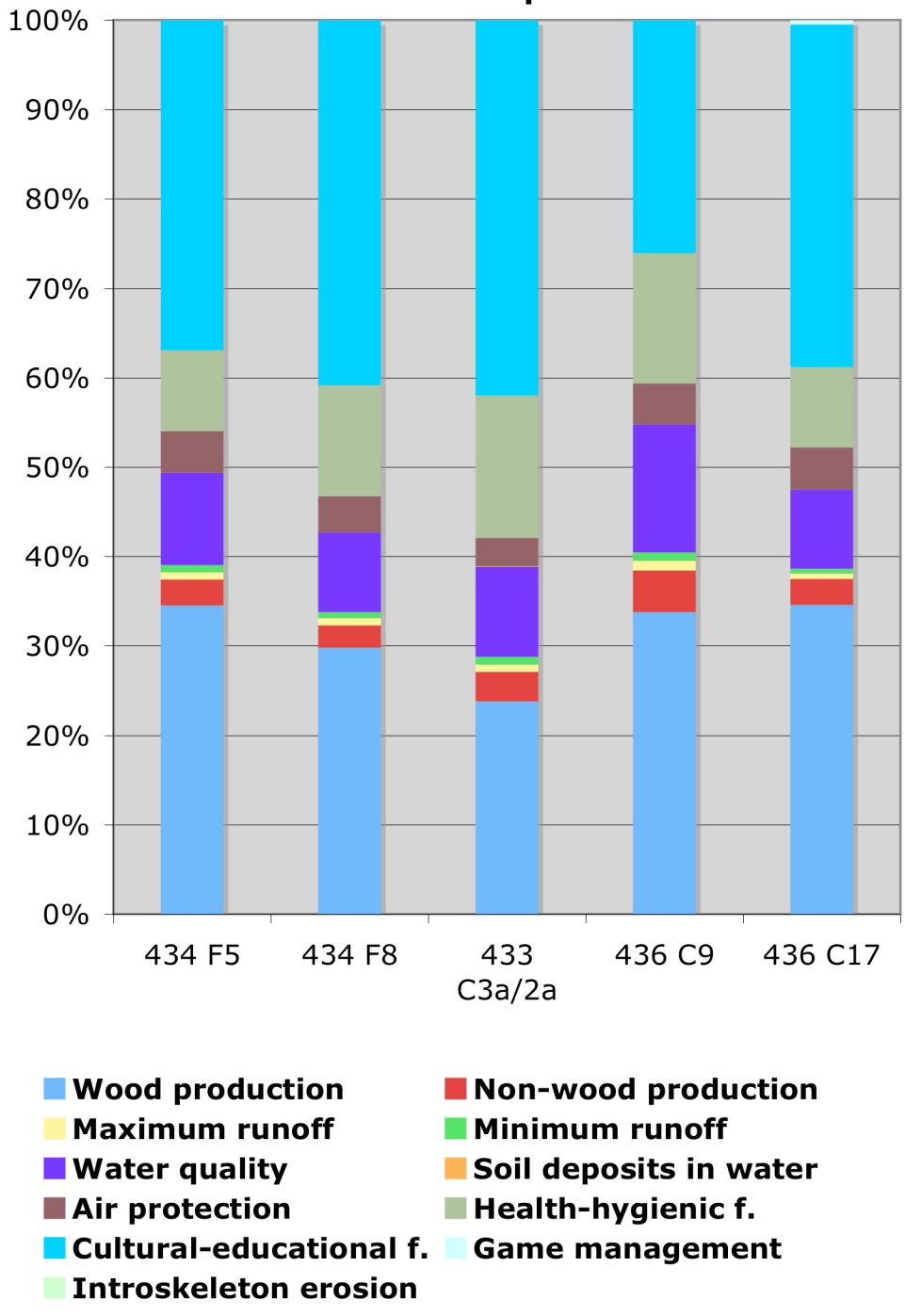


Table 12: Capitalised forest services prices and their percentage within all the plots

	434 F5		434 F8	
	CZK/ha	%	CZK/ha	%
Timber production	590 000	35	590 000	30
Game management	0	0	0	0
Non-wood production	49 350	3	49 350	2
Maximum runoff	13 793	1	15 188	1
Minimum runoff	13 450	1	13 450	1
Water quality	175 933	10	175 933	9
Introskeleton erosion	0	0	0	0
Soil deposits in water	50	0	50	0
Air protection	80 000	5	80 000	4
Health-hygienic f.	154 511	9	245 074	12
Cultural-educational f.	629 821	36	807 196	41

	433 C3a/2a		436 C9	
	CZK/ha	%	CZK/ha	%
Timber production	357 688	24	357 688	33
Game management	0	0	0	0
Non-wood production	49 350	3	49 350	5
Maximum runoff	12 243	1	11 275	1
Minimum runoff	13 450	1	10 088	1
Water quality	150 800	10	150 800	14
Introskeleton erosion	0	0	0	0
Soil deposits in water	50	0	50	0
Air protection	48 500	3	48 500	5
Health-hygienic f.	238 258	16	154 601	15
Cultural-educational f.	629 821	42	275 071	26

	436 C17	
	CZK/ha	%
Timber production	590 000	35
Game management	8 500	0
Non-wood production	49 350	3
Maximum runoff	10 490	1
Minimum runoff	9 684	1
Water quality	150 800	9
Introskeleton erosion	0	0
Soil deposits in water	50	0
Air protection	80 000	5
Health-hygienic f.	152 881	9
Cultural-educational f.	653 494	37

8.2. Brief evaluation of applied method

The manual [3] has to be, from its principle, continually adjusted to reflect actual prices. Thus it is subject of permanent improving and comments of the users could help to make next issue of *Methodology* clearer and more effective. Manual is targeted on foresters and specialists, not on (laic) public. But even professionals can be sometimes little bit confused if they are solving such assignment for the first time. Computation procedure of most of the services is understandable and easy but some parts or formulations should be clearer and mainly data availability must improve.

The most considerable problem in the time of thesis solving was not matter of proper manual – it was a lack of quality maps. Maps of forest damages (quality of forest stands) available on http://www.geoportal2.uhul.cz/index.php are very rough and it is almost impossible to take an orientation within it. Maps of potential introskeleton erosion on http://www.infodatasys.cz/lesnioblasti/default.htm have not been ready yet for some of forest natural areas. Also maps of potential water erosion (Stehlik's classification) on http://www.uhul.cz/ did not work in the time of research and it was necessary to find it in another way. Hand-made maps included in manual are just approximate.

There is also an obscurity in computation of cultural-educational services prices. In the manual there is a Table no.11 (page 23), which summarizes various qualitative characteristics of forests. Most of them cover each other (they are just different levels of nature protection) and a reader is not able to recognize if it is necessary to add them together or if the highest value is relevant and valid only. In the manual (issue from 2006) some explanation is missing. This part had to be consulted with Prof. Sisak, the responsible author. The second - but not so important - problem in solving of cultural-educational functions is subtraction of (some specific) percent of the commercial forest from the result. But that problem is just matter of imperfect formulation and it is possible to take it from comparison with a solved model examples. Unfortunately, these examples are missing in the newest issue of manual (2006). There is probably an assumption of knowledge of older issue [10] of the manual in which are included both model examples even brief explanation of mentioned calculations.

The differentiated method is appropriate mainly for calculation of compensation in the case of damages, deforestation, limitation of public benefits or withdrawal of forestland designated for

the fulfillment of forest services.

The advantages of the differentiated method are minimal financial costs, small personal casting and savings of the time and, concurrently, special approach to each forest service and respect to specific local conditions.

Furthermore, that method is simply and transparent. From the calculations it is obvious, which factors (parameters) influence the final prices of an individual services. So, although the services are valued and accelerated subjectively, thus it is possible to recognize the preferences of a researcher and, potentially, start disputation on results.

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Ordinance MF 540/2002 O ocenovani majetku (Estate valuation)

List of abbreviations

CR - Czech republic

CZU - Czech university of life sciences

FLD - Faculty of Forestry and Wood Sciences

LDF - Faculty of Forestry and Wood Technology

LVS - Forest vegetation tier

MF - Ministry of finance

Mze - Ministry of agriculture

MZLU - Mendel University of Agriculture and Forestry in Brno

PLO - Natural forest area

TTP - grassland

UFE - University forest enterprise (Skolni lesni podnik – SLP)

USES - Territorial system of ecological stability

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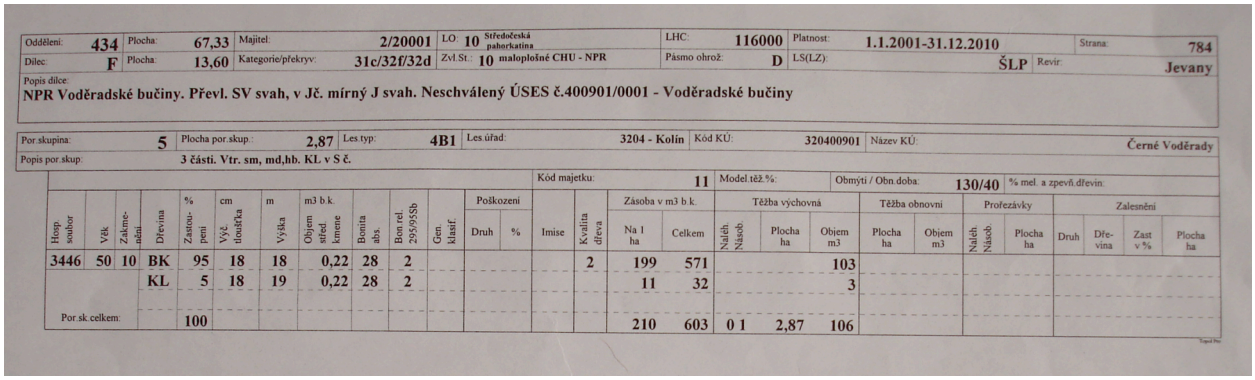
11. Appendixes

Appendix 1: Stand map of Voderadske buciny

Source: Forest Management Plan (LHP)

Appendix 2: Forest management plan (LHP) – Plot 434 F5



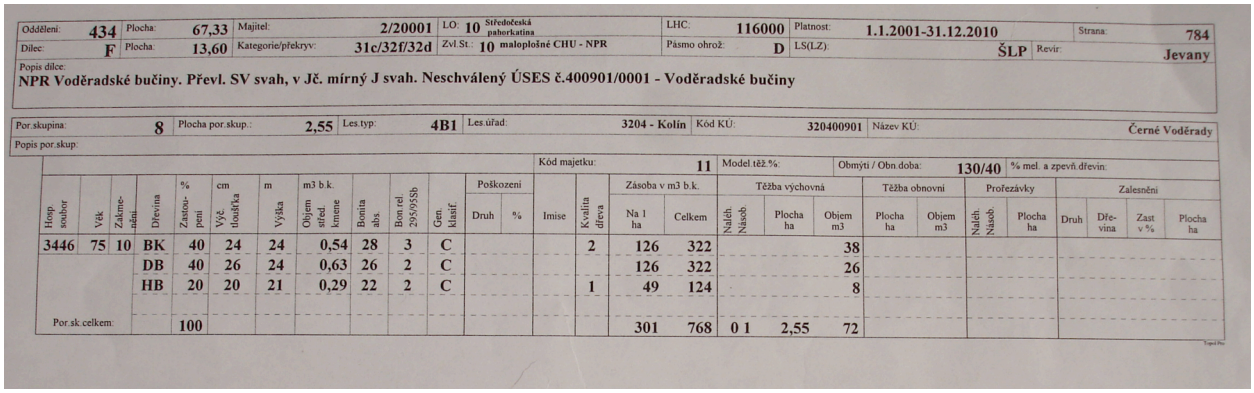
Oddělení: 434 | Plocha: 67,33 | Majitel: 2/20001 | LO: 10 Středočeská pahorkatina | LHC: 116000 | Platnost: 1.1.2001-31.12.2010 | Strana: 784
Dílec: F | Plocha: 13,60 | Kategorie/překryv: 31c/32f/32d | Zvl.St.: 10 maloplošné CHU - NPR | Pásmo ohrož: D | LS(LZ): ŠLP | Revír: Jevany
Popis dílce: NPR Voděradské bučiny. Převl. SV svah, v Jč. mírný J svah. Neschválený ÚSES č.400901/0001 - Voděradské bučiny

Por.skupina: 5 | Plocha por.skup.: 2,87 | Les.typ: 4B1 | Les.úřad: 3204 - Kolín | Kód KÚ: 320400901 | Název KÚ: Černé Voděrady
Popis por.skup: 3 části. Vtr. sm, md,hb. KL v S č.

Kód majetku: 11 | Model.těž.%: | Obmýtí / Obn.doba: 130/40 | % mel. a zpevň.dřevin:

Hosp. soubor	Věk	Zakme-nění	Dřevina	% Zastou-pení	cm Výč. tloušťka	m Výška	m3 b.k. Objem střed. kmene	Bonita abs.	Bon.rel. 29/59Sb	Gen. klasif.	Poškození Druh	Poškození %	Imise	Kvalita dřeva	Zásoba v m3 b.k. Na 1 ha	Zásoba v m3 b.k. Celkem	Těžba výchovná Naléh. Násob.	Těžba výchovná Plocha ha	Těžba výchovná Objem m3	Těžba obnovní Plocha ha	Těžba obnovní Objem m3	Prořezávky Naléh. Násob.	Prořezávky Plocha ha	Zalesnění Druh	Zalesnění Dře-vina	Zalesnění Zast v %	Zalesnění Plocha ha
3446	50	10	BK	95	18	18	0,22	28	2					2	199	571			103								
			KL	5	18	19	0,22	28	2						11	32			3								
Por.sk.celkem:				100											210	603	0 1	2,87	106								

Appendix 3: Forest management plan (LHP) – Plot 434 F8



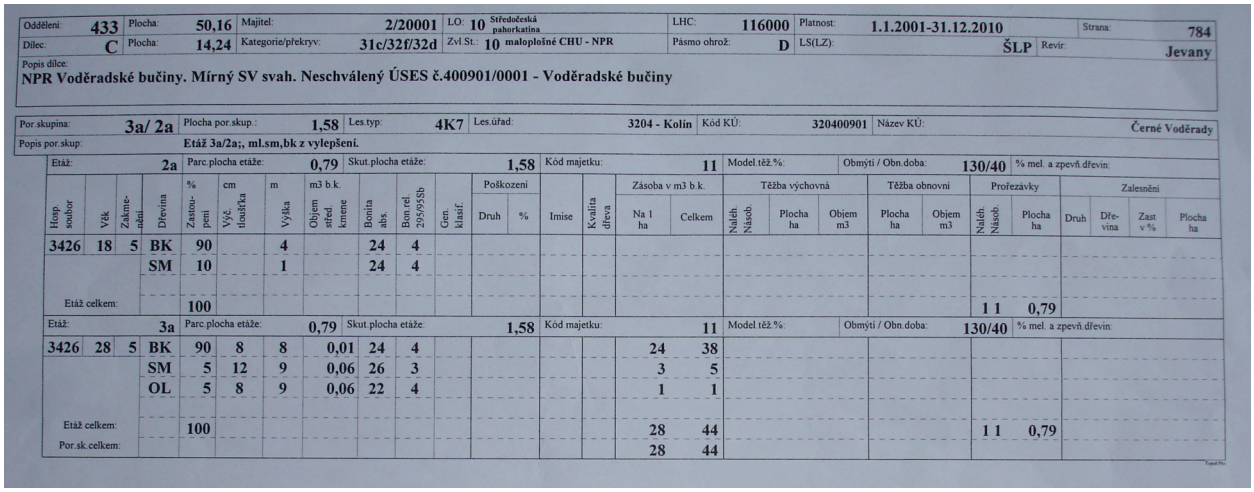
Oddělení: 434 | Plocha: 67,33 | Majitel: 2/20001 | LO: 10 Středočeská pahorkatina | LHC: 116000 | Platnost: 1.1.2001-31.12.2010 | Strana: 784
Dílec: F | Plocha: 13,60 | Kategorie/překryv: 31c/32f/32d | Zvl.St.: 10 maloplošné CHU - NPR | Pásmo ohrož: D | LS(LZ): ŠLP | Revír: Jevany
Popis dílce: NPR Voděradské bučiny. Převl. SV svah, v Jč. mírný J svah. Neschválený ÚSES č.400901/0001 - Voděradské bučiny

Por.skupina: 8 | Plocha por.skup.: 2,55 | Les.typ: 4B1 | Les.úřad: 3204 - Kolín | Kód KÚ: 320400901 | Název KÚ: Černé Voděrady
Popis por.skup:

Kód majetku: 11 | Model.těž.%: | Obmýtí / Obn.doba: 130/40 | % mel. a zpevň.dřevin:

Hosp. soubor	Věk	Zakme-nění	Dřevina	% Zastou-pení	cm Výč. tloušťka	m Výška	m3 b.k. Objem střed. kmene	Bonita abs.	Bon.rel. 29/59Sb	Gen. klasif.	Poškození Druh	Poškození %	Imise	Kvalita dřeva	Zásoba v m3 b.k. Na 1 ha	Zásoba v m3 b.k. Celkem	Těžba výchovná Naléh. Násob.	Těžba výchovná Plocha ha	Těžba výchovná Objem m3	Těžba obnovní Plocha ha	Těžba obnovní Objem m3	Prořezávky Naléh. Násob.	Prořezávky Plocha ha	Zalesnění Druh	Zalesnění Dře-vina	Zalesnění Zast v %	Zalesnění Plocha ha
3446	75	10	BK	40	24	24	0,54	28	3	C				2	126	322			38								
			DB	40	26	24	0,63	26	2	C					126	322			26								
			HB	20	20	21	0,29	22	2	C				1	49	124			8								
Por.sk.celkem:				100											301	768	0 1	2,55	72								

Appendix 4: Forest management plan (LHP) – Plot 433 C3a/2a



Oddělení: 433 | Plocha: 50,16 | Majitel: 2/20001 | LO: 10 Středočeská pahorkatina | LHC: 116000 | Platnost: 1.1.2001-31.12.2010 | Strana: 784
Dílec: C | Plocha: 14,24 | Kategorie/překryv: 31c/32f/32d | Zvl.St.: 10 maloplošné CHU - NPR | Pásmo ohrož: D | LS(LZ): ŠLP | Revír: Jevany
Popis dílce: NPR Voděradské bučiny. Mírný SV svah. Neschválený ÚSES č.400901/0001 - Voděradské bučiny

Por.skupina: 3a/ 2a | Plocha por.skup.: 1,58 | Les.typ: 4K7 | Les.úřad: 3204 - Kolín | Kód KÚ: 320400901 | Název KÚ: Černé Voděrady
Popis por.skup: Etáž 3a/2a;, ml.sm,bk z vylepšení.

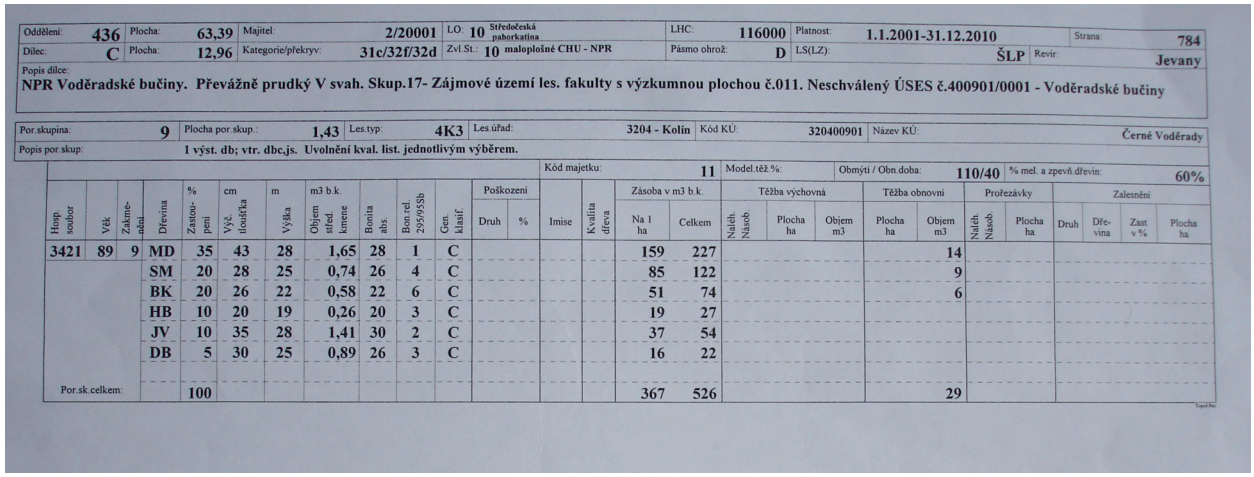
Etáž: 2a | Parc.plocha etáže: 0,79 | Skut.plocha etáže: 1,58 | Kód majetku: 11 | Model.těž.%: | Obmýtí / Obn.doba: 130/40 | % mel. a zpevň.dřevin:

Hosp. soubor	Věk	Zakme-nění	Dřevina	% Zastou-pení	cm Výč. tloušťka	m Výška	m3 b.k. Objem střed. kmene	Bonita abs.	Bon.rel. 29/59Sb	Gen. klasif.	Poškození Druh	Poškození %	Imise	Kvalita dřeva	Zásoba v m3 b.k. Na 1 ha	Zásoba v m3 b.k. Celkem	Těžba výchovná Naléh. Násob.	Těžba výchovná Plocha ha	Těžba výchovná Objem m3	Těžba obnovní Plocha ha	Těžba obnovní Objem m3	Prořezávky Naléh. Násob.	Prořezávky Plocha ha	Zalesnění Druh	Zalesnění Dře-vina	Zalesnění Zast v %	Zalesnění Plocha ha
3426	18	5	BK	90		4		24	4																		
			SM	10		1		24	4																		
Etáž celkem:				100																		1 1	0,79				

Etáž: 3a | Parc.plocha etáže: 0,79 | Skut.plocha etáže: 1,58 | Kód majetku: 11 | Model.těž.%: | Obmýtí / Obn.doba: 130/40 | % mel. a zpevň.dřevin:

Hosp. soubor	Věk	Zakme-nění	Dřevina	% Zastou-pení	cm Výč. tloušťka	m Výška	m3 b.k. Objem střed. kmene	Bonita abs.	Bon.rel. 29/59Sb	Gen. klasif.	Poškození Druh	Poškození %	Imise	Kvalita dřeva	Zásoba v m3 b.k. Na 1 ha	Zásoba v m3 b.k. Celkem	Těžba výchovná Naléh. Násob.	Těžba výchovná Plocha ha	Těžba výchovná Objem m3	Těžba obnovní Plocha ha	Těžba obnovní Objem m3	Prořezávky Naléh. Násob.	Prořezávky Plocha ha	Zalesnění Druh	Zalesnění Dře-vina	Zalesnění Zast v %	Zalesnění Plocha ha
3426	28	5	BK	90	8	8	0,01	24	4						24	38											
			SM	5	12	9	0,06	26	3						3	5											
			OL	5	8	9	0,06	22	4						1	1											
Etáž celkem:				100											28	44						1 1	0,79				
Por.sk.celkem:															28	44											

Appendix 5: Forest management plan (LHP) – Plot 436 C9



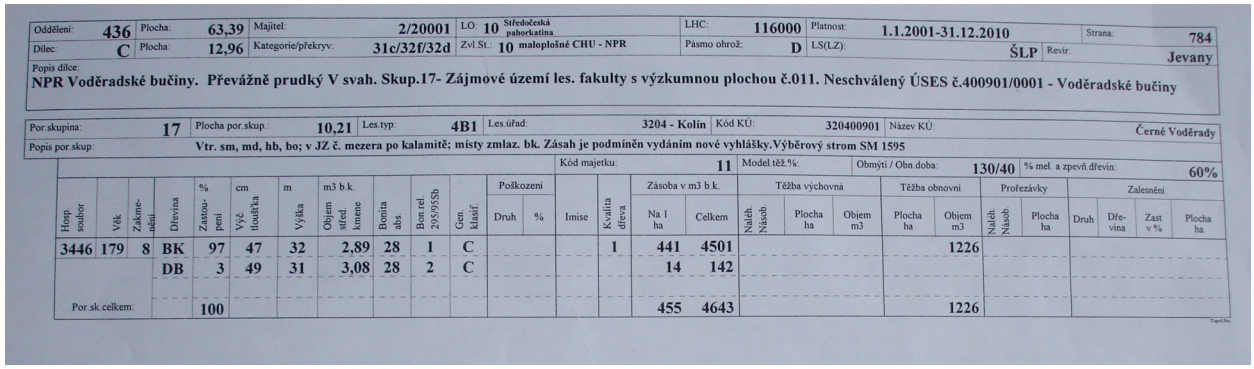
Oddělení: 436 | Plocha: 63,39 | Majitel: 2/20001 | LO: 10 Středočeská pahorkatina | LHC: 116000 | Platnost: 1.1.2001-31.12.2010 | Strana: 784
Dílec: C | Plocha: 12,96 | Kategorie/překryv: 31c/32f/32d | Zvl.St.: 10 maloplošné CHU - NPR | Pásmo ohrož: D | LS(LZ): ŠLP | Revír: Jevany
Popis dílce:
NPR Voděradské bučiny. Převážně prudký V svah. Skup.17- Zájmové území les. fakulty s výzkumnou plochou č.011. Neschválený ÚSES č.400901/0001 - Voděradské bučiny

Por.skupina: 9 | Plocha por.skup.: 1,43 | Les.typ: 4K3 | Les.úřad: 3204 - Kolín | Kód KÚ: 320400901 | Název KÚ: Černé Voděrady
Popis por.skup: 1 výst. db; vtr. dbc,js. Uvolnění kval. list. jednotlivým výběrem.

Kód majetku: 11 | Model.těž.%: | Obmýtí / Obn.doba: 110/40 | % mel. a zpevň.dřevin: 60%

Hosp. soubor	Věk	Zakmenění	Dřevina	Zastoupení %	Výš. tloušťka cm	Výška m	Objem střed. kmene m3 b.k.	Bonita abs.	Bon.rel. 295/95Sb	Gen. klasif.	Poškození Druh	Poškození %	Imise	Kvalita dřeva	Zásoba v m3 b.k. Na 1 ha	Zásoba v m3 b.k. Celkem	Těžba výchovná Náleh. Násob.	Těžba výchovná Plocha ha	Těžba výchovná Objem m3	Těžba obnovní Plocha ha	Těžba obnovní Objem m3	Prořezávky Náleh. Násob.	Prořezávky Plocha ha	Zalesnění Druh	Zalesnění Dřevina	Zalesnění Zast. v %	Zalesnění Plocha ha
3421	89	9	MD	35	43	28	1,65	28	1	C					159	227					14						
			SM	20	28	25	0,74	26	4	C					85	122					9						
			BK	20	26	22	0,58	22	6	C					51	74					6						
			HB	10	20	19	0,26	20	3	C					19	27											
			JV	10	35	28	1,41	30	2	C					37	54											
			DB	5	30	25	0,89	26	3	C					16	22											
Por.sk.celkem:				100											367	526					29						

Appendix 6: Forest management plan (LHP) – Plot 436 C17



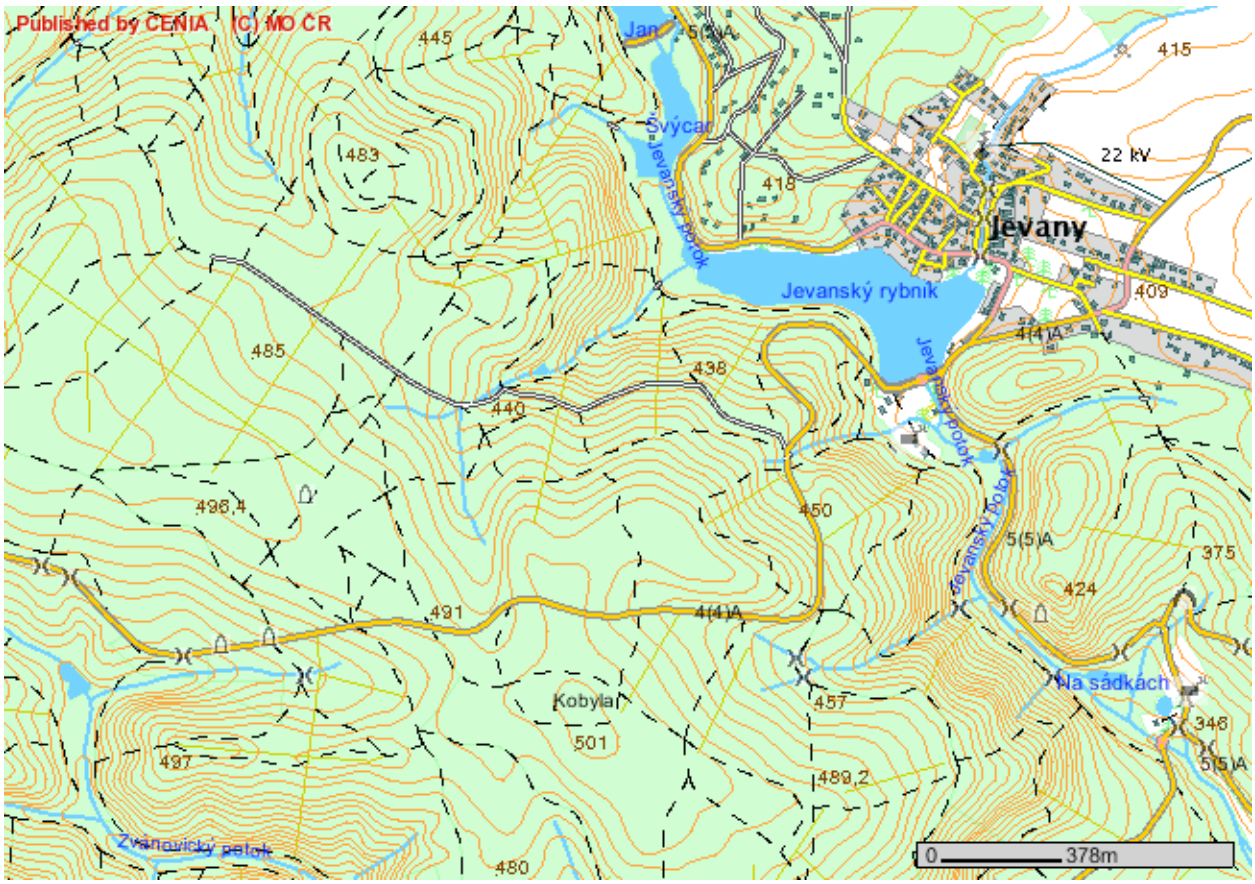
Oddělení: 436 | Plocha: 63,39 | Majitel: 2/20001 | LO: 10 Středočeská pahorkatina | LHC: 116000 | Platnost: 1.1.2001-31.12.2010 | Strana: 784
Dílec: C | Plocha: 12,96 | Kategorie/překryv: 31c/32f/32d | Zvl.St.: 10 maloplošné CHU - NPR | Pásmo ohrož: D | LS(LZ): ŠLP | Revír: Jevany
Popis dílce:
NPR Voděradské bučiny. Převážně prudký V svah. Skup.17- Zájmové území les. fakulty s výzkumnou plochou č.011. Neschválený ÚSES č.400901/0001 - Voděradské bučiny

Por.skupina: 17 | Plocha por.skup.: 10,21 | Les.typ: 4B1 | Les.úřad: 3204 - Kolín | Kód KÚ: 320400901 | Název KÚ: Černé Voděrady
Popis por.skup: Vtr. sm, md, hb, bo; v JZ č. mezera po kalamitě; místy zmlaz. bk. Zásah je podmíněn vydáním nové vyhlášky.Výběrový strom SM 1595

Kód majetku: 11 | Model.těž.%: | Obmýtí / Obn.doba: 130/40 | % mel. a zpevň.dřevin: 60%

Hosp. soubor	Věk	Zakmenění	Dřevina	Zastoupení %	Výš. tloušťka cm	Výška m	Objem střed. kmene m3 b.k.	Bonita abs.	Bon.rel. 295/95Sb	Gen. klasif.	Poškození Druh	Poškození %	Imise	Kvalita dřeva	Zásoba v m3 b.k. Na 1 ha	Zásoba v m3 b.k. Celkem	Těžba výchovná Náleh. Násob.	Těžba výchovná Plocha ha	Těžba výchovná Objem m3	Těžba obnovní Plocha ha	Těžba obnovní Objem m3	Prořezávky Náleh. Násob.	Prořezávky Plocha ha	Zalesnění Druh	Zalesnění Dřevina	Zalesnění Zast. v %	Zalesnění Plocha ha
3446	179	8	BK	97	47	32	2,89	28	1	C				1	441	4501					1226						
			DB	3	49	31	3,08	28	2	C					14	142											
Por.sk.celkem:				100											455	4643					1226						

Appendix 7: Map of Voderadske buciny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489,2
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