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FINANCIAL EXPRESSION OF FOREST FUNCTIONS VALUE

Abstract: The financial expression of forest functions value can be based (similarly as an approach to forest functions) on different conceptions: anthropocentric utilitarian conception - forest and its functions are an economic estate (instrument of production) fully controlled by man, and ecosystem life-preserving conception – forest and its functions are a life-giving source and irreplaceable component of the environment at the same time being the source of an essential renewable raw material. The ecosystem conception of forests and their functions does not consider forests as an exclusive economic estate but as a national wealth and irreplaceable component of the environment. Expression of values of forest functions through money is thus a comparable means of society to control and maintain life-giving sources and components of the environment. A method used for the financial expression of values of forest functions is "a financial explicit comparison to a socially well-known economic event". The dominant product of a bioproduction function – wood and its financial relations – price is a socially well-known economic event from the field of forest functions. However, from the viewpoint of a known economic event, wood price in not a quite objective indicator. It is dependent on market relations and changing social demands. The generally used market principle of society, however, does not use permanent or absolute constant financial values. Value conditions, levels and scales are always topical conditions.

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FINANSIJSKI PRIKAZ VRIJEDNOSTI FUNKCIJA ŠUME

Apstrakt: Finansijski izraz vrijednosti funkcija šume može se bazirati (slično kao i pristup funkcijama šume) na različitim konceptima: koncept korišćenja od strane čovjeka - šuma i njene funkcije su privredno dobro (instrument proizvodnje) koje u potpunosti koristi čovjek, i sa druge strane koncept zaštite živog svijeta u ekosistemu - šuma i njene funkcije su izvor života i samim tim predstavljaju nezamjenljiv dio prirode koji istovremeno predstavlja izvor obnovljivih sirovina. Koncept ekosistema sam po sebi ne podrazumijeva šumu i njene funkcije isključivo kao privredno dobro, već i kao nacionalno dobro i nezamjenljiv dio prirodne sredine. Prikaz vrijednosti funkcija šume kroz novac stoga predstavlja jedan od komparativnih metoda koje društvo koristi da bi rukovodilo i održavalo izvore života i sastavne dijelove prirodne sredine. Za finasnijski prikaz vrijednosti funkcija šume korišćen je metod "poređenja finansijskog eksplicita i socijalno poznatog ekonomskog slučaja". Vrijednost dominantnog proizvoda bioproizvodne funkcije - drvo i novčani prihodi koji shodno tome proizilaze - predstavlja socijalno poznat ekonomski slučaj u oblasti funkcija šume. Međutim, sa stanovišta poznatog ekonomskog slučaja cijena drveta ne predstavlja objektivan indikator. On zavisi od kretanja tržišta i promjena u zahtjevima društva. Princip trgovine u društvu koji se najčešće koristi, ne koristi trajne ili apsolutne finansijske vrijednosti, već ove vrijednosti uvijek predstavljaju aktuelno stanje.

Ključne riječi: funkcije šume, ekosistemski pristup funkcijama šume, finansijska procjena funkcija šume, ekološki gubici

INTRODUCTION

A modern ecosystem conception states that forests are on the level of natural systems, i.e. subsistence life-giving resources even for the human society. Forest functions are potentials to produce effects resulting from its nature and ecosystem processes. They are produced by an every specific ecosystem of the forest.

The financial expression of forest functions value can be based (similarly as an approach to forest functions) on different conceptions: anthropocentric utilitarian conception - forest and its functions are an economic estate (instrument of production) fully controlled by man, and ecosystem life-preserving conception – forest and its

functions are a life-giving source and irreplaceable component of the environment at the same time being the source of an essential renewable raw material. The ecosystem conception of forests and their functions does not consider forests as an exclusive economic estate but as a national wealth and irreplaceable component of the environment.

METHOD

Method of Quantification and Evaluation of Forest Functions (Vyskot I. at al. 1996-2003, 2006), is developed and still cultivated by team of univ. prof. Vyskot in Department of Landscape Management FFWT MUAF in Brno, Czech Republic**.** It's base for financial expression of forest functions with wide application, as examples of Czech Republic and Slovakia show. Detailed and exhaustive description of method is published in monograph Vyskot, I. et al., 2003.

Expression of values of forest functions through money is thus a comparable means of society to control and maintain life-giving sources and components of the environment.

A method used for the financial expression of values of forest functions is "a financial explicit comparison to a socially well-known economic event". The dominant product of a bioproduction function – wood and its financial relations – price is a socially well-known economic event from the field of forest functions. However, from the viewpoint of a known economic event, wood price in not a quite objective indicator. It is dependent on market relations and changing social demands. The generally used market principle of society, however, does not use permanent or absolute constant financial values. Value conditions, levels and scales are always topical conditions.

The long average price of a unit of the dominant product of a bioproduction function ***1 m³ wood*** is a ***financial value unit*** for the financial expression of values of forest functions.

ECOSYSTEM METHOD OF QUANTIFICATION AND EVALUATION OF FOREST FUNCTIONS

All-society (i.e. of society as a whole) functions of forests are the realized production of natural ecosystem effects which are independent on man. The ecosystem method of quantification and evaluation of forest functions is, therefore, based on the quantification and evaluation of elements and parameters of forest ecosystems determining their functional effects.

To quantify a forest ecosystem it is necessary to define its condition entering the evaluation. The procedure is implemented in the following levels:

Real potential of forest functions – quantified functional potential of forests (values of produced functions) under optimum ecosystem conditions.

Real topical effect of forest functions – topical quantified functional effects of forests (values of produced functions) under topical ecosystem conditions.

Needs of society often require the specific use of forests limited exclusively by social urgency and not by their ecosystem effects. The functional effect is then evaluated by extra-ecosystem superstructure parameters:

Topical social effect of forest functions – topical, super structural, socially preferred functional effect specified by "usage" indicator of the weight of the topical social interest.

Classification of effectiveness parameters and determination criteria of functions

Each of the forest functions (effectiveness functional group) is quantified through quantities of functions of determining parameters (determination criteria). The compatible (value) classification of parameters (criterion elements and segments) also expresses the extent of functional effectiveness of functional determination criteria through the hierarchy of value degrees (rate of quantity).

Determination of stand types in functional target management groups of stands (MGS)

Determination of stand types in functional target MGS is the result of analyses of database sources of forest management plans (FMP) according to species composition in stand parts of forests of the CR. Examples of determination and coding particular stand types:

D6 ….. mixed stand type with the "dominant" proportion of beech ST and "interspersed" species

M1Z6P9x ….. mixed stand type of spruce ST and beech ST and "admixed" ST of other broadleaves

Values of real potentials of forest functions

Values of real potentials of forest functions are processed for ecosystem units of the whole territory of forests of the Czech Republic.

- Functions of forests are determined by function criteria. Their values are expressed by value degrees in classification levels (0 – 6).

- The function value is (from the aspect of effectiveness) the weighed average of values (value degrees) of its function criteria. It is expressed by an analogical value as well as practical verbal classification.
- he total real potential of functions is the sum of potentials of particular functions (BP - bioproduction function, ES - ecological-stabilization function, HV- hydric – water-management function, EP- edaphic – soil-conservation function, SR - social-recreation function, ZH - sanitary-hygienic function)

$$\mathbf{RP_{FL} = RP_{BP} + RP_{ES} + RP_{HV} + RP_{EP} + RP_{SR} + RP_{ZH}}$$

- The value of the total real potential of functions is the sum of values of potentials of particular functions **(0–36)** being classified in classes $\mathbf{RP_{FL}}$ **I –VI**.

For the purpose of practical use, the function evaluation is given in tables of final values (value degrees) of real potentials of forest functions, in the resulting value of the total real potential of functions (RP_{FL}) and classification class I-VI.

Real effects - topical condition of forest functions

The real effect represents the topical function effectiveness of a forest ecosystem, i.e. function effects resulting from its topical condition. It expresses the rate of a produced function with respect to its potential capacities in percentage values.

On the basis of the excerption of a broad spectrum of scientific findings and the study of linkages of function effects of forest stands and their structures, three virtually available dominant criteria were used characterizing conditions of stands, their function dynamics and effectiveness, viz. ***age, stocking and health condition.*** The criteria are of a functionally "reduction" character because under optimum values only they represent full (potential) function capabilities of the forest. With the increasing difference from optimum values function effectiveness also decreases. Therefore, they are further named as ***"function- reducing"*** criteria**.**

Calculation of real effects of particular functions

Resultant (synergic) real effect is the weighed arithmetical average of values of real effects determined by particular function-reducing criteria:

Bioproduction function	$RE_{BP} = vT_1 . T_1 + vZ_1 . Z_1 + vZS_1 . ZS_1$	(%)
Ecological-stabilization function	$RE_{ES} = vT_2 . T_2 + vZ_2 . Z_2 + vZS_2 . ZS_2$	(%)
Hydric– water-management function	$RE_{HV} = vT_3 . T_3 + vZ_3 . Z_3 + vZS_3 . ZS_3$	(%)
Edaphic – soil-conservation function	$RE_{EP} = vT_4 . T_4 + vZ_4 . Z_4 + vZS_4 . ZS_4$	(%)
Social-recreation function	$RE_{SR} = vT_5 . T_5 + vZ_5 . Z_5 + vZS_5 . ZS_5$	(%)
Sanitary-hygienic function	$RE_{ZH} = vT_6 . T_6 + vZ_6 . Z_6 + vZS_6 . ZS_6$	(%)

Where

T_{1-6} value of the partial real effect of a given function in relation to *age* (stand development stage)

Z_{1-6} value of the partial real effect of a given function in relation to *stocking* (stand development stage)

ZS_{1-6} value of the partial real effect of a given function in relation to *health condition* (stand development stage)

vT_{1-6} weight of *age* for a given function in the stand development stage

vZ_{1-6} weight of *stocking* for a given function in the stand development stage

vZS_{1-6} weight of *health condition* for a given function in the stand development stage

Calculation of the value of real topical effects of functions and quantitative evaluation of forest functions on the basis of ecosystem, parametric and data objectification on the level of possibilities of the present knowledge and applications.

Structure of financial expression procedure steps

- Financial expression of the value of real potentials of forest functions
- Financial expression of the value of real effects of forest functions
- Financial expression of the value of topical social effects of forest functions
- Financial expression of damage to forest functions

Calculation of the financial expression of the value of real potentials of forest functions

The financial expression of real potentials of particular functions (RP_{FL}) is determined according to a general formula:

$$FRP_{FL} = \frac{CD.PP.U}{3}.RP_{FL}.P$$

Calculation of the financial expression of the value of real effects of forest functions

The financial expression of real effects of particular functions (RE_{FL}) is determined according to a general formula

$$FRE_{FL} = \frac{CD.PP.U}{3}.RP_{FL}.\frac{RE_{FL}}{100}.P$$

Then:

$$FRE_{FL} = FRP_{FL}.\frac{RE_{FL}}{100}$$

Financial expression of a value of the topical social effects of forest functions

Financial expression of topical social effects of particular functions (SE_{FL}) is determined according to a formula

$$FSE_{FL} = \frac{CD.PP.U}{3}.RP_{FL}.\frac{RE_{FL}}{100}.FAZ_{FL}.P$$

Then:

$$FSE_{FL} = .FRE_{FL}.FAZ_{FL}$$

FSE_{FL} = financial expression of a value of the topical social effect of a function in CZK

FRE_{FL} = financial expression of a value of the real effect of a function in CZK

RP_{FL} = value (value degree) of the real potential of a function (see RP_{FL})

RE_{FL} = value of the real effect of a function (%) (See RE_{FL})

FAZ_{FL} = value of the factor of the topical social interest (0-3) (see FAZ)

CD = decennial average price of wood at the roadside in CZK per m^3 announced by the CR Ministry of Agriculture

PP = average annual potential production of forests in the Czech Republic in $m^3.ha^{-1}$ determined by a special directive (6.3 m^3 . ha $^{-1}$)

U = stand rotation

P = area of the unit (stand, stand part) in ha.

RESULTS

Example of financial expression of the value of concrete (model) forest unit (stand) functions

Characteristics of a model forest stand (stand part):

Area 3.0 ha, age 87 years, forest type group (FTG) 4B, rotation period 110 years, species composition: spruce 70%, larch 20%, beech 10%, stocking: 10, prescribed cut: no felling, topical health condition: 0/I - stands with the first symptoms of damage, topical social interest: multifunctional forests with the standard all-society utilization of all functions

Categorization into a stand type (ST)

On the basis of species composition given in FMP (spruce 80, larch 20), the stand part was included into the stand type:

M1P4 - mixed stand with the majority proportion of ST of spruce with admixed ST of larch

Assignment of the function management group of stands (MGS) according to a forest type group (FTG)

According to FTG 4B, the forest stand site was classified to the function management group (MGS) 45 - fertile sites of higher lies.

Determination of RP_{FL} values corresponding to the given ST within the MGS

ST	MGS	RP_{FL}						ΣRP_{FL}	Class RP_{FL}
		BP	ES	HV	EP	SR	ZH		
M1P4	45	**5**	**2**	**2**	**3**	**4**	**5**	21	IV

Explanatory notes: BP - bioproduction function, ES - ecological-stabilization function, HV- hydric – water-management function, EP- edaphic – soil-conservation function, SR - social-recreation function, ZH - sanitary-hygienic function

Determination of real values of function-reducing criteria

On the basis of topical stand conditions the following real values were determined of function reducing criteria:

VALUES OF FUNCTION-REDUCING CRITERIA		
Age (years)	**Stocking**	**Health condition**
87	10	0/I

Explanatory notes: 0/I- stands with the first symptoms of damage

Determination of values of real effects of particular functions

In relation to real values of function-reducing criteria we read values of real effects of particular functions in relation to *AGE* in percentage of rotation, in relation to *STOCKING* and in relation to *HEALTH CONDITION* .

Calculation of real effects of functions

Calculation of RE_{FL} for particular groups of functions is calculated according to a formula:

(Details see on Method part)

$$\mathbf{RE_{FL} = T \,.\, v_T + Z \,.\, v_Z + ZS \,.\, v_{ZS}}$$

RE_{FL} (in % RP_{FL})					
BP	ES	HV	EP	SR	ZH
86.5	**100.0**	**100.0**	**100.0**	**91.0**	**100.0**

Financial expression of forest functions of a model forest stand

FSE_{FL} (in Euro)						
BP	**ES**	**HV**	**EP**	**SR**	**ZH**	**Total**
99 979	46 233	46 233	69 350	84 114	115 583	**461 521**

Financial value of real effects of functions of the stand on an area of 4.0 ha

$$\mathbf{FRE_{FL} = EUR\ 461\ 521}$$

Factor of a topical social interest (FAZ)

A model forest stand is defined as a multifunction stand with standard all-society utilization of all functions. Particular functions are determined by FAZ = 1:

Evaluation of all-society functions of the model stand

The forest stand is characteristic by the very high potential of bioproduction and sanitary-hygienic functions and high potential of the social-recreation function. On the other hand, low potentials are achieved in ecological-stabilization and hydric–water-management functions. Edaphic–soil-conservation functions achieve average potentials.

Topical function effects of the stand are extraordinary the majority of functions being fulfilled in a range of 90 – 100%.

The model stand is multifunctional with standard all-society utilization of all functions, the value of its functions is not adjusted (FAZ = 1). The real effect of functions corresponds to the topical social effect.

The financial value of its social functions is **EUR 461 521on the area of 3.0 ha.**

DISCUSSION

Practical applications of this method of quantification and evaluation of forest functions are still more abundant.

Applications at the level of ecosystem, organizational and spatial units of forests:

- Determination of values of real potentials of functions for every ecosystem unit with applications in each of the units of the organizational and spatial arrangement of forests in the CR
- Determination of the quantitative extent of a detriment to functions for each of the units of the organizational and spatial arrangement of forests,
- Financial expression of values of topical social effects of functions of units of the organizational and spatial arrangement of forests according to categories, subcategories and other division of forests
- Financial expression of incurred damage to functions for each of the units of the organizational and spatial arrangement of forests
- Calculation of values of topical social effects of functions of units of the organizational and spatial arrangement of forests according to categories, subcategories and other division of forests

Application at the conceptual, administrative, control and executive levels:

- Educational and probative means of the new philosophy and conception of functionally integrated forest management.
- Sources and data for the execution of state administration of forests.
- Data for the execution of supervision and inspection in forests.
- Data for processing directions, subsidies, compensations and reparations in forestry.
- Data for forest planning.
- Data for relationships between landscape and forestry planning
- Data for the preparation of plans of care of specially protected areas.
- Data for objectified categorization of forests.
- Data for social regionalization of forests.
- General data of management procedures for functionally integrated management.

Sources and data for the preparation and processing of forest management plans.

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FINANSIJSKI PRIKAZ VRIJEDNOSTI FUNKCIJA ŠUME

Rezime

Metod "kvantifikacije i procjene funkcija šume" (Vyskot I. et al. 1996-2003, 2006) je razvio i još uvjek unapređuje tim koji predvodi profesor Vyskot sa Katedre za pejzažni menadžment FFWT MUAF u Brnu, Češka. Ovaj metod predstavlja osnovu za finansijski prikaz funkcija šume sa veoma širokom primjenom, koju potvrđuju primjeri u Češkoj i Slovačkoj. Detaljan i iscrpan opis ove metode se nalazi u monografiji Vyskot, I. et al., 2003.

Prikaz vrijednosti funkcija šume kroz novac stoga predstavlja jedan od komparativnih metoda koje društvo koristi da bi rukovodilo i održavalo izvore života i sastavne dijelove prirodne sredine.

Za finasnijski prikaz vrijednosti funkcija šume korišćen je metod "poređenja finansijskog eksplicita i socijalno poznatog ekonomskog slučaja". Vrijednost dominantnog proizvoda bioproizvodne funkcije - drvo i novčani prihodi koji shodno tome proizilaze - predstavlja socijalno poznat ekonomski slučaj u oblasti funkcija šume. Međutim, sa stanovišta poznatog ekonomskog slučaja cijena drveta ne predstavlja objektivan indikator. On zavisi od kretanja tržišta i promjena u zahtjevima društva. Princip trgovine u društvu koji se najčešće koristi, ne koristi trajne ili apsolutne finansijske vrijednosti, već ove vrijednosti uvijek predstavljaju aktuelno stanje

Dugoročna prosječna jedinična cijena dominantnog proizvoda bioproizvodnje za 1 m^3 drveta predstavlja jedinicu novčane vrijednosti za finansijski prikaz vrijednosti funkcije šume.

Finansijski prikaz se sastoji od sljedećih faktora: finansijski prikaz vrijednosti realnog potencijala funkcija šume, finansijski prikaz vrijednosti realnih efekata funkcija šume, finansijski prikaz vrijednosti aktuelnog socijalnog efekta funkcija šume, finansijski prikaz šteta funkcija šume.

Na gubitke koji se pojavljuju u funkcijama utiče razlika između finansijske vrijednosti socijalnih funkcija sastojine u uslovima prije sječe i finansijske vrijednosti socijalnih funkcija sastojine u uslovima poslije sječe.