Professor **Olha Prokopenko**, Doctor of Economics, University of Economics and Humanities (Bielsko-Biala, Poland); Head of the Economic Theory Department, Sumy State University (Ukraine)

Iryna Marekha, Candidate of Economic Sciences, Assistant of the Economic Theory Department, Sumy State University (Ukraine)

FRAMING ECOLOGICAL VALUES IN THE GLOBAL NATURAL RESOURCE ECONOMICS[1]

Introduction. Ukrainian integration with the European Union requires undertaking drastic ecological measures to prevent degradation of the natural resources and ecosystem services. Besides ecological values, natural resources and ecosystem services bring additionally social and economic benefits. The ecological values can be generally defined as the level of ecological, social and economic benefits that the space, water, minerals, biota and all other factors which make up natural ecosystems provide to support indigenous live forms, humans in particular (Cordell et al. 2005). Value-oriented pro-European ecological development of Ukraine needs systemic transformation of the national economy from an existing anthropocentric growth to an eco-centric one. It has been demonstrated that ecologically oriented development is a part of economic growth as well as ecological values being incorporated into a form of ecological culture could be reasonably employed these days as a factor of production. Fundamental economic issues of ecological culture assessment were enlightened in (Tkach 2004), where an author relates interdependently sustainable development with ecological culture of production. Some writers have included societal factors into ecological culture consideration (Ogbu & Simons 1998; Ristic 2001). The idea of ecological culture importance for preventing ecological crises has been developed in the works of Clair and Bush. The problem of ecological culture incorporation and appropriate value-based economic development arises the question of axiological (derived from Greek ἀξία – value) natural resources management. Motivated by the recognition that ecological values contribute to an economic development and are tightly correlated to global economics futurity, we have begun a new era of environmental economic theory at the scale of the global ecosystems. Some global approaches to natural resource economics were developed in our

[1] The paper was written according to budget money from the Ministry of Education and Science of Ukraine, given to develop scientific-research topic № 53.15.01-01.15/17.3Ф «Methodology of forming mechanism of national economics innovative development based on alternative energy»

previous publication (Marekha 2015), where we proposed an ecological classification of the global natural resources which relates completely to the life of the future generations. In this study we attempt to examine global ecological values in the context of the economic theory framework. The main working hypothesis of the article is to improve decision-making performance based on ecological values appreciation. The estimation of an ethical side of the technological progress and moral responsibility for restoring natural processes are of crucial importance nowadays.

In ecological literature, there are two theoretical approaches to understanding economic development (Titarenko 2012). One approach is based on a premise that economic values are much more important than ecological ones. Such approach is commonly understood as economically-oriented, or technocentric one. The main presumptions of the above mentioned approach are: profit is the biggest value; exploitation of natural resources brings a good profit; a human dominates nature; there is a severe competition for natural resources which are at disposal of private investors. Another approach focuses primarily on the supremacy of ecological values over economic ones. In this case, great attention is paid to the following issues: protection of the nature from destruction is the highest public value; humans are a part of the nature; natural resources and ecosystem services are a public good; the need for cooperation as a way to solve a problem of limited endowments of the natural resources. Our search for economic explanation of ecological values enables us to tackle the second approach. An important part of our efforts in this study is to bring more attention to: a) classification of ecological values; b) incorporation of ecological values into a form of ecological culture; c) existence and functioning of ecological values as a factor of production and its comparison with traditional agents of economic growth; d) regarding ecological values from marginal utility function point of view; e) incorporation ecological values in the global resource economics; f) developing generation-based approach to natural resource global economics.

Results. In this study, we do not strive too deep into philosophical understanding of the term “value”. On the other side, we propose to identify ecological values with ones generating utility for a particular society.

Classification of ecological values is an independent task for the economic theory. We propose to classify ecological values using the following classification criteria:

1. Incorporated form:
   1.1. Natural values: natural resources.
   1.2. Medical values: health.

1.3. Socially beneficial values: ecosystem services.

1.4. Consciously generated values: ecological justice, responsibility.

1.5. Landscape values: parks, sea beaches.

1.6. Humanitarian values: ecological education.

2. Stratification level:

2.1. Global use: ozone layer, atmospheric air, space resources.

2.2. Country use: country's natural resources.

2.3. Regional use: regional endowments of natural resources.

2.4. Local use: parks, forest belt, local beach.

3. Tangibility:

3.1. Tangible: natural resources endowments, balneal beaches.

3.2. Intangible: ecological responsibility.

4. Meeting the needs:

4.1. Biological needs: air, drinking water, timber.

4.2. Economic needs: mineral and fuel resources, biomass.

4.3. Social needs: forest for resting.

4.4. Aesthetic needs: picturesque landscape.

4.5. Ethical needs: ecological justice.

5. Appreciation level:

5.1. Appreciated values: clean drinking water.

5.2. Pseudo-values: dirty drinking water.

5.3. Anti-values: cut forests, destroyed soil.

6. Economic assessment techniques:

6.1. For natural resources: cost-benefit analysis, rental and reproductive methods.

6.2. For ecosystem services: transportation costs method, hedonic price method, contingent evaluation studies.

Ecological values as a defining element of ecological culture could be reasonably employed as a new factor of production. It should be mentioned that ecological culture is quite different from traditional agents of production (labour, land, capital, business skills) which can be characterized as follows:

– firstly, if traditional factors are not employed in society it fails its economic growth;

– secondly, a deficit of traditional factors reduces economic growth and causes economic recession;

– thirdly, marginal costs of production are directly correlated with marginal economic growth.

Specificity of ecological culture as a factor of production is revealed in three key aspects:

– firstly, if there is no ecological culture in a definite society it does not necessarily prevent it from economic growth;

– secondly, the society can ignore ecological culture completely and increase its economic growth to some ecological measure due to the deficit of this one;

– thirdly, ecological culture and economic growth can be correlated inversely.

A comparative analysis of the factors of production has been represented in a Table 1.

Table 1 – Comparative characteristics of the factors of production (authors' approach)

Criteria	Factors of production				
	Land	Labor	Capital	Business talent	Ecological culture
Relation to economic system	exogenous factor	exogenous factor	exogenous factor	endogenous factor	endogenous factor
Influence on economic growth	singular	singular	singular	singular	cumulative
Reaction on factor deficit	very high	very high	very high	weak	few, but very high for some time
Tangibility	tangible factor	tangible factor	mixed factor	intangible factor	intangible factor
Scarcity factor	absolutely scarce factor	relatively unlimited factor	scarce factor	partly scarce factor	scarce factor
Reproduction	partly renewable factor	renewable factor	reproductive	non-renewable	hardly renewable
Ability to meet needs of future generations	low ability	low ability	low ability	low ability	the highest ability
Global factor supply	absolutely inelastic	surplus	high	limited	exclusive
Global factor demand	increasing	selective	very high	very high	the highest

Economic specialization	agrarian economics	traditional economics	industrial economics	creative economics	sustainable development economics
Impact on sustainability	negative	insufficient	sufficient	insufficient	preferable

Ecological values, understood as ones generating public utility taken from natural resources and ecosystem services, are different from traditional factors of production in part of unreality of application a principle of diminishing marginal utility. This principle states that as the consumption of goods increases, its marginal utility decreases. However, the situation is different in case of the consumption of natural resources. As future generations shall experience in future a lack of natural resources because of their current over-exploitation, there is an effect of increasing marginal futuristic utility of natural assets and ecosystem services.

Global efforts dealing with undertaking human economic and food security have become tremendously important over the past decades and are now in widespread use in terms of sustainable development concept. The firstly proclaimed principle of sustainable development was tightly connected to generational one: “meeting the needs of the present without compromising the ability of future generations to meet their own needs” (Our common future 1987). It should be mentioned that human needs are regularly met with natural resources. With the recognition that economic security is a no-danger present activity to future societies, the great efforts to include strategic natural resource assessment into policy-making processes are now taken around the globe.

The ecological needs of humans have undergone transformation over the past century. People have been using more of the Earth’s natural resources than ever before, seriously harming the environment and placing the well-being of future generations at risk. Consequently, meeting the needs of the present and future generations should be, first of all, developed on principles of eco-equity. The idea is considered to be employed within either one generation («intra-generational» equity) or several generations («inter-generational» equity) (Vojnovic 1995). The working definition of the term ecological equity is as follows: eco-equity is a birth right given to all generations to be equal users of global resources, natural resources in particular. This mostly prevents from economic and social discrimination in resource consumption activities. Moreover, it develops understanding of better appreciation of future generations against present ones resulting from time-expired natural resources and

escalating their marginal consumer value respectively. It is equally important to reflect economic issues coming from the above mentioned definition. Obviously, ecological equity demands greater economic productivity. To reduce pressure on basic natural resources, such as drinking water, land, minerals and fuel, we should use them economically.

The global experience of enhancing resource productivity for eco-effective future is reflected through jointly created strategic resource programs («Energy and Climate Change», «Food and Water» etc.) and sustainable development concepts (concepts of green and blue economics). In this relation, there is an obvious need to undertake academic research on generation-related issues of natural resources that are relevant to environmental economics and associated with global economic and food security. Generation-based approach provides the opportunity to substitute commonly accepted way of understanding natural resources as presently circulating assets for more appropriate one regarding resources as assets with incorporated futuristic values. For this reason eco-futuristic classification of the global natural resources is of crucial importance. Following eco-equity principle in this case is quite possible due to setting ecological priorities to each resource in order to correct the level of its consumption.

Using terminological definition of sustainable development proposed by the World Commission on Environment and Development (Our common future 1987) as a baseline in this article, we develop generational approach to natural resource economics based on such key assumptions. First, all humankind needs can be generally divided into three groups: biological, manufacturing, and cultural ones. Second, the ability of natural resources to meet the needs of future generations could be defined through accounting their quantitative parameters and qualitative ecological properties (as far as they are reproducible, substitutive, exhaustible, vulnerable to climate fluctuations etc.).

The most acceptable way to classify global natural resources is to relate them to the humankind needs:

- Food resources: plants, drinking water, seafood etc.
- Energy resources: non-renewable (oil, gas, coil, uranium etc.), partly renewable (biomass etc.), and renewable (wind-power energy, solar energy, water-power energy, geothermal energy etc.) ones.
- Housing resources: clay, glass, cement.
- Manufacturing resources: timber, iron ore, copper ore, aluminum etc.
- Ecosystem services: recreation and eco-tourism, soil-building etc.

The proposed classification of natural resources is rather convenient for sustainable consumption purposes. As the concept of sustainable development is primarily concerned with preventing ecological risks, resulting from natural resources consumption, the above created classification is a good tool for precise identification of the eco-needs being at risk of global depreciation.

Generation-based approach assumes that classification of the global natural resources needs reliable identifications and predictions for future generations. In this article we follow the view of futurologist who proposes to name upcoming generations based on the Greek alphabet starting from the letter Alpha (Schawbel). Each next generation is going to be replaced by the consecutive one over 28 years which is the mean age of mothers at first child's birth (OECD). We have chosen the year 1987 which is sometimes cited as a birth year of sustainable development to be the future generations' reference point. Based on mathematical calculations, we suggest the following formalization of future generations: Generation Alpha (2016-2044), Generation Beta (2045-2073), Generation Gamma (2074-2102).

The classification of future generations is a corner stone for classification of natural resources. The main aim of natural resources classification is to reveal threats of ecological harm exposing to future generations. The final task of eco-futuristic classification is allocation of the world resources on eco-equity principle.

Table 2 – Eco-Futuristic Classification of the Global Natural Resources (authors' approach)

Natural Resources	Generation α (2016-2044)	Generation β (2045-2073)	Generation γ (2074-2102)
Food			
plants		*	
seafood			**
drinking water	*		
Energy			
oil		*	
natural gas		*	
coal			**
uranium ore		*	
biomass			**
wind power			****
geothermal power			****

solar power			****
hydro electric			**
Housing			
clay			***
glass material			***
cement material			***
Manufacturing			
wood			**
copper ore	*		
iron ore		*	
aluminum ore			**
phosphorites			**
precious metal	*		
Ecosystem services			
recreation			**
soil building			**
photosynthesis			***
assimilative capacity			**

Some remarks should be carried out from the Table 2. Natural resources marked with * are relevant to assets with the lowest capacity to meet the needs of future generations, owing a marginal futuristic ecological value, and are of the first-turn priority to be saved. Natural resources marked with ** are relevant to assets with poor capacity to meet the needs of future generations, owing a low futuristic ecological value, and are of the second-turn priority to be saved. Natural resources marked with *** are relevant to assets with high capacity to meet the needs of future generations, owing a high futuristic ecological value, and are of the third-turn priority to be saved. Natural resources marked with **** are relevant to assets with the highest capacity to meet the needs of future generations, owing the highest futuristic ecological value, and are of the fourth-turn priority to be saved.

The findings indicate that prevailing part of natural resources belong to Generation Gamma. It means that natural resource endowments are quite sufficient to meet the needs for the three upcoming generations. But, nevertheless, food resources are at risk of exhaustion which is going to provoke ecological conflicts within generations. We can easily predict that future ecological conflicts will be focused on access to drinking water resources. One more important outcome can be drawn: meeting the needs of future generations on eco-equity

principles is possible due to implementation of mono-cultural and multicultural resource--saving tools (Table 3).

Table 3 – Selection of Resource-Saving Tools according to the Eco-Futuristic Value of the Natural Resources (authors' approach)

Natural resources	Resource-saving tools	
	mono-cultural	multicultural
	Eco-equity	
	intra-generational	inter-generational
Marginal futuristic value	Direct saving	Substitution
Low futuristic value	Conservation	Conversion
High futuristic value	–	Regeneration
Best futuristic value	–	–

The task of economic stimulation for resource efficient, or sustainable, development can be approached from two directions: tax or preference regulation (Table 4).

Table 4 – Selection of Economic Stimulation Tools according to the Eco-Futuristic Value of the Natural Resources (authors' approach)

Natural resources	Economic stimulation tools	
	taxes	preferences
	Eco-equity	
	intra-generational	inter-generational
Marginal futuristic value	Damaging-preventive ones	Securing ones
Low futuristic value	Curative ones	Energy-saving ones
High futuristic value	Economically inefficient	Resource-saving ones
Best futuristic value	Economically inefficient	Climate-saving ones

Conclusions. Our results provide three important lessons for the economic theory: a) classification of ecological values promotes their better theoretical understanding; b) ecological values in a form of ecological culture can be employed as a new factor of production which is quite different from traditional ones; c) there is an effect of increasing marginal futuristic utility of ecological values.

In this article we suggest to implement the theory of generations into the frames of global natural resource economics. We hope to stimulate an academic debate about this performance. In addition, we assume that appropriate economic regulation serves as a great contributor to ecological security of the present and future generations. All environmentally related economic instruments should be reconciled with intra- and inter-generation requirements for sustainability. The elaboration of adequate economic mechanism of enhancing environment is a subject for future research.

References:

1. Clair R. & J. Bush. *The Need for an Ecological Cultural Community.* Retrieved from: www.jan.ucc.nau.edu.
2. Cordell H. Ken, Bergstrom John C., Bowker J.M. (2005). *The multiple value of wilderness*: Pennsylvania, Venture Publishing, Inc.
3. Marekha I.S. (2015). *Generation-based approach to natural resource economics*. Nauka i Studia. NR 11 (142).
4. OECD Family Database. *Retrieved from*:: www.oecd.org/social/family/database.
5. Ogbu J. & Simons H. (1998). *Voluntary and Involuntary Minorities: A Cultural--Ecological Theory of School Performance with some Implications for Education*. Anthropology & Education Quarterly, Vol. 2.
6. *Our common future*: Report of the World Commission on Environment and Development (1987). Oxford University Press, Oxford.
7. Ristic J. (2001). *Towards an Ecological Culture: Sustainability, Post-Domination and Spirituality.* Retrieved from: http://digitalcommons.library.umaine.edu/etd/513.
8. Schawbel D. *Five Predictions for Generation Alpha. Retrieved from*: http://danschawbel.com/blog/5-predictions-for-generation-alpha.
9. Titarenko L.G. (2012). *Sistema ekologicheskih tzennostey naseleniia Respubliki Belarus'*. Sociology, № 3.
10. Tkach, E.S. (2004). *Ecological industrial culture as a factor of economic growth*: thesis for gaining a candidate degree.
11. Vojnovic I. (1995). *Inter-generational and Intra-generational Requirements for Sustainability*. Environmental Conservation. Vol. 22. Issue 3.

Abstract. *Generation-based approach to natural resource economics has been developed in the article. Based on sustainable development definition, generations can be categorized by present and future ones. An ecological classification of the global natural resources has been proposed, which is related to future generations. Economic issues of eco-futuristic classification have also been raised in the article. Classification of ecological values has been proposed and ecological values being incorporated into a form of ecological culture and exploited as a new factor of production have been analyzed. The effect of increasing marginal futuristic utility of ecological values has been revealed at the end of the article.*

Keywords: *ecological values, ecological culture, classification, factor of production, utility, sustainable development*