

ARGUMENTATION OF ECONOMIC EFFECT FROM USE OF FOREST ECOSYSTEM SERVICES IN CASE OF LAND CONSERVATION

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Abstract

Solution of ecological problems is an urgent and extremely important task at the present stage of social-economic development of Ukraine. Unreasonably high degree of economic (mostly agricultural) reclaiming of area causes spreading and intensification of degradation processes in ecosystems. Conservation of lands, including the one carried out by means of foresting of degraded lands, is the principal way to renature environment. The article concerns an issue of land conservation in the context of ecosystem services of forests. The aim of the article is to assess the economic value of ecosystem services of forests in case of land conservation. To achieve the aim the authors developed a classification system of ecosystem services of forests according to their functional purposes; provide the calculation of prospective economic value of ecosystem services while foresting of a land plot with heavy eroded soil. The research was carried out using system, monographic and abstract-logical methods. The integral evaluation of prospective ecosystem services of forest in case of foresting of degraded land resulted in: minimum – 5. 07 thousand UAH per 1 ha in a year, maximum – 35. 91 thousand UAH per 1 ha in a year. The calculation of economic costs of ecosystem services should be applied for assessment of the economic value from protection of nature-protective areas as well as implementation of economic stimulation for land conservation.

Key words: land degradation, land conservation, ecosystem services of forests, economic estimation.

Introduction

An anthropogenic impact on environment is a topical issue in the world. Human activities are accompanied by negative ecological and social-economic consequences: exhaustion of resources, degradation and desertification of land, shoaling of rivers, deterioration of the quality of water and air, poverty, level of diseases and forced migration of population, etc. (Polovskyj, 2013; Ecologizaciya lisokorystuvannja, 2014).

As regards Ukraine, an anthropogenic impact has resulted in high agricultural reclaiming of land – 68.8% are occupied by agricultural farms, including arable land – 53.9%, forests – only 17.6%, peat land – 1.6% (Derzhemahent). It has caused land degradation: 32.1% of agricultural lands suffer from water erosion, 22.0% - from deflation (Kolmaz, 2015).

Land conservation is one of the measures to protect and recover potential of natural resources (Stoiko, 2014). In spite of the approved nature-protective programs (Concept of national ecological policy of Ukraine for the period till 2020, State focused program “Forests of Ukraine” for the period of 2010-2015), implementation of them is a rather difficult task, mostly because of the absence of an effective system of economic regulation and financing of nature-protective activities. In Ukraine, only 0.02% of degraded agricultural land are in the process of conservation (Kolmaz, 2015).

It is necessary to establish national ecological policy, securing implementation of approved nature-protective agreements and programs, in particular extension of an area of ecologically stable territories (forests, natural meadows, peat lands). The attention should be concentrated on the ecosystem services as an economic category, being a central element of modern complex system of relations between performing of natural ecosystems, activity of economic subjects and well-being of society (Mishenin, Oliinyk, 2010). The above mentioned has defined the *subject* and the *aim* of the given article, i.e. assessment of the economic value of ecosystem services of forests in case of land conservation. To achieve the aim we have set the following *tasks*: to develop characteristics of ecosystem functions of forests; to calculate prospective economic benefit of some ecosystem services from foresting of a land plot with heavy eroded soil.

Methodology of the research and materials

The following methods were used in the research: system (considering the object as an integrity of elements in combination of relations between them); monographic (studying leading experience,

leading and progressive methods to ground measures directed at the further development); abstract-logical (making theoretical generalizations and conclusions).

The authors used methods of determination of current economic value of ecosystem services of forests (Vrublevska, 2007) in case of foresting of a land plot with heavy eroded soil (13.5 ha) within the boundaries of Romaniv village council of Peremyshliany district in Lviv region.

Discussion and results

In Ukraine, the study and introduction of the concept of ecosystem services is at the initial stage, whereas foreign scientists started to investigate the issue of ecosystem services since the second half of the 20th century (Table 1).

Table 1

Definition of the notion of “ecosystem services”*

Author, year	Definition
G. C. Daily (1997)	Functions of ecosystem, being used to support and improve human life, secure existing of biological variety, produce ecosystem goods
De Groot R. S. (2002)	Potential of natural processes and components to supply goods and services, being used directly or indirectly for satisfaction of human needs; perform functions of regulation, biotopic, productive, informational
Millennium Ecosystem Assessment (2005)	Functions of ecosystems, securing economic benefits for consumers of the services and are aimed to satisfy different kinds of regulating function by means of nature
Mishenin Ye.V., Oliinyk N.V. (2010)	Economic benefits, obtained by economic subjects, using existing functions of ecosystems, as well as those, resulting from regeneration, reproduction, support, regulation of ecosystem processes, focused activity of different economic subjects of different forms of ownership and levels of hierarchical management
Zahvoiska L.D. (2013)	Economic category, taken to define contribution of ecosystem into human well-being; it is reconceptualization, determination of benefits, obtained by people and biota from ecosystems

*Completed by the authors on the basis of sources Daily, 1997; De Groot, 2002; Millennium Ecosystem Assessment, 2005; Mishenin, Oliinyk, 2010; Zahvoiska, 2013.

The interpretation of the notion of “ecosystem services” is still ambiguous and conceptual. However, it is obvious that “economic services” is considered to be an economic category and benefits from them should be economically identified.

Land conservation is one of the ways to decrease a negative anthropogenic impact on environment. The method envisages withdrawal of land from economic circulation (agricultural or industrial) to fulfill measures of recovery of soil fertility, protection of land resources and support of biological diversity of the landscape (Stoiko, 2014).

An important environment-stabilizing role of the biosphere is performed by forests, performing a unique function of absorption of carbon dioxide and supply of oxygen (The Economics of Ecosystems and Biodiversity, 2010). In addition, forests influence both microclimate and the climate of the whole planet. To determine a possible effect from foresting of degraded lands we worked out the classification of ecosystem services according to their functional purposes (Fig. 1).

It is difficult to evaluate a multiple character of forest ecosystem services. The importance of ecosystem services of forests depends on direct (forest logging, berry gathering, recreation, hunting, etc.), indirect (regulation of climate, water exchange, carbon deponation etc.) and possible (value of existing, heritage) use (Zahvoiska, 2014). Benefits obtained from the forest ecosystem are not uniformly distributed in space and time (“diffusion of ecosystem benefits”). The estimation is also complicated because of the latent (hidden) character of many benefits from ecosystem services of forests which are free (underestimated). It causes degradation of ecosystems (Sotnyk, Horobchenko, 2012).

Applying methods of determination of the current economic value of ecosystem services of forests (Vrublevska, 2007), the authors have calculated prospective economic value of some ecosystem services provided by foresting of a land plot (Table 2).

The research presents estimation of some services supplied by forests, but there are some issues which are impossible to be evaluated, e.g. esthetic, scientific, spiritual value.

Conclusions and proposals

In Ukraine degradation of land is one of the negative consequences of an anthropogenic impact. An important measure to solve the problem is to increase the area of ecology-stabilizing lands by means of land conservation, first degraded lands. Forest ecosystems are of the most environment-stabilizing importance for the biosphere.

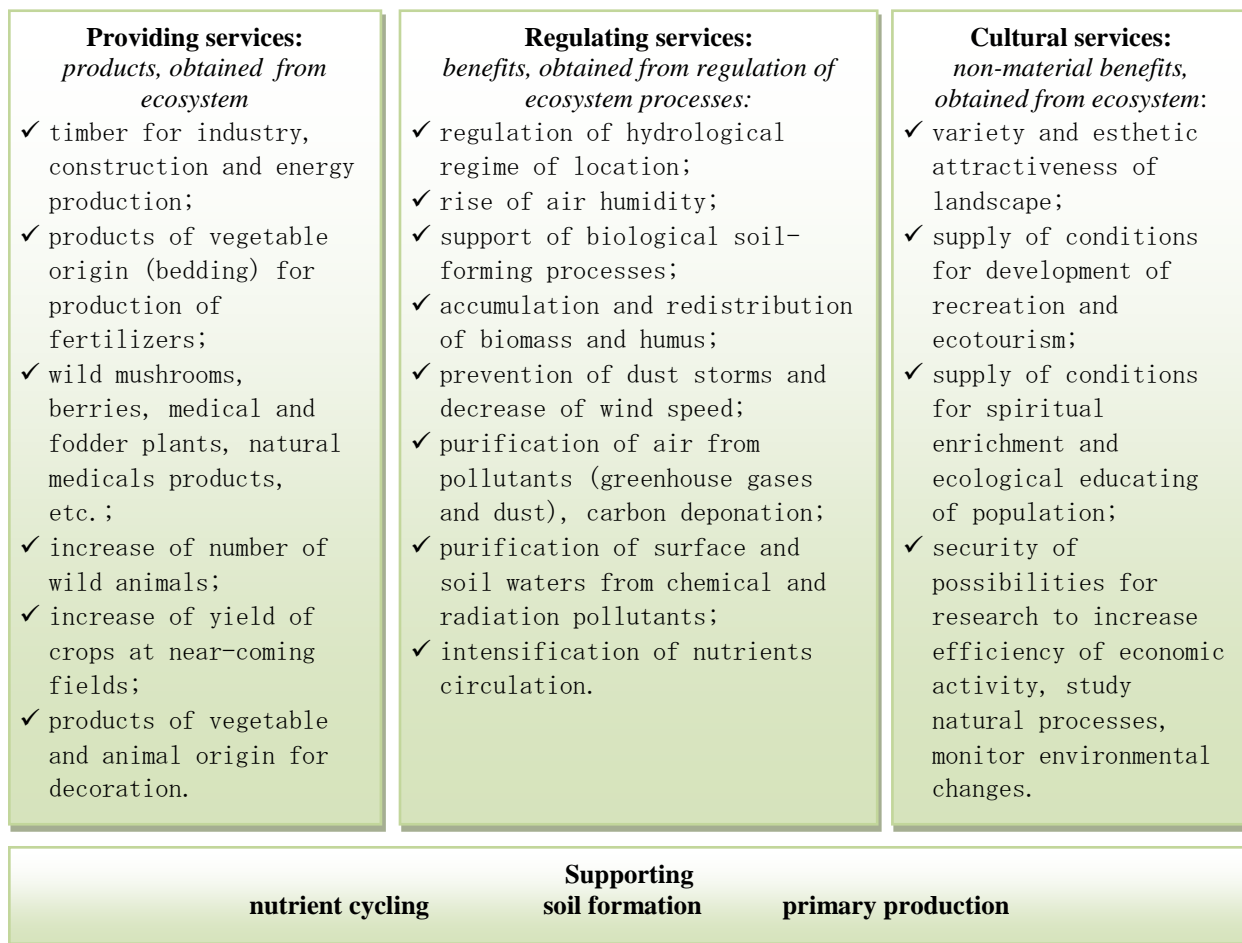


Fig. 1. Classification of ecosystem services of forests according to their functional purpose (developed by the authors on the basis of “The Economics of Ecosystems and Biodiversity, 2010; Millennium Ecosystem Assessment, 2005; Petrovych, 2014; Mishenin, Dehtjar, 2015)

An integral appraisal of prospective ecosystem services of forest in case of foresting of land created: minimum – 5.07 thousand UAH per 1 ha in a year, maximum – 35.91 thousand UAH per 1 ha in a year. The calculation of the economic value of ecosystem services should be applied for justification of economic effect gained from existing, protection and creation of nature-protective territories, as well as implementation of economic stimulation of land conservation.

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Table 2.

Determination of prospective economic evaluation of main ecosystem services of a land plot, subjected to foresting*

Name of an ecosystem service	Formula of calculations	Notations	Value of ecosystem service per 1 ha, thou. UAH in a year (min – max)	Value of ecosystem service at forested area, thou. UAH in a year (min – max)
Economic estimation of non-wood forest vegetation	$EE_{nwf} = \sum p_i \times Q_i / S$	P_i – corrected value of readiness to pay for a unit of a resource of i-type, UAH/kg (Vrublevska, 2006); Q_i – economically available volume of a resource of i-type, kg (Vrublevska, 2006); S – area of lands, covered with forest vegetation, ha.	0.02	0.27
Economic estimation of hydrolytic impact of forest	$EE_i = N \times Q_B / S$	N – norm of payment for specialized utilization of water resources, UAH/m ³ (Cabinet of Ministers of Ukraine, 1997); Q_B – additional amount of water resources, available to be used to satisfy demand for water of population and industrial consumers, m ³ (Mikhovych, 1986); S – area of lands, covered with forest, ha.	0.14	1.89
Economic estimation of forest impact on agricultural production	$EE_{agr} = \Delta P \times S_{agr} / S$	ΔP – additional profit, obtained from 1 ha of an agricultural land plot, being under the impact of forest, UAH (fluctuates from 11 % to 15 %); S_{agr} – area of agricultural lands, being influenced by forest, ha**; S – area of lands, covered with forest, influencing an agricultural land plot, ha;	0.49 – 1.62	6.62 – 21.87
Economic estimation of benefits from carbon deponation	$EE_{cd} = M \times P$	M – mass of CO ₂ deponation to forest vegetation, in ton per 1 ha of vegetation area in a year: 1) in the first 10 years - 2,5 ton of CO ₂ are absorbed; 2) all next years – 3.5 ton of CO ₂ (Los, 2007) P – price of 1 ton of CO ₂ at the international market of quotas for discharge of greenhouse gases, UAH (5-20 € in correspondence to currency rate of the National Bank of Ukraine) (Vrublevska, 2007);	1) 0.32 – 1.25 2) 0.38 – 1.75	1) 4.32 – 16.88 2) 5.13 – 23.63
Economic estimation of benefits from recreation	$EE_r = R \times P$	R – normative recreational load for a forest plot, person-day of rest per 1 ha (Shparyk, 2006); P – readiness to pay for 1 person-day of rest, UAH (fluctuates within 3-5 UAH).	4.10 – 32.88	55.49 – 443.88
Integral value*			5.07 – 35.91	68.59 – 484.79

*Calculated by the authors according to (Vrublevska, 2007). Area of the land plot constitutes 13.5 ha with heavy eroded light loamy soil. The plot is located within the boundaries of Romaniv village council in Peremysliany district of Lviv region and is subjected to foresting, according to (Nakaz Ministerstva agrarnoi polityky ta prodovolstva Ukraine, 2013).

** the total area of favorable ecological impact of forests on surrounding lands by 40% exceeds the area of the very forests (Smoliarshuk, 2013).