

## Psychological Aspects of Building Environmental Consciousness

**Olena Khrushch<sup>\*1</sup>, Yuliya Karpiuk<sup>2</sup>**

<sup>1</sup>Department of General and Clinical Psychology, Vasyl Stefanyk Precarpathian National University, Ivano-Frankivsk, Ukraine. Email: [olena.khrushch@pnu.edu.ua](mailto:olena.khrushch@pnu.edu.ua)

<sup>2</sup>Department of General and Clinical Psychology, Vasyl Stefanyk Precarpathian National University, Ivano-Frankivsk, Ukraine. Email: [yuliakarpyk@gmail.com](mailto:yuliakarpyk@gmail.com)

*\*Corresponding Author | ORCID: 0000-0002-5126-444X*

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### Abstract

This paper provides a theoretical analysis of environmental consciousness in terms of its defining features, structural dimensions and types. More specifically, it explores the correlation between the anthropocentric/ecocentric perspective and sustainable household practices and interactions with the natural world. Another focus is the underlying dimensions of environmental consciousness such as environmental sensitivity, sustainable consumption, environmental concern and commitment to act pro-environmentally. Ecological crisis is examined through the lens of spirituality, value orientations, attitudes, worldviews and environmental consciousness. Among the other issues addressed are effective environmental literacy programs through school-family partnership and the driving forces of pro-environmental behaviour.

### Keywords

Environmental consciousness; Environmental education; Environmental culture; Spirituality; Morality; Values

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## Introduction

The current ubiquity and magnitude of social and economic challenges, such as proliferation of conflicts, increasing hostility and anti-social behavior, rapid globalization, environmental degradation and the impending ecological catastrophe, have added new urgency to research that will help raise environmental consciousness and shift value orientations towards sustainable consumption (Beck, 2009; Kiselov, 1990; Liuri, 1997; Morris, 2002; O'Sullivan and Taylor, 2004; White, 2009). Ecology used to be a sub-field of biology, which focused on exploring interactions among living beings and non-living objects in a particular territory. Today, however, ecology encompasses all aspects of the human-nature relationship. Being global in scope, environmental issues have not only gained prominent relevance in biology, medicine, sociology, pedagogy, psychology, political science and economics but also in a comprehensive and interdisciplinary perspective. For instance, Vernadsky (1967) examines a number of theoretical issues in ecology with consideration of social and planetary evolution. Most ecological problems are attributed to populations living in extreme climatic and geographical conditions. Hence, it is important to explore the effect of such conditions on an individual's health, livelihood and overall well-being. No less important is the need to examine the magnitude of human impact on such natural environments and suggest ways of minimizing it.

The late 20th and early 21st century saw significant degradation of natural resources with the resultant need to search for new ones. The globalization of environmental issues stems from the negative effects of anthropogenic activity on the natural systems. More specifically, any type of livelihood and commercial activity disrupts the ecological equilibrium constructed by nature, thereby, increasing the risk of another anthropogenic catastrophe. There is a significant body of research attributing ecological crisis to self-centered consciousness and a crisis of spirituality. Therefore, this article intends to examine the psychological aspects of environmental consciousness, which underly a propensity for sustainable consumption.

## Methodology

This article provides a theoretical analysis of publications embodying environmental psychology with a focus on environmental consciousness regarded as worldviews and behavior patterns that optimize the positive outcomes of the human-nature relationship while minimizing its negative impacts. The papers analyzed in this study were published in the last fifty years and retrieved from libraries and other databases in print or digital form. The authors first examined the interacting effects among 10 types of environmental attitudes and 4 forms of environmental consciousness, as well as their impact on livelihoods. Next, they outlined the underpinnings of effective environmental education based on shaping the cognitive domain of environmental consciousness. This is followed by a comprehensive summary of ideas about building adequate environmental consciousness, with a particular emphasis on home and school influences. Finally discussed are the environmental attitudes and value orientations of children living in high-altitude areas, as well as ways of motivating them to regard nature as valuable and worthy of protection. In terms of research methodology, this article relies on the prior studies conducted and published by Darenskyi (2006), Deriabo and Yasvin (1996) and Losev (2010), who provided a comprehensive description of approaches to exploring environmental consciousness. This research employs systematic and personal approaches. More specifically, the personal approach takes into account an individual's relationship with nature. Thus, the authors identified character traits and personal qualities in individuals who had different types of environmental consciousness. The systematic approach was used to explore the structure of environmental consciousness, the development of its dimensions and formation mechanisms.

## Results and Discussion

### *Environmental consciousness*

There is widespread recognition among sociologists and experts dealing with the human-nature relationship that human activity in natural settings is controlled by environmental consciousness (Darenskyi, 2006, p.29). While processing information, environmental consciousness assesses human activity and predicts its consequences for the natural world, thereby, optimizing the human-nature relationship. Serving as a mediator between human and nature, environmental consciousness shapes judgments about the natural environment through self-reflection and analysis of technological transformations, and social and cultural contexts (Losev, 2010, p.11).

It should be noted in this regard that the perception and regulation of human behaviour depends on an individual's psychological make-up, which accounts for the rich variety of attributes characterizing the environmental consciousness of different individuals. If viewed as a form of perceiving and reflecting the ecological dimension of life from a social perspective, environmental consciousness can be defined as a multidimensional conceptual domain for organizing the human-nature relationship. Thus, environmental consciousness serves as both a form and a means of representing the content that encompasses the strong connections between human and nature.

From the perspective of psychology, the dual nature of consciousness manifests itself as activity and reflection. Unlike psyche, consciousness is composed of conceptual and semantic content reflected in mental models (Rubinshtein, 2000, p.39). Having socio-historical roots, the semantic dimension of consciousness is a social construct, which manifests itself in interactions with the surrounding world and society represented by collective consciousness. Therefore, the link between the material, particularly natural, world and consciousness is mediated by its social essence.

Vygotsky (1982) emphasizes the importance of regarding consciousness as a precondition for behavior. Consciousness serves as an inherently human, higher-order mental representation, which enables the cognition, reflection and awareness of the surrounding world. The manifestations of consciousness include knowledge of the self; the external and internal world; as well as evaluative, theoretical and practical attitudes to surrounding reality. More specifically, attitudes to nature play a mediating role in human interactions with natural objects, the ecological system and the surrounding milieu.

The scope of environmental consciousness is currently a matter of ongoing debate. Some studies (Girusov, 1983; Kochergin *et al.*, 1987) treat environmental consciousness as a set of views, theories, conceptions and social emotions, which reflect interactions between society and the natural environment. Other studies (Deriabo and Yasvin, 1996) define it as a complex system, which builds, stabilizes or alters the human-nature relationship associated with the satisfaction of human basic needs.

Shagun (1994) views environmental consciousness as an aspect of psyche connected with knowledge and ideas about values, behavioral and emotional convictions associated with environmental conservation. At the same time, environmental values constitute the moral dimension of consciousness, which is responsible for selecting relevant activities and taking decisions. In turn, the most stable values build an individual's value orientations, which then mark the direction and essence of their activity. In addition, value orientations determine an individual's general vision of the world and themselves, serve as landmarks in life, motivate opinions and behaviour. An individual shapes his/her relationships with nature by relying on the experience of previous generations as well as on his/her own perceptions. Consequently, attitudes, value orientations and worldviews underlie human interactions with natural objects. This is the basis for identifying the intersection of individual and collective consciousness, which affects personal opinions, views and preferred solutions to problems arising from interaction with the environment. The dynamics of such interaction

manifests itself as certain actions, acts, behaviour and personal ideas about the connections between humans and natural ecosystems.

Deriabo and Yasvin (1996, p.6) view environmental consciousness as a system of attitudes. The researchers define environmental consciousness as a set of individual and collective ideas about the interconnections in the human-nature system, as well as in nature itself, about well-formed attitudes to nature, corresponding strategies and interaction techniques.

Lihachev (1993) defines environmental consciousness as a system of safeguarding aspirations, and the system is based on the principle of sustainability in the human-nature interactions. Additionally, the ecological dimension includes a system of knowledge, skills and abilities, which are responsible for sustainable domestic activities. It stems from the need to preserve natural resources on a countrywide scale. Such a need belongs to the realm of personal characteristics that motivate behaviour; in addition, they impact an individual's moral, political and ideological views, value orientations, industriousness, and creativity – all being in line with social expectations.

Zverev *et al.* (1994) and Suravegina (1999), *inter alia*, stress that environmental consciousness includes knowledge of environmental laws, determinants of contradictions inside the human-nature relationship system, with contradictions indicating the discrepancies between social laws and those of nature.

#### *Types of environmental consciousness*

Environmental consciousness has undergone continuous change, with its every stage marked by special interactions between human and nature. This research has identified two main types of environmental consciousness: the anthropocentric and the ecocentric perspectives. More specifically, “western” environmental consciousness is anthropocentric”. In other words, its underlying feature is human exceptionalism, which is perceived as freedom from the need to comply with objective ecological norms. Summarizing the typological features of anthropocentric environmental consciousness, Deriabo and Yasvin (1996) note that it regards human life as inherently valuable in contrast to non-human living beings; the latter being perceived in terms of benefits from them. In this view, humans are the only beings who have intrinsic value and, therefore, the right to dominate over the natural world, which only exists for their own benefit. The pragmatic imperative views nature only in relation to what it can provide for humanity. Ethical norms and rules hardly extend to the human-nature relationship. Sustainability is motivated exclusively by pragmatic considerations. For instance, environmental stewardship is regarded as important only when it comes to preserving natural resources for future generations.

The New Environmental Paradigm values the environment for its own sake. According to Deriabo and Yasvin (1996) and Simonova (1999), this type of environmental consciousness is focused on ecological relevance, which preserves balance between pragmatic and non-pragmatic human activity within the boundaries of ecological systems. It is based on a comprehensive awareness of imminent global catastrophe and the development of ecological crisis. In addition, it contains a moral dimension, which is responsible for selecting purposeful activities. Decision-taking is based on the ecological imperative and of its desirability.

#### *Groups of environmental consciousness*

In modern psychology, environmental consciousness is traditionally divided into four groups. Medvedev and Aldasheva (2001) define *collective environmental consciousness* as shared views on attitudes to nature determined by the level of awareness, as well as ideas about the unity of an individual, humanity and the environment. Collective environmental consciousness includes general interpretations of the human-nature relationship, which is characteristic of a certain social structure (professional group or population, ethos or humanity as a whole). It is responsible for a systemic assessment of the human-nature relationship, its

organizational goals and impacts on natural objects and phenomena. Another feature is general acceptance and commitment to all norms and laws pertaining to the human-nature relationship.

At the same time, *individual environmental consciousness* represents an individual's concrete experience with nature, and its outcomes. It encompasses a system of knowledge about the natural world that an individual acquires through studies and socialization, while building awareness of the existing social dimensions of environmental consciousness and ecological behaviour. An important aspect is the assimilation of new experience by taking into account an individual's personal psychological characteristics. In this connection, mass media serve as an important tool for shaping a society's consciousness. At the same time, in modern society individual environmental consciousness is faced with a growing number of changes caused by anthropogenic influence, which poses a real threat to human wellbeing. Thus, consciousness is characterized by its openness to information, which allows for a possibility of understanding the causes of change and estimate their extent and possible negative consequences. Medvedev and Aldasheva (2001) identify *routine environmental consciousness* as a system of views shaped on the basis of immediate contacts with natural objects, as well as controversial data obtained from various sources. Another characteristic feature refers to shaping views from individual experience under the pressure from the surroundings without any link with scientific substantiation of the data or purposeful environmental education.

*Scientifically substantiated environmental consciousness* is shaped through scientific inquiry, which uses objective relationships inside natural systems, plus interactions between human and nature, nature and society. Furthermore, it takes into account urgent societal interests. Scientifically substantiated environmental consciousness results from a critical analysis of ecological consequences as well as the significance of predicted changes for an individual, a social group, or society as a whole. Scientifically substantiated environmental consciousness is closely connected with scientific knowledge about natural objects and their interrelations. They enable an individual to estimate their importance, the possibilities and ways of using them in order to satisfy human needs and interests, as well as predict the outcomes of the preferred type of interaction with a particular object in the environment, both for an individual and the object itself.

#### *Forms of environmental consciousness*

Researchers identify four major forms of environmental consciousness. *The consciousness of negation* is marked by disregard for information about the nature and content of ecological links that have no direct bearing to a particular individual or social group with a mature collective environmental consciousness. In this perspective, there is personal detachment from certain questions or issues. The phenomenon of negation can be observed in conditions of very slow changes in the environment. There is a prevailing orientation towards the current moment and current events. In consequence, individuals possessing this form of environmental consciousness tend to perceive ecological problems as political, economic or nationalistic. This breeds indifference to nature; disregard for existing and potential problems; light-mindedness about environmental bans and restrictions.

*Hyperbolized environmental consciousness* is marked by unrealistic or inadequate assessment of ecological problems, a tendency towards fatalism and catastrophism. At the same time, this perspective on environmental consciousness fails to differentiate between what refers directly to a particular individual and what does not... As a result, threatening situations are perceived with exaggeration, whereas favourable changes are assessed inadequately or slightly pessimistically. Hyperbolized environmental consciousness tends to be burdened with frustration arising from underestimated capabilities to control a situation. Consequently, ecological behaviour is marked by reluctance to search for active creative solutions, as well as automatic and stereotyped actions and disbelief in their success. Furthermore, there is an atrophied capacity for prediction or an inclination towards pessimistic vision, which leads to passivity in performing predefined algorithms (Deriabo and Yasvin, 1996, pp. 49-66).



Hyperbolization is based on information obtained through direct interaction with nature and through the mass media. Hyperbolized environmental consciousness is steady. Yet, if there is a contradiction between the original information, the predictions inferred from it and further events, this form of consciousness can be replaced with that of negation.

*Self-centered environmental consciousness* stems from the human-nature relationship and human-society interaction, which comply with existing regulations and moral restrictions. At the same time, in resolving problematic ecological issues, subjective interest assumes priority. This form of ecological behaviour pursues individual self-centered objectives closely connected with satisfying material needs. It is noteworthy that an individual can be aware or know of the possible unfavourable consequences of their own ecological behaviour in the present or future. However, individuals with self-centred environmental consciousness are prone to justify their choice of illegal methods and ways to achieve personal goals. Developing collective ecological self-centered consciousness is associated with the predominance of the interests of a particular group over those of a whole society, and individual interests over those of a social group. This process leads to decreased resilience and the emergence of contradictions between an individual's worldview, their aspirations, decisions and actions. If self-centred consciousness spreads to individuals of a higher rank, it has a direct effect on political decision-taking concerning the human-nature relationship. Self-centred consciousness underlies pragmatic inclinations aimed at conquering the world and using natural resources in order to obtain short-lived benefit. Its characteristics include narrow-mindedness, prevailing false ideas about "man being the master of nature"; and when an individual's omnipotence and exceptionalism are confirmed in practice, they resort to barbaric devastation of nature.

Rapid capitalization, desire to become rich "at any cost" and "by any means" lead to the dominance of behaviour directed at transformation and depletion over the ability to enjoy natural beauty (Deriabo and Yasvin, 1996, p. 59). Destruction is the most disgusting form of interaction with nature; it stems from self-centred environmental consciousness. A practical manifestation of self-centred environmental consciousness is statistics on deforestation that reflect daily transportation of timber in hundreds of train cars from immature Carpathian forests, destruction of berry fields and rare animal species. Another instance of self-centred environmental consciousness is profit-motivated mismanagement. More specifically, river-bank slips are caused by extensive removal of gravel and sand and the resulting meander of mountainous rivers and torrents.

The current pervasiveness of pragmatism and instrumentalism has a significant impact on the human-nature interaction. Specifically, human desire for wellbeing knows no bounds; unrestrained overconsumption and excessive comfort will inevitably lead to psychophysiological and moral degradation (Rohozha, 2006, p. 84). This breeds avarice and pathological consumerism, thus turning a person into a predator devoid of common sense or morality, let alone spirituality. The complexity of developing personality and environmental consciousness is that, in modern society, the rich and poor divide is widening. Extreme social polarization and lack of middle-class households inhibit the natural development of a personality, especially in high-altitude areas. Having become rich through ruthless exploitation of mountains (deforestation, aggregate resources, etc.), the so-called "new Ukrainians" go unpunished for destroying the nature of the Carpathians. Particularly harmful is the path to enrichment through environmentally unfriendly behaviour rooted in self-centred environmental consciousness. A fear of industrial poverty and a strong disbelief in the possibility of human existence without natural resources, which are being exhausted, are catching people off guard and leaving them dazed in the face of the consequences of their own actions, thus shaping self-indulgent exploitation of the natural world.

Ukrainians tend to be selfish, which is why their interaction with nature can be driven by personal benefits. This self-centredness and disregard for others reflect lack of development, culture and manners. Distorted perceptions of human needs and lack of common-sense manifest themselves in hunting endangered animals, fishing during the spawn, water pollution, outdated manufacturing practices – all causing air pollution,

massive use of environmentally hazardous substances, absence of safe waste disposal technologies and so on. Such activities are detrimental to both ecosystems and humans themselves. Thus, mere sufferings caused by deteriorating health by air and water pollution, harmful substances in food urges an individual to think about environmental sustainability and placing restrictions on their interaction with nature. It should be noted that self-centred environmental consciousness and its characteristic behaviour leads to environmental degradation.

Therefore, the mass media are becoming increasingly fixated on “the crisis of civilization”, “the death of humanity and all life on the Earth”, “catastrophic consequences”, “effects of globalization”. As a result, society has become subconsciously aware of pervasive tension, anxiety and unrest. At the same time, the awareness that the danger is coming from self-centered ecological behaviour is the driving force for finding out about the actual causes of crises, catastrophes, or any other cataclysms, which reflect a crisis of spirituality in the ecological, economic, financial and anthropological dimensions. Konnov (2006, p. 67) notes in this matter that activism has external limits: a person must not exceed the measure set by the Creator or count exclusively on themselves; nature cannot be transformed without the mediation of the Spirit.

Scientific and technological progress, in the context of declining morality and distorted perceptions of the good and the evil, causes number of difficulties in the development of personality, building environmental consciousness and relationship with nature. Nature is not only an object of human impact but also a living reflection of a human being in nature and a reflection of nature in the living being themselves. This indivisible whole can be grasped only by an individual possessing a highly developed self-awareness and spirituality (Dobronosova, 2006, p. 91). Grasping the essence and sense of nature in a human and the sense of a human in nature means pointing the development of the human being themselves in the right direction. For this reason, we believe that highly developed spirituality promotes a more environmentally conscious behaviour and helps move beyond the boundaries of human selfishness. Most philosophers believe that a person is more interested in preserving life on the Earth. Thus, it is only a person who is capable of preventing a global ecological catastrophe. For this reason, scientists are convinced that a person has a remarkable role to play in promoting the significance of nature with its resources. We partly agree with this point. More specifically, we believe that only a developed person, who possesses a strong sense of self-awareness, profound knowledge of the natural world and a willingness to assume responsibility for it, is capable of sustaining the environment and its natural ecosystems. These are characteristics of adequate environmental consciousness.

*Adequate environmental consciousness* is a scientifically substantiated consciousness, which considers the natural environment as a higher intellect marked by spiritual grandeur. Nature is regarded as spiritual refuge for a person to get away from the hustle and bustle of everyday life, thus focusing on the philosophical problems of the origins of the universe. Adequate environmental consciousness urges sustainability, thereby, minimizing the likelihood of environmental damage from rapid economic growth. Adequate environmental consciousness is marked by activism and constructivism in looking for solutions to urgent problems. Constructive solutions are based on compromise, which prohibits from setting certain goals in the course of scientific and technological progress. The first activities to be limited or prohibited are the ones provoking environmental damage, thus exceeding the benefit gained from them. The decision-taking process and its outcome are affected by emotionally sensual and aesthetic factors. In addition, there is a strong interconnection between individual and collective adequate environmental consciousness. Therefore, the current ecological situation requires unity in viewing ecological issues, solutions and joint coordinated actions.

#### *Types of environmental attitude*

Yasvin (2000), in his monograph on the psychology of the human-nature relationship, describes ten types of environmental attitudes identified on the basis of differences between objective and subjective perceptions of nature. The author considers *objective pragmatic attitude* to nature as perceived through the

prism of material benefits as a source of resources and as a tool for achieving goals. This type of attitude is found in individuals with self-centred environmental consciousness. *Subjective pragmatic attitude* can be observed in individuals with subjective perception of natural objects as agents and partners. Human activity is motivated by pragmatism and is inherent in self-centred environmental consciousness.

*Objective aesthetic attitude* is characteristic of people with perceptive sensual and aesthetic perceptions of the environment. *Subjective aesthetic attitude* is based on the aesthetic experience of contacting natural objects serving as a sort of subjects. Therefore, individuals with this type of environmental attitude are capable of giving an emotional response to nature, having feelings for it, interacting with it on a par. Both types of attitudes are found in individuals with adequate environmental consciousness.

*Objective cognitive attitude* is marked by a characteristic dominance of the cognitive dimension of environmental consciousness and view. Individuals displaying this type of environmental attitude perceive nature as an object of examination from a rational perspective. *Subjective cognitive attitude* entails exploring nature with complete awareness of its intrinsic value, self-sufficiency and uniqueness; recognizing its unalienable right to existence and the possibility of an equal interaction on the basis of socially acceptable norms and rules.

The defining feature of *objective practical attitude* is intensity and practical ecological views. In this case, nature is perceived as an object and instrument for satisfying individual needs without any attempts to establish a harmonious relationship with the natural environment. A person's practical steps are directed at the natural object *per se*; in other words, it is based on partnership. A person is sensitive towards the features of a natural object, tending to interpret them from a subjective perspective and reacting to them. It is noteworthy that the relationship with the environment is based on reflection and gets adjusted in line with nature's "interests".

*Objective safeguarding attitude* to nature is marked by the dominance of the behavioural dimension of environmental consciousness and a highly intense objective perception of nature. This type of attitude stems from perceiving nature as belonging to the whole humanity, including future generations in whose interests it is necessary to safeguard natural objects. It should be noted that the above-mentioned type of attitude to nature is regarded as "conscious", "responsible" "rational", and is declared for purposes of environmental education. It is characteristic of environmental activists who promote sustainable environmental movement, as well as for school teachers (Yasvin, 2000).

The abovementioned types of attitudes to nature were identified on the basis of their reflection in certain ideas, opinions, worldviews and value orientations. However, environmental consciousness encompasses not only attitudes to nature but also to an individual's activities in a natural environment, connections between an individual and society and so on. It is necessary to consider these factors while fostering adequate environmental consciousness in children and adults.

#### *Psychological aspects of building environmental consciousness*

The personality of an environmentally conscious individual manifests itself in behavioural norms and rules, as well as environmental attitudes. The ability to identify and analyse environmental problems, assess their urgency and suggest environmental solutions are the features of a well-formed adequate environmental consciousness (Zverev *et al.*, 1994). Because of the structural features of environmental consciousness, it can be inferred that its formation is a long and complex process, which depends on a great number of factors. Except for "adequate environmental consciousness" described in the literature, its other forms must not be discussed in schools because their nature contradicts the goal of environmental education, which is preparing young people for resolving ecological problems and adopting pro-environmental behaviour. Therefore, shaping adequate environmental consciousness is the main goal of environmental education.



Building environmental consciousness requires a profound understanding of the danger of global ecological catastrophe and local ecological crises. Achieving this goal is possible only through systematic, step-by-step education at all stages of secondary school. Environmental education must focus on shaping a safeguarding attitude to nature. Ecological competence is a cognitive constituent of environmental consciousness, which reflects a body of knowledge about the natural world, the principles and models of interacting with it. It is shaped during the formal education through a special system of educational activities or through self-education as an independently organized activity.

Losev (2010, p.11) is of the opinion that environmental consciousness is built by socio-cultural factors, which urge an individual to act according to their goals; such factors cannot be normal (they do not possess features of crisis situations) since an absence of a problem cannot lead to a new understanding, a new attitude to nature. It follows from this explanation that social and individual experiences arising from ecological crisis motivate an individual to search for a new understanding of the natural world under the emergent socio-cultural conditions. Therefore, socio-cultural circumstances reflect a crisis between society and nature; and new social and personal experiences lead an individual to the development of a new environmental consciousness capable of building a new relationship between nature and society, preventing crisis, reducing tension, searching for environmental solutions. Therefore, the development of the cognitive dimension of environmental consciousness relates to worldviews, which shape attitudes to nature and foster environmental consciousness.

Furthermore, the development of environmental consciousness depends on the cognitive (knowledge and constructive ecological reasoning) and emotive (emotional experiences and feelings associated with environmental interaction) aspects of consciousness, which determine the perception and mental reflection of this part of an individual's life. There are two types of ecological consciousness shaped under the influence of mental processes. One type is marked by automatic involvement of scientific knowledge of ecology and personal ecological experience by analyzing situations, identifying their interconnections, comparing primary information with newly acquired ecological knowledge, predictions, judgments, analytical forecasts and models, and, finally, new environmental behaviour patterns. The other type is characterized by emotional judgment, which arises from personal experiences, assumptions and judgments based on "trusted sources" of environmental knowledge and personal intuitions about ecologically salient events, sources of information, environmental resolutions made by governmental bodies and officials (Chuikova, 2012a, 2012b Chuikova and Chuikov 2014a, 2014b).

Therefore, the selection of information in the course of building the cognitive aspects of environmental consciousness must be based on a historical analysis of natural and social detrimental factors, which lead to a shortage of food, territory, energy or any other vital resource, because they are representative of the effects on the development of human population and human-nature relations, and they stimulate interest in finding ways of building a harmonious ecological relationship. In addition, it is necessary to conduct an analysis of social factors, which provoke environmental consumerism blurring humane attitudes to nature. The development of critical ecological reasoning and adequate environmental judgments must be based on analyzing academic publications and scientific popular literature, social aspects of using ecological resources, environmental legislation, mass media reports (Chuikova, 2014).

Environmental education is intended to build adequate environmental consciousness on the basis of knowledge and skills acquired in the course of environmental education. Specifically, it is important to develop the ability to analyse one's own impact on natural resources and choose environmentally sustainable strategies. Hence, adequate environmental consciousness manifests itself in a pro-environmental lifestyle. Additional determinants of adequate environmental consciousness include the well-formedness of self-organization, self-control, self-restraint and self-motivation.

To prevent the aggravation of dangerous ecological situations, it is necessary to learn to treat nature on a par with humans. There is an interdependence between adequate environmental consciousness and

environmental perception, environmental stewardship. Thus, attitudes and value orientations are the major constituents of environmental consciousness, which determine attitudes to environmental issues. In building adequate environmental consciousness, the key factor is a move away from anthropocentric to ecocentric environmental consciousness. Building environmental consciousness is linked to socialization. Social well-being and environmental value orientations are interdependent. Therefore, environmental education must embrace all social institutions – from family through school to society as a whole. Dominant value orientations determine decision-taking and behavioural patterns (Chuikova, 2013).

A child's environmental consciousness takes its roots in the family and continues in primary school under the guidance of teachers, with whom the child spends most of the day. Yet, a child's exposure to the natural world can have profound effects. Perception is associated with the emotional experience of the significance of the human-nature interaction, comparison of one's own ideas with societal ecological norms, followed by the development of one's own views. Building adequate environmental consciousness is facilitated by observing ecological attitudes in the child's family circle. During a lifetime, an individual will accumulate environmental knowledge from schools, the mass media, family members and peer friends, outdoor activities, other professional and personal experiences.

#### *The environmental education of children living in mountainous areas*

This research shows that the impact of high-altitude environments on the mental development of primary school children is reflected in spirituality and local traditions associated with the human-nature relationship. Thus, the human-nature relationship is traditionally viewed from two perspectives: the first one focuses on the links between an individual's psychophysiological development and his/her geographical and living conditions; the other one explores the effect of mental maturity and national mentality on environmental behaviour. While the first perspective is traditionally believed to have greater explanatory power, we will contemplate all the above-mentioned factors as a single coherent whole. Therefore, personal growth and mental development can be the key to the challenges of the natural environment.

The analysis of data shows that there is a significant body of literature exploring the impact of a child's family and school, peers and adults, as well as the mass media on their ecological conscience. However, the interdependence between the geographical conditions, particularly those in mountainous areas, and household activities, traditions, mode of life is scantily studied in national academia. According to Gumilov (2001), differences in the human-nature relationship stem from different geographical living conditions; therefore, the essence of an individual's environmental consciousness is shaped by their experiences with nature. Hrushevsky (2012) demonstrates that the culture and mentality of Ukrainians are inextricably connected with their natural living conditions. Exploring the spiritual life and household activities of Ukrainians, Kostomarov (1921) identifies their culture-specific characteristics such as individualism, tolerance, unity of religious faith and the church, high spiritual development, and respect for a woman in society. Chyzhevsky (1992) emphasizes the importance of the natural environment for the development of Ukrainians. More specifically, the author regards landscape as the main contributing factor to the Ukrainian psychic make-up; Ukrainians are described as emotional and sentimental, sensitive and lyrical, individualistic and striving for freedom, which can sometimes lead to self-isolation, proneness to conflict, and restlessness. Gachev (1999, pp.47-48) explores how an individual's living conditions (terrain, climatic conditions, weather patterns, flora and fauna) determine their choice of subsistence mode (foraging, horticulture, pastoralism, agriculture) and shape their worldview. A person saturates the surrounding natural environment, uses it to satisfy his/her needs for subsistence and, at the same time, the natural environment saturates the person, his/her household, soul, body and mind. Kulchytsky (1993) notes that vast forest areas associated with mystery and danger develop a tendency towards caution, suspiciousness, patience, apprehension, fear and adaptability. According to Rybchyn (1996, pp.21-23), forest dwellers tend to be romantic and to live in harmony with nature, which is vividly reflected in their folklore, patterns on their craft objects, colours and sounds reminiscent of nature. Khrushch (1994, 2008) describes the Carpathians

as emotional, impulsive, dynamic, cheerful and passionate, which can be attributed to the geographic diversity of a high-altitude area with its blooming vegetation and the vibrant interplay of light and shadow.

The character of a primary school child living in a high-altitude area is shaped under the influence of landscape and climate, including the associated risks: squalls, wild rivers, landslides, atmospheric instability, long winter and short summer, hypoxia, hypothermia and so on. The impact of such conditions on a child's character is unavoidable. This might explain the reasons for the commonly held opinion that mountain dwellers are proud of, brave, resilient, independent, courageous, inventive, and so on. Similar descriptions can be found in folklore, fiction, research papers in ethnology, history, ethnopsychology; however, they tend to be unsubstantiated and lack generalizability (Khrushch, 2008, p.174).

The negative traits commonly attributed to mountain dwellers include "intolerance, disregard for authority, grudge bordering on revengefulness, pointless persistence bordering on stubbornness, covert envy, obsessive fear of being deprived of their land, irritability, psychological instability, neglect of familial values, suspiciousness of strangers and so on" (Khrushch, 2007-2008a, p.174-175). In our opinion, it depends on livelihood, mode of life, cultural and historical traditions.

If a person is capable of grasping the essence and significance of the natural world, he/she also understand their dependence on it and try to live in harmony. The possibility of a harmonious co-existence between human and nature depends on intellectual, moral, aesthetic, spiritual maturity. Narrow-mindedness, ignorance, false beliefs in human exceptionalism and omnipotence lead to barbaric, ruthless destruction of nature. Thus, a crisis of spirituality gives rise to environmental crisis because most of the problems we face are inside of us. This is the reason why human has the key role in the human-nature relationship.

School age is the most sensitive period of shaping the perception of a human as exceptionally important, perfect and unique due to having consciousness. Yet, a human continues to depend climate, flora and fauna, landscapes, atmospheric phenomena and so on. Natural disasters expose a person's limited power and the importance to safeguard the environment.

We are strongly convinced that the changes happening in life, including those in the human-nature relationship system, depend on a person's level of development, orientation (towards the good or evil, improvement or destruction, augmentation or wastage), morality, spirituality and environmental consciousness (Khrushch, 2013, p.5).

Only a highly conscious and cultured person is capable of combining, on the one hand, the feeling of great awe for the nature of mountains, the desire to preserve them for future generations and, on the other hand, the need to use their resources for improving human life. Spiritual development (which is based on faith, sympathy for others, concern for the consequences of own actions), enables a person to control their desires and make rational choices, thus protecting themselves from being enslaved by comfort at the cost of dominance over nature by using novel technologies.

Human and nature are closely intertwined, with the former being an important part of nature. At the same time, conscious as human is, they do not always display sufficient development and culture. The interdependence between cultural, moral, spiritual development and environmental protection has been discussed by many thinkers. To illustrate, the Austrian scientist Lorenz (1974) describes the "deadly sins" of a civilized person: overpopulation, devastation of the environment, man's race against himself, the breaking with tradition, emotional entropy, indoctrinability, genetic decay and nuclear weapons. In this regard, worthy of special mention is Pope John Paul II's opinion that "the seriousness of the ecological issue

lays bare the depth of man's moral crisis" (John Paul II, 1990). Rohozha (2006) wrote about the issue<sup>1</sup> thuswise:

"Ecological crisis is a systemic crisis of values, a crisis of our cultural existence ... [abridged] therefore, it is necessary that we activate our ability ... [abridged] to resolve the ecological crisis through overcoming the crisis of spirituality, a crisis of cultural exploration of the world." (Rohozha, 2006, p.123)

The spirituality of school age children is shaped through work: while working together with adults, children acquire an understanding of the importance of labor in fighting poverty, create a sense of rightful possession of forests, valleys, cultivated by their ancestors. While morality and spirituality based on industriousness, care and thrift. Lomatsky (1960) writes that during the times of Dovbush<sup>2</sup> there was no place for poverty in the Carpathian Mountains. Dovbush himself considered poverty to be a sin committed due to laziness. *Hutsuls*<sup>3</sup>, with their keen sense of dignity and industriousness, believe that a healthy, able-bodied person must not be poor; this might only happen to the frail, lonely or elderly.

Studying the development of the relationship between nature and children inhabiting high-altitude areas entails exploring their mental processes, worldviews, social perceptions, reactions, sensory images, verbal and non-verbal communication, reasoning skills and so on. In addition, it is necessary to measure the depth and stability of mental processes, memory, consciousness and self-awareness. Another dimension worthy of investigation includes self-esteem, respect for spiritual and material heritage, a commitment to preserve it and deter environmental destruction.

## Conclusion

Considering the theoretical analysis of environmental consciousness above, it is important to fully grasp the close bond between human and nature. Attitude to natural resources is indicative of environmental culture and consciousness.

Environmental consciousness is an integrative construct that encompasses knowledge, values and behaviour patterns, which manifest themselves in environmental stewardship and consumption. An individual's higher-order environmental consciousness is consistent with ecological wisdom; an individual is guided by them in their ways of living and domestic activities. Adequate environmental consciousness underlies pro-environmental behaviour.

The underlying dimension of adequate environmental consciousness includes environmental education programs involving a combination of educational approaches that foster value orientations and worldviews aimed at environmental stewardship, capacity to logically process environmental issues, develop strategies of achieving sustainable ways of living through self-restrained consumerism.

A child's environmental consciousness is largely shaped by their adult community, as well by hands-on experiences with nature, a sense of connectedness to nature. Such sensorial engagement creates values. Effective environmental education must enhance a child's hands-on experience by involving child-parent transmission of knowledge, skills and commitments that lead to environmental stewardship in different circumstances and settings.

<sup>1</sup> Криза довкілля - це системна криза цінностей, криза нашого культурного існування... тому потрібно активізувати нашу здатність... вирішення кризи екологічної через подолання кризи духовної, кризи культурного освоєння світу.

<sup>2</sup> The leader of the resistance group based in the Carpathian Mountains and composed of Ukrainian peasants who rebelled against serfdom in the 18th century. They robbed the rich and distributed their property among the poor.

<sup>3</sup> An ethnic group of Ukrainian pastoral highlanders inhabiting the South-Eastern part of the Carpathian Mountains.

Building adequate environmental consciousness must teach parents and educators the fundamentals of understanding the intrinsic value of nature, with all its challenges such as squalls, blizzards, fast-flowing mountain torrents, deep canyons, sharp changes in weather conditions in order to ensure that children acquire true perceptions of the power of nature and the importance of environmental resilience. Building attitudes of concern for the environment will boost children's intention to safeguard nature in all its diversity, thereby protecting it from mismanagement and mindless devastation.

## References

- Beck, U. (2009). *World Risk Society*. Cambridge: Polity Press.
- Chuikova, L. (2012a). Ekologicheskoe informatsionnoe prostranstvo i ego vliianie na ekologicheskoe soznanie [Ecological Informational Space and Its Impact on Environmental Consciousness]. *Astrahanskii vestnik ekologicheskogo obrazovaniia* [Astrahan Bulletin of Ecological Education], 2(20): 15-40.
- Chuikova, L. (2012b). O kliuchevykh ponятиiah, svyazannykh s ekologicheskim obrazovaniem, ekologicheskim vospitaniem i ekologicheskim informatsionnym prostranstvom kak faktorom, aktivno vliiaushchim na formirovaniie tipa ekologicheskogo soznaniia [On the Key Notions Associated with Ecological Education, Ecological Attitude and Ecological Informational Space as a Driving Force of Building Environmental Consciousness]. *Astrahanskii vestnik ekologicheskogo obrazovaniia* [Astrahan Bulletin of Ecological Education], 4 (22):122-129.
- Chuikova, L. (2013). *Ekologicheskoe soznanie: sotsialno-pedagogicheskie aspekty, determiniruiushchie ego formirovanie: monografiia* [Environmental Consciousness: Socio-Pedagogical Determinants of Its Development: A Monograph]. Astrahan: Izd-vo Nizhnevolzhskogo Ekotsentra.
- Chuikova, L. and Chuikov, Y. (2014a). Ekologicheskaiia pedagogika kak oblast issledovaniia i primeneniia [Environmental Pedagogy as a Field for Research and Application]. *Gumanitarnye issledovaniia* [Humanitarian Studies], 1(49): 111-118.
- Chuikova, L. and Chuikov, Y. (2014b). Ekologicheskaiia pedagogika: sodержaniie ekologicheskoi informatsii v kontseptsii formirovaniia adekvatnogo ekologicheskogo soznaniia [Environmental Pedagogy: the Content of Ecological Information within the Conception of Building Adequate Environmental Consciousness]. *Gumanitarnye issledovaniia* [Humanitarian Studies], 1(49): 118-125.
- Chyzhevsky, D. (1992). *Narysy z istorii filosofii na Ukraini* [Essays on the History of Philosophy in Ukraine]. Kyiv: Orii, pp.15-19.
- Darenskyi, V. (2006). "Dialog" liudyna-pryroda yak ekzysyentsiinyi fenomen [The Human-Nature "Dialogue" as an Existential Phenomenon]. In: Tolstoukhov, A. et al. (Eds.), *Filosofiia Pryrody* [The Philosophy of Nature]. Kyiv: PARAPAN, p.29.
- Deriabo, S. and Yasvin, V. (1996). *Ekologicheskaya pedagogika i psikhologiiia* [Environmental Pedagogy and Psychology]. Rostov n/D: Feniks.
- Dobronosova, Y. (2006). Tilesnist yak osnova rozuminnia yednosti pryrody ta liudyny [Corporeality as a Foundation for Grasping the Unity between Nature and Human]. In: Tolstoukhov, A. et al. (Eds.), *Filosofiia Pryrody* [The Philosophy of Nature]. Kyiv: PARAPAN, p.91.
- Gachev, G. (1999). *Natsionalnye obrazy mira. Evraziia – kosmos kochevnika, zemledeltsa i gortsa* [National Worldviews. Eurasia – a Cosmos of the Nomad, the Farmer and the Highlander]. Moskva: Institut DI-DIK.
- Girusov, E. (1983). *Ekologicheskoe soznanie kak usloviie optimizatsii vzaimodeistviia obshchetva i prorody* [Environmental Consciousness as a Determinant for Optimizing the Interaction between Society and Nature]. Moskva: Progres, pp.108-118.
- John Paul II (1990). *XXIII World Day for Peace 1990, Peace with God the Creator, Peace with All of Creation*. [online] Vatican.va. Available at: [http://www.vatican.va/content/john-paul-ii/en/messages/peace/documents/hf\\_jp-ii\\_mes\\_19891208\\_xxiii-world-day-for-peace.html](http://www.vatican.va/content/john-paul-ii/en/messages/peace/documents/hf_jp-ii_mes_19891208_xxiii-world-day-for-peace.html) [Accessed 8 May 2021].



- Hrushevsky, M. (2012). Na horakh [In the Mountains]. In: Sokhan P. et al. (Eds.), *Tvory: u 50 t. T.13 [Essays: in 50 volumes. Vol.13]*. Lviv: Svit, pp.196–199.
- Gumilov, L.N. (2001). *Etnogenez i biosfera Zemli [Ethnogenesis and the Earth's Biosphere]*. SPb.: Krystall.
- Khrushch, O. (1994). Vyvchennia etnopsykholohichnykh osoblyvostei kharakteru hutsuliv [Studying the Character of Hutsuls from an Ethnopsychological Perspective]. *Etnichna psykholohiia [Ethnic Psychology]*. Ivano-Frankivsk, p.45.
- Khrushch, O. (2008). Vyvchaemo psykholohiiu horian [Studying the Psychology of Highlanders]. *Hirska shkola ukrainskykh Karpat [The Mountain School in the Ukrainian Carpathians]*, 2-3:174.
- Khrushch, O. (2008a). Vyvchaemo psykholohiiu horian [Studying the Psychology of Highlanders]. *Hirska shkola ukrainskykh Karpat [The Mountain School in the Ukrainian Carpathians]*, 2-3: 174-175.
- Khrushch, V. (2013). Hory yak osoblyve seredovyshche rozvytku osobystosti [Mountains as a Special Environment for the Development of Personality]. *Hirska shkola ukrainskykh Karpat [The Mountain School in the Ukrainian Carpathians]*, 8-9: 3-8.
- Kiselov, N. (1990). *Mirovozzrenie i ekologiiia [Worldview and Ecology]*. Kyiv: Nauk. dumka.
- Kochergin, A., Markov, Y. and Vasilev N. (1987). *Ekologicheskoe znanie i soznanie: osobennosti formirovaniia [Ecological Knowledge and Consciousness: Development Specifics]*. Novosibirsk: Nauka.
- Konnov, O.F. (2006). Vzaemovidnosyny liudyny z pryrodou yak ontolohichna problema [The Human-Nature Relationship as an Ontological Problem]. In: Tolstoukhov, A. et al. (Eds.), *Filosofiiia Pryrody [The Philosophy of Nature]*. Kyiv: PARAPAN, p.67.
- Kostomarov, M. (1921). *Knyhy bytiia ukrainskoho narodu [Books of the Genesis of the Ukrainian People]*. Lviv-Kyiv.
- Kulchytsky, O. (1993). Rysy kharakterolohii ukrainskoho narodu [The Characterology of the Ukrainian People]. *Entsyklopediia Ukrainoznavstva [The Encyclopedia of Ukrainian Studies]*. Vol.2. Lviv, p.708.
- Lihachev, B.T. (1993). Ekologiiia lichnosti [The Ecology of Personalty]. *Pedagogika [Pedagogy]*, 2: 19–23.
- Liuri, D. (1997). *Razvitie resursopolzovaniia i ekologicheskie krizisy, ili zachem nam nuzhny ekologichaskie krizisy? [The Development of Natural Resource Use and Ecological Crises, or Why Do We Need Ecological Crises?]*. Moskva: Delta.
- Lomatsky, M. (1960). “Verkhovyno, svitku ty nash”. *Narysy z Hutsulshchyny [“Verkhovyna, you are our world”. Essays from the Hutsul Region]*. New York: Hoverlia.
- Lorenz, K. (1974). *Civilized Man's Eight Deadly Sins. Translated by Marjorie Kerr Wilson*. New York: Harcourt Brace Jovanovich.
- Losev, V. (2010). Osnovnye kulturno–ideologicheskije determinanty “ekologicheskogo soznaniia” [Major Cultural and Ideological Determinants of “Environmental Consciousness”]. PhD Dissertation, Saratov.
- Medvedev, V. and Aldasheva, A. (2001). *Ekologicheskoe soznanie: Uchebnoe posobie [Environmental Consciousness: A Study Manual]*. Moskva: Logos.
- Morris, M. (2002). Ecological consciousness and curriculum. *Journal of Curriculum Studies*, 34(5): 571-587. DOI: 10.1080/00220270110108187
- O'Sullivan, E. and Taylor, M. (2004). *Learning Toward an Ecological Consciousness: Selected Transformative Practices*. London: Palgrave Macmillan Ltd.
- Rohozha, M. (2006). Pryroda yak etnosna tsinnist [Nature as an Ethnic Value]. In: Tolstoukhov, A. et al. (Eds.), *Filosofiiia Pryrody [The Philosophy of Nature]*. Kyiv: PARAPAN, p.84.
- Rohozha, M. (2006). Pryroda yak problema kultury [Nature as a Cultural Issue]. In: Tolstoukhov, A. et al. (Eds.), *Filosofiiia Pryrody [The Philosophy of Nature]*. Kyiv: PARAPAN, p.123.
- Rubinshtein, S. (2000). *Osnovy obshchei psihologii [Foundations of General Psychology]*. SPb.: Piter.
- Rybchyn, I. (1996). *Heopsykhichni reaktsii i vdacha ukraintsia [Geo-psychic Reactions and Ukrainian Character]*. München: Dniprova Khvyliia.
- Shagun, G., Pavlov, V. and Ryzhenkov, P. (1994). Issledovaniie ekologicheskogo soznaniia detei i podrostkov [An Exploration of Environmental Consciousness in Adolescents and Children]. *Psikhologicheskii zhurnal [Psychological Journal]*, 15 (1).

- Simonova, T. (1999). Sotsialnaia ekologiia v sisteme ekologicheskogo obrazovaniia studentov [Social Ecology in the System of Environmental Education of Students]. *Materialy yubilenoi nauchno-prakticheskoi konferentsii "Problemy Severo-Zapada: ekologiia i obrazovaniie"* [Proceedings of the Jubilee Research to Practice Conference "North-West Issues: Ecology and Education"]. Saint Petersburg, pp. 41-42.
- Suravegina, I. (1990). Ekologicheskoe obrazovanie v shkole [Ecological Education in School]. *Sovetskaia Pedagogika* [Soviet Pedagogy], 12: 47–49.
- Vernadsky, V. (1967). *Biosfera* [The Biosphere]. Moskva: Mysl.
- Vygotsky, L. (1982). *Sobranie sochinenii: V 6-ti t. T.1.* [A Collection of Essays: In 6 volumes. Vol.1]. Moskva: Pedagogika.
- White, P. (2009). *A phenomenological exploration of ecological consciousness development*. PhD Dissertation, Sydney
- Yasvin, V. (2000). *Psikhologiia otnosheniia k prirode: monografiia* [The Psychology of Treating Nature: A Monograph]. Moskva: Smysl.
- Zverev, I. et al. (1994). *Ekologicheskoe obrazovaniie v shkole. Kontsepsiia* [Ecological Education in School. A Conception]. Moskva: Moskovskii tsentr mezhnatsionalnogo i sravnitel'nogo obrazovaniia.

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Conceived and designed the research or analysis	Yes	Yes
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Contributed to data analysis & interpretation	Yes	Yes
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