

## Perceptions of Secondary School Students' Towards Environmental Services: A Case Study from Czechia

Mehreteab Tesfai<sup>a</sup>, Udaya Sekhar Nagothu<sup>a</sup>, Josef Šimek<sup>b</sup>, Petr Fučík<sup>c</sup>

<sup>a</sup>Norwegian Institute of Bioeconomy Research, NORWAY; <sup>b</sup>METCENAS, o.p.s., CZECH REPUBLIC; <sup>c</sup>Research Institute for Soil and Water Conservation, Prague, CZECH REPUBLIC

### ABSTRACT

A total of 967 students (males and females) from four secondary schools in Vysocina region of Czechia were interviewed via 24-question Likert-type questionnaire to assess student's environmental awareness and perceptions. The generalized linear models were used to test if (and to what extent) student perceptions related to environment are/ or not influenced by various factors including gender, age, place of residence, educational level, and specialization. The results showed that students' age, place of residence, education level and their specialization did not significantly affect ( $p < 0.05$ ) their environmental perceptions. However, gender appeared to be statistically significant ( $p < 0.05$ ) influencing student environmental perceptions and also showed linkages to basic environmental education, attitudes and engagement of students in science-related activities. Our results strongly support the need for more environmental education, awareness campaigns in the schools and engaging students in outdoor environment related activities. Future research should include detail environmental surveys targeting school students across Czechia.

### KEYWORDS

Environmental awareness, environmental services, perceptions, schools, students

### ARTICLE HISTORY

Received 05 April 2016  
Revised 10 May 2016  
Accepted 11 May 2016

## Introduction

Our basic understanding and knowledge of the environmental services (ES) differs widely from country to country and so does our perception among the different segments of population. In this paper, the terms environmental services (ES) and ecosystems services are used interchangeably. According to MEA (2005), ecosystem services is defined as "... *the benefits people obtain from ecosystems. These include provisioning services such as food and water; regulating services such as regulation of floods, drought, land degradation, and disease; supporting*

**CORRESPONDENCE** Mehreteab Tesfai ✉ mehreteab.tesfai@nibio.no

© 2016 Tesfai et al. Open Access terms of the Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>) apply. The license permits unrestricted use, distribution, and reproduction in any medium, on the condition that users give exact credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if they made any changes.



*services such as soil formation and nutrient cycling; and cultural services such as recreational, spiritual, religious and other nonmaterial benefit*". There are large variations in how people perceive ES and these perceptions largely influence the way ES are managed and policies are formulated in different countries (Vihervaara et al., 2010). "Perception" is concerned with both sensual (usually visual) responses to nature and with the way, people attach meaning and value to it (Swanwick, 2009).

Peoples' perceptions of ES within a water body catchment and outside differs and this could have different implications for policy and future management of that region. Human activities in upstream of a catchment can create negative environmental impacts downstream, and this could lead to upstream-downstream tensions (Alcott et al., 2013). For instance, downstream users often perceive that more soil and water conservation activities in the upstream means less water, less nutrients, and less fertile soils for them, which poses a threat to their livelihoods. Falkenmark (2003) documented the upstream-downstream interactions in the context of resource management and suggested adapting an integrated catchment-based approach in order to maintain sustainable supply of crucial ES up on which upstream and downstream users depend for social and economic developments. The approach is based on the principles that upstream development should not be carried out at the expense of the downstream and *vice versa* (Oweis and Hachum, 2006). Under this management, the entire value chain (from resource conservation to production-processing-marketing-consumption-recycling) are interlinked in such way that the producers (*i.e.*, the farmers or herders or others) and the consumers (*i.e.*, the public at large) mutually benefit from the ES. Despite increased attention given to the role of ES in human well-being, the relationship between human perceptions and ES has not been investigated adequately so far (Lindemann-Matthies et al., 2013).

The quality of environment in the former Czechoslovakia was one of the worst in Europe. Hence, improving the quality of the environmental resources was one of the main objectives of Czechia during the transformation period from 1990 onwards. Since then, there has been an improvement in the environmental protection in Czechia. Progress made in this endeavour, was indeed one of the basic conditions for successful accession of the Czechia to the European Union in 2004. The country has now gained some experience in environmental legislation and practical implementation, particularly in the area of water protection, waste management, addressing old environmental challenges and air protection as well. However, there still exists a lack of proper information on ES perceptions and awareness of the public. More specifically, youth perceptions of the environmental impacts caused by agriculture-related activities and measures required to improve the ES (Karásek et al., 2014).

One of the commonly studied population groups in environmental studies are students of different sex, age, educational level and how these variables impact their perceptions of ES. Students comprise of an important segment of a society and warrant attention in terms of studying environmental culture, opinions, attitudes and behaviours. They will be working in various sectors of society in the future and playing important roles as managers, teachers, business persons, industrialists and the like (Erdogan, 2013). In some contexts, students have been the leading custodians in the modern-day environmental activities and movements (Thapa, 2001; Jenkins & Pell, 2006; Rappaport, 2008). Hence,

understanding students' perceptions on environmental issues are fundamental for the design of policies to enhance their environmental awareness and sensitivity, to support development and use of sustainable practices, methods and products (Erdogan, 2013). It will be necessary to consider the social and demographic characteristics of the cohorts of the students' population in addition to the physical aspects of the environment when investigating the perceptions of students towards environment. Environmental perceptions are affected by host of factors including socio-demographic characteristics that change in space and time. For an environmental education (EE) program to be effective in changing students' perceptions, it must be part of holistic EE curricula in the schools (Eagles & Demare, 1999).

We focus our study on students' perceptions of environmental impacts, their attitudes and engagements. Our research questions were two fold. These were: i) Do students' perceptions of ES differ due to their gender, age, educational levels, place of residence in terms of geographical location, and specialization; and ii) If yes, which of these factor/s is the most influential in determining students' perceptions of ES?

Due to increased attention on environmental problems, we expected that majority of students will perceive environment positively. The main objective of this study was to examine the environmental perceptions and awareness of secondary school students and to identify the major factors influencing students' perceptions of ES and the need for EE at schools.

### **Literature Review: Factors Affecting Student Perceptions**

Studies have shown that students take an active role in environment related activities at schools, if given an opportunity. The present day youth (in this case, the students) will be the ones who will take the responsibility to manage the resources of their country in the future (Müderrisođlu & Altanlar, 2011). Hence, several studies were carried out to understand the environmental attitudes and behaviours of the students. The socio-demographic factors such as age (Mohai & Twright, 1987), gender (Mohai, 1992; Sasidharan & Thapa, 1999; Shobeiri et al., 2007), place of residence (Sasidharan & Thapa, 1999) and educational level (Thapa, 1999) and their impact on perceptions were studied in the past. These studies have shown that, students from rural areas, girls, and younger students have more sophisticated environmental awareness than those from urban areas, boys and older ones, respectively.

Thapa (1999) and Tehrani et al. (2009, 2010) observed some changes in the environmental attitudes and behaviours of the students based on their educational background. Students who had better education on environment were more aware of ES than those with less or without education. Environmental literacy is often linked with students' sensitivity, awareness and understandings of changing environmental issues. Hence, increased and responsible environmental actions are the result of environmental education given to students (Bradley et al., 1997; Moseley, 2000; Magntorn & Hellden, 2007; Woodworth et al., 2011).

The place of residence can also influence student perceptions significantly. Robertson and Burdge (1998) stated that people living in the urban areas are more concerned with environmental issues than those living in the rural areas. On the other hand, land care groups in Australia comprising of mainly land users in rural



areas are devoted to develop sustainable land management practices. This suggests that rural residents are also more environmentally conscious than urbanites. Students growing up in developed versus less developed countries, their environmental settings had significantly different levels of environmental awareness despite their common shared exposure to institutionalized environmental education (He et al., 2011; Hoalst-Pullen et al., 2012)

Another important factor that is likely to influence the perceptions is gender. Several studies reported that females are more positive and show greater concern towards environmental issues than do males (Tikka et al., 2000; Alp et al., 2006; Taskin, 2009). Conversely, some studies found males to be more sensitive to environmental issues than females (MacDonald and Hara, 1994). Yet, some others found no significant differences based on gender (Yilmaz et al., 2004; Shobeiri, et al., 2007). The studies carried out in the past indicated that environmental attitude and awareness varied between male and female. In most of these studies, the attitudes and behaviours of women towards environmental protection were more developed than their male counter parts (Davidson & Freudberg, 1996; Burger et al., 1998; Müderrisođlu & Altanlar, 2011). The results from Tuncer et al. (2005) indicated that there was a statistically significant effect of gender and school type attendance on the environmental attitudes of young people in Turkey, with girls achieving higher scores than boys.

The perceptions can also differ with age of a person. Some studies suggest that young children had more positive attitudes towards environmental issues than older students (Malkus & Musser, 1997; Musser & Diamond, 1999). Age was found to have a statistically significant effect on environmental attitudes of high school students who participated in science survey in United Kingdom (Lyons & Breakwell, 1994). Adejoke et al. (2014) reported that younger learners had better scores than their older counterparts in terms of environmental knowledge and attitudes. It is recommended that investment in environmental education should be at the early stage of children's schooling in order to increase their understandings and knowledge of the environment. Young people's environmental attitudes have shown to be important because they are the ones that will be affected. They can provide alternative solutions to environmental problems arising from present day activities. Today's youth are future scientists, policy-makers, consumers, and voters of a country. Therefore, it appears that effective environmental education for school students is of importance (Bradley et al., 1997).

## **Methodology**

### ***Sampling Methods***

This study was conducted in Vysočina region in the towns of Jihlava and Humpolec of the Czechia during 2014-15 school year from May to July (Figure 1). A total sample of 965 volunteer secondary school students (n = 587 girls and n = 378 boys) were selected from four different schools, namely the Gymnázium Humpolec grammar School (n = 601); Gymnázium Jihlava grammar School (n = 171); Humpolec secondary school of agriculture (n = 100); and Jihlava basic school (n = 93).

Stratified random sampling technique was used to select the sample of students (Shobeiri, 2005). Students' knowledge of environment related to ES was examined across five independent variables namely gender, age, place of

residence, level of education and specialization in four separate schools. The following hypotheses were formulated for testing the assumptions listed in Table 1 at significance level of  $p < 0.05$ .

**Table 1.**

Hypothesis no.	Description	References
H <sub>1</sub>	There will be statistically significant difference between male and female students with respect to perceptions of ES.	Alp et al. (2006); Taskin (2009)
H <sub>2</sub>	There will be statistically significant difference among students' age with regard to perceptions of ES	Malkus and Musser (1997); Musser and Diamond (1999)
H <sub>3</sub>	There will be statistically significant difference among students' educational levels with respect to perceptions of ES.	Hellden (2007); Woodworth et al. (2011)
H <sub>4</sub>	There will be statistically significant difference among the students' place of residence with respect to perceptions of ES.	He et al. (2011)
H <sub>5</sub>	There will be statistically significant difference among students' school specialization with respect to perceptions of ES.	Woodworth et al. (2011)



**Figure 1.**

### Data Collection

Students' perceptions towards ES and agri-environmental effects were investigated with the help of questionnaire consisting of 27 questions. These questions cover topics related to basic environmental education (6 questions: Q1-6), agri-environmental impacts (5 questions: Q7-11) agri-environmental measures (10 questions: Q12-21), and my out of school activities (3 questions: Q22-24) which are presented in Table 2. The students were asked to indicate the extent to which

they agree or disagree with the questions listed in Table 2. The questions were developed and structured taking into consideration the revised new environmental paradigm (NEP) scale by Dunlap et al. (2000).

In addition, socio-demographic data (3 questions) related to gender (male or female); age (under age groups: 13-15 and 16-18 years old and adolescence group: 18 +yr old); place of residence (village up to 500 inhabitants, village up to 2000 inhabitants, small town, district town, regional capital); educational levels (basic study; 4-year grammar study, multi-year grammar study, secondary school of agriculture); and specialization (general education, sport, or agriculture), were also collected. Students were briefly provided with some background information and objectives of the survey. Each student was asked to provide his or her valuation for each closed type question on a five point Likert type scale (Strumse, 1996). The scales were rated ranging from 1 to 5 as follows: 1 = definitely Yes; 2 = rather Yes; 3 = Neutral; 4 = rather No; 5 = definitely No. 'Neutral' choice was given for each question so that a student was not forced to give an answer (Yes or No) if s/he did not feel comfortable to respond.

**Table 2.**

Question set	Survey questions
<i>Environmental education related</i>	Q1: Environment protection is very important to me Q2: The current state of agricultural land in the Czech Republic is satisfactory. Q3: The main purpose of agricultural land should be food production. Q4: The protection of water resources, forests, wild animals, plants, and birds is important for the environment as well as for future generations. Q5: Good environmental conditions are of public interest. Q6: I consider water pollution to be an important issue.
<i>Environmental impacts related</i>	Q7: Agriculture causes water pollution. Q8: The intensification of agriculture and conversion of meadows and pastures to arable land have reduced water quality in streams, ponds and reservoirs. Q9: The overuse of fertilizers and pesticides contributes to the deterioration of the environment. Q10: Intensive crop production for purposes other than production of food (rape, corn) leads to environmental degradation. Q11: Farmers contribute to good landscape management and ecology (biodiversity).
<i>Suggested measures by students to improve the environment</i>	Q12: Building wetlands and small reservoirs on agricultural land can enhance water quality, aesthetics of the landscape as well as biodiversity. Q13: Establishing balks, spinneys and grass strips within agricultural lands improves quality of the environment and reduces soil erosion. Q14: Increasing the proportion of grasslands (meadows, pastures) at the expense of arable land improves ecological stability at landscape level. Q15: Afforestation increases the quality and amount of water in the landscape.

**Table 3.** Continued.

Question set	Survey questions
<i>Suggested measures by students to improve the environment</i>	Q16: Good quality of food is important to me.
	Q17: Crop production for purposes other than production of food (rape, corn) on farmland reduces our food sovereignty.
	Q18: Subsidies for farmers are important to preserve farmland management.
	Q19: Environmental education for students is important.
	Q20: More educational programs focusing on environmental issues are needed at schools.
<i>Attitudes/ engagement</i>	Q21: Financial profit for farmers is more important than reducing farming activities for the sake of environment protection.
	Q22: Attitude towards the environment
	Q23: Engagement in leisure-time science activities
	Q24: Engagement in voluntary science activities at school

### Data Analysis

Data gathered from questionnaires were tabulated in MS Excel spreadsheet. Statistical procedures were used to analyse the data collected including descriptive statistics. The data was analysed using the generalized linear models (GLM) in R software (Crawley, 2007). For individual models, we used the function *glm* ( ) to work with GLM in R.

$$glm(Y \sim x_1 + x_2 + x_3 + \dots + x_n, family = binomial) \text{ of R} \quad [1]$$

where *glm* means generalized linear model, *Y* is the dependent variable and  $x_1 + x_2 + x_3 + \dots + x_n$  are independent variables, while *family=binomial* implies the binomic dependent variable. In this study, the independent variables are student's gender, age, place of residence, education and specialization. Whereas, the dependent variables are the 24 questions that students provided with responses.

We conducted data analysis from the student survey in two stages. During the first stage, aggregated data from all schools (965 valid responses) were included in the GLM model. We tested the influence of selected independent variables on all the dependent variables. Furthermore, we evaluated the impact of the same factors on four cumulative variables that were created by aggregating dependent variables that include Q1-6, Q7-11, Q12-15 and Q16-20, corresponding to the set of questions shown in Table 2. In the second stage, data from individual schools were processed excluding non-applicable factors for e.g. school factor for all schools and educational level or specialization for selected schools.

### Results and Discussion

#### *Socio-Demographic Characteristics of the Students'*



Some of the socio-demographic characteristics of the sampled students are presented in Table 3. Except for gender (which is a dichotomy), the other four independent variables (i.e. student age, place of residence, education and specialization) are polytomies.

**Table 4.**

Groups	Specification	Frequency	Percent
<i>Gender</i>			
Female	-	587	60.8
Male	-	378	39.2
<i>Age (years)</i>			
13-15	Under age	288	30.0
16-18	Under age	554	57.0
18 +	Adolescence	121	13.0
<i>Education level</i>			
Basic school	-	93	9.8
4-Year Grammar school	-	293	30.9
Multi-Year Grammar school	-	462	48.7
Secondary school	Agriculture	100	10.5
<i>Place of residence</i>			
Village	Up to 2000 inhabitants	320	33.2
Town	Small and district	242	25.6
City	Regional capital	396	41.1
<i>Specialization</i>			
General	-	774	80.2
Agriculture	-	100	10.4
Sport	-	91	9.4

Of the 965 students that participated in the study, 61 percent were female and 41 percent were male. About 30 percent of the sample were between the age of 13-15, 57 percent were between the age of 16-18 years old and the rest 13 percent were above 18 years old. The average age of the student was 16.5 years, with the youngest being 13 years and the oldest 23 years with a standard deviation of 1.75. Almost 10 percent attended basic study, 31 percent followed a 4-year grammar study, 49 percent a multi-year grammar study and 11 percent were from secondary school of agriculture. Nearly 33 percent reside in villages, 26 percent in small and district towns and 41 percent in regional capital city. About 80 percent of the sample students are taking general education. The remaining 20 percent are taking specialized education in agriculture (about 10 percent) and sports (about 10 percent) (Table 3).

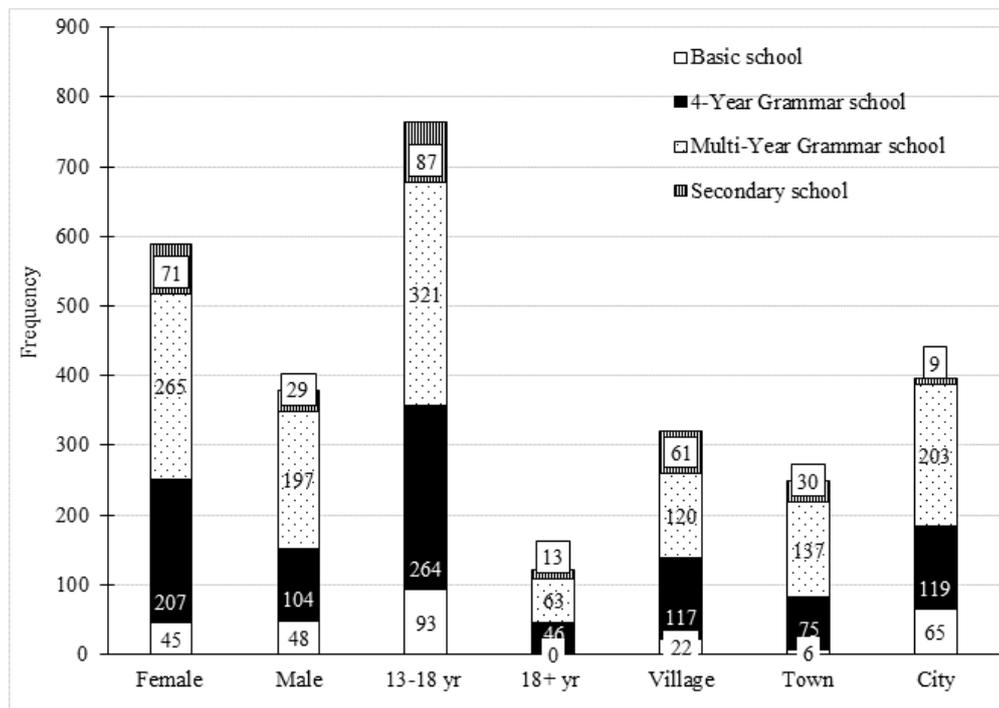


Figure 2.

Figure 2 shows the distribution of students' gender, age and place of residence across the four type of schools. Majority of the students who participated in this study, are attending the multi- year grammar study and a few are doing their basic study.

### Students' Perceptions of Environment

Figures 3, 4 and 5 show percent of students' perceptions of environmental impacts derived from agriculture-based activities, measures to improve the environment, subsidies and environmental education program. From the environmental impacts related questions, for e.g. more than 75 percent of the students agreed that the overuse of fertilizers and pesticides contributes to the deterioration of the environment (Q9). On the other hand, only 27 percent of the students agreed that intensive crop production for purposes other than production of food (rapeseed, corn) leads to environmental degradation (Q10) and the same percentage agreed that farmers contribute to good landscape management and better ecology and biodiversity (Q11). Nearly a half of the surveyed students (40-50 percent) neither disagreed nor agreed to the most of the questions related to environmental impacts caused by agricultural activities (Figure 3).

With regard to measures to improve the environment, 60-70 percent of the students agreed and less than 10 percent disagreed (Figure 4). However, there were about 26 to 32 percent of the students who did not decide on the proposed measures (Figure 4). Similarly, more than 50 percent of the students' responded positively to farmer subsidies and support to intensify environmental education programs in the schools. While, only 28 percent of the students' agreed that their current education status with regard to environment, has good quality (Figure 5).

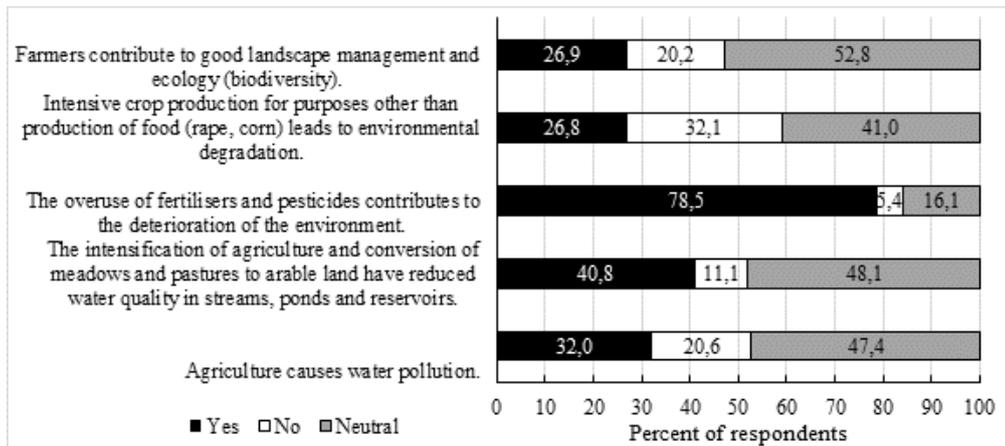


Figure 3.

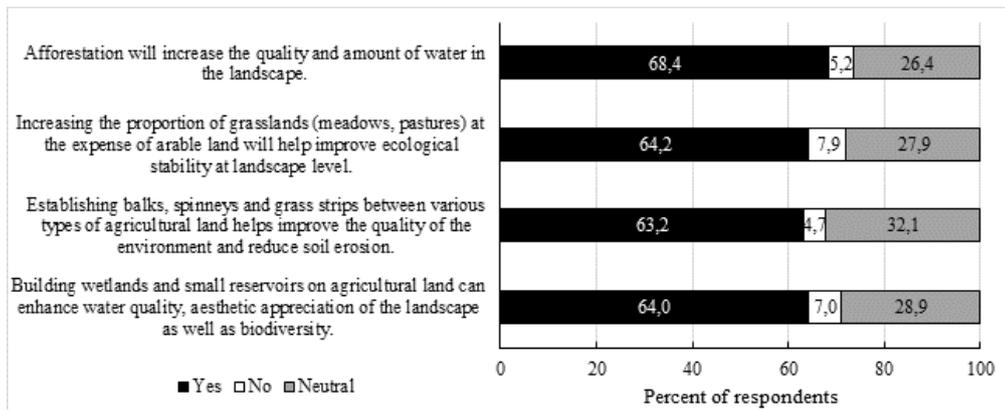


Figure 4.

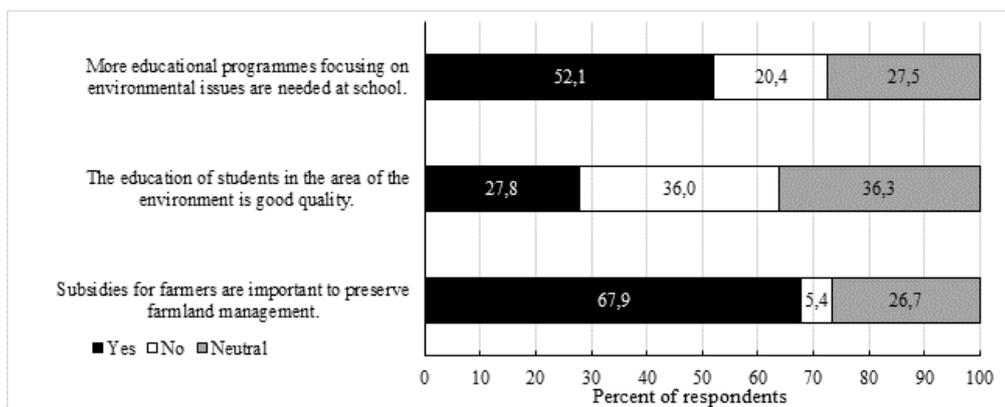


Figure 5.

In general, students' attitudes towards the environmental issues were more positive to Q22 (scores 1-2) regardless of their gender, age, educational level, place of residence and specialization. However, students' engagement in science activities during leisure time and at school in response to Q23 and Q24, falls more on the neutral side (score 2.7-3.4) which is shown in Table 4. This means that students were ambivalent in the above-mentioned questions probably due to lack of access to activity-based science education in the classrooms and well as outside the school. Similar results were reported by Alp et al. (2006) who emphasized the importance of activity-based science classrooms in increasing students' awareness and their role to protect the environment and solve environmental problems.

On the other hand, students' engagement in leisure-time science activities and engagement in voluntary environmental activities at school, showed a good correlation ( $r = 0.53-0.60$ ). In this paper, leisure-time activity can be defined as the voluntary use of free time for activities related to the environment outside the daily routine; it is one of the major components of a healthy lifestyle (Wang, et al., 2012). Surprisingly, the correlation between engagement in voluntary environmental activities (Q24) and students' attitude towards the environment (Q22) was poor ( $r = 0.29-0.32$ ). The relationship between students' attitude towards the environment (Q24) and engagement in leisure-time science activities (Q23) was also poor ( $r = 0.40-0.43$ ). However, the combined effect of students age and educational level in response to Q24 (i.e. engagement in voluntary environmental activities) was significant ( $p < 0.05$ ) only in gymnasium Humpeloc School. This could be attributed to the active involvement of students in leisure time science activities has increased their environmental awareness.

The overall positive attitudes of students towards environmental issues (Q22) regardless of their gender, age, educational level, place of residence and specialization, is partly due to the influence of family elders and access to social media that raises students' awareness.

### ***Factors Influencing Student Perceptions of Environment***

The data in Table 5 shows the significance levels of the five factors influencing students' perception of ES for all the four schools. When the data of the four schools was combined, it showed a strong significant difference (both at  $p < 0.05$  and  $p < 0.01$ ) between male and female students towards perception of ES in general and in particular to questions referring to basic environmental education (Q1-Q6) and attitudes and engagement in the environment (Q21-Q22). However, when it came to environmental impact-related questions (Q7-Q11) and measures to improve the environment (Q12-Q15), the number of questions showing significant difference were few. For instance, students' age, residence, educational level and specialization showed significance difference ( $p < 0.05$ ) only in a few questions (Table 5 and Figure 6). This implies that differences in students age, residence, education and specialization did not affect significantly ( $p < 0.05$ ) their environmental perceptions in our study (Figure 6).



Table 6.

	n	Q22: Attitude towards the environment	Q23: Engagement in leisure-time science activities	Q24: Engagement in voluntary science activities
<i>Gender</i>				
Female	578	1.67	2.92	3.07
Male	378	1.81	3.15	3.26
<i>Age</i>				
13-15 yr	288	1.79	2.98	2.98
16-18 yr	554	1.70	3.01	3.18
18 + yr	121	1.67	3.05	3.36
<i>Educational level</i>				
Basic School	93	1.91	3.17	3.03
4-Year Grammar school	293	1.69	3.08	3.27
Multi-Year Grammar school	462	1.72	2.99	3.11
Secondary school	100	1.66	2.73	2.99
<i>Place of residence</i>				
Village	320	1.63	2.90	3.11
Town	242	1.72	2.99	3.10
City	396	1.80	3.12	3.20
<i>Specialization</i>				
General	774	1.72	3.02	3.14
Agriculture	100	1.66	2.73	2.99
Sport	91	1.84	3.25	3.40

\* Coded on a five point Likert type scale where (1 = definitely positive, 2 = rather positive, 3 = Neutral, 4 = rather negative, and 5 = definitely Negative). The lower the average score the more the pro environmental attitudes.

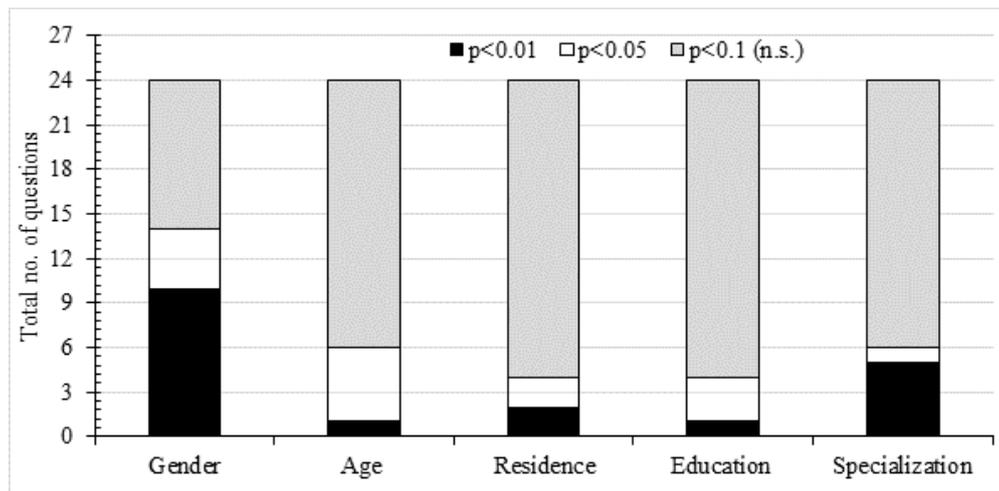


Figure 6.

Table 7.

Question no.	Gender	Age	Residence	Education	Specialization	School
Q1	0.000**	0.015*	0.0222*	0.023*	n.s.	n.s.
Q2	0.005**	n.s.	n.s.	n.s.	n.s.	n.s.
Q3	0.006**	n.s.	n.s.	n.s.	0.000**	n.s.
Q4	0.000**	n.s.	n.s.	0.046*	n.s.	n.s.
Q5	0.000**	0.013*	n.s.	n.s.	0.005**	0.00**
Q6	0.018*	n.s.	n.s.	0.000**	n.s.	n.s.
Cumulative Q1-6	0.058	n.s.	n.s.	0.000**	n.s.	n.s.
Q7	n.s.	0.015*	n.s.	n.s.	0.006**	n.s.
Q8	n.s.	n.s.	n.s.	n.s.	0.017*	n.s.
Q9	0.006**	n.s.	n.s.	n.s.	n.s.	0.015*
Q10	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Q11	n.s.	n.s.	n.s.	n.s.	0.000**	n.s.
Cumulative Q7-11	0.056	0.031*	n.s.	n.s.	n.s.	n.s.
Q12	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Q13	n.s.	n.s.	0.0210*	n.s.	n.s.	n.s.
Q14	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Q15	n.s.	n.s.	n.s.	n.s.	0.058	n.s.
Cumulative Q12-15	n.s.	n.s.	n.s.	0.002**	n.s.	n.s.
Q16	0.012*	n.s.	n.s.	n.s.	n.s.	n.s.
Q17	0.025*	0.041*	n.s.	n.s.	n.s.	n.s.
Q18	n.s.	0.070	n.s.	n.s.	n.s.	n.s.
Q19	n.s.	0.010*	n.s.	n.s.	n.s.	0.00**
Q20	0.000**	n.s.	n.s.	n.s.	n.s.	n.s.
Cumulative Q16-20	0.015*	n.s.	n.s.	n.s.	0.024*	n.s.
Q21	0.009**	n.s.	n.s.	n.s.	0.001**	n.s.
Q22	0.011*	n.s.	0.001**	n.s.	n.s.	n.s.
Q23	0.001**	n.s.	0.003**	0.015*	n.s.	n.s.
Q24	0.006**	0.000**	n.s.	n.s.	n.s.	n.s.

Note: For Q1-24 descriptions, the reader can refer Table 2. n.s: non-significant ( $p < 0.1$ ), \* significant at  $p < 0.05$  and \*\* significant at  $p < 0.01$

In the following section, the effect of *gender, age, residence, education and specialization* on students' environmental perceptions in the four schools were analysed and discussed question wise.

### Student's gender

The influence of students' gender on perception of ES showed a significance difference ( $p < 0.05$ ) for 16 out of 24 questions (i.e. 67 percent). The rest of questions (i.e. nearly 33 percent) were non-significant (data not shown). The questions addressing basic environmental education (Q1, Q2, Q5, and Q6), showed significance difference between male and female respondents in gymnasium Jihlava school in addition to Q9 and Q16. In the case of Agri. Sec. Sch. Humpolec, questions related to measures to improve the environment (Q13, Q17 and Q19) plus Q3 displayed significant difference between male and female students. Gender difference was also significant in students environmental attitudes and engagement (Q21, Q22, and Q23) in gymnasium Jihlava School and Agri. Sec.



Sch. Humpolec school in addition to Q20 (i.e. a set of environmental measures). The effect of gender was also significant with respect to Q4 (i.e. a set of basic environmental education) in gymnasium Humpolec and gymnasium Jihlava schools.

Our hypothesis (i.e. *there will be statistically significant difference between male and female students with respect to perceptions of ES*) can be accepted because more than 50% of the questions replied by students displayed a significance difference ( $p < 0.05$ ). The result of this study are consistent with those obtained by Alp et al. (2006) who reported that females have more positive opinions and attitudes and greater concern toward environmental issues than their male counterparts.

### **Student's age**

The students in the four schools belonged to different age groups (13-15 years, 16-18 years, and above 18 year). The influence of students age on perception of ES exhibited significance difference ( $p < 0.05$ ) for 10 out of 24 questions (i.e. 42 percent). More specifically, Q1 was significant in both gymnasium Humpolec and gymnasium Jihlava schools. The response of students to Q4 (basic environment education), Q13 and Q15 (environmental measures), and Q23 and Q24 (engagement in science activities) showed significant difference ( $p < 0.05$ ) in gymnasium Humpolec School. Whereas only Q3 (basic environment education), Q7 (environmental impacts) and Q17 (environmental measures) were significant in gymnasium Jihlava school, and only Q19 (environmental measures) in Agri. Sec. Sch. Humpolec.

Our hypothesis (i.e. *there will be statistically significant difference among students' age with regard to perceptions of ES*) is rejected as a whole. In all, 58 percent of the questions responded by the students were non-significant (data not shown). This result is not in consistence with others studies report (for e.g. Malkus & Musser, 1997; Musser & Diamond, 1999) that reported that young children had more positive attitudes towards environmental issues than older students. In the present study, majority of the students are under age of 18 (87 percent) and have good exposure to social media and environmental issues. Hence, age did not have much impact on the environmental awareness of the students.

### **Student's Place of Residence**

The students in the four schools reside in different locations including villages, in towns, and some of them in the regional capital of Vysočina. The influence of student's residence location on environmental perception displayed significance difference ( $p < 0.05$ ) for only 5 out of 24 questions (i.e. 20 percent). Whereas, there were no significance difference at  $p < 0.05$  in response to the remaining 19 out of 24 questions. The locations of students' residence had a significant effect for Q6 (basic environment education), Q13 (environment measures), and Q24 (engagement in science activities) which was registered in Agri. Sec. Sch. Humpolec. There was also significance difference in perception of the students in Q16 (Good quality of food is important to me) in all schools except gymnasium Jihlava school. The Q22 (attitudes towards environment) was significant only in gymnasium Jihlava School.

Our hypothesis (i.e. *there will be statistically significant difference among the students' place of residence with respect to perceptions of ES*) is rejected because

80 percent of the questions replied by students did not affect their environmental perceptions significantly ( $p < 0.05$ ). In fact, students whether residing in villages, towns or regional capital did not matter much and it had marginal influence on their perception of ES. This finding, when assessed as a whole, is inconsistent with many other studies (for e.g. Robertson & Burdge, 1998; He et al., 2011) who found significant difference (in terms ES attitudes) between people living in urban areas and those living in rural areas. These days access to environment related information via information technology and various mass media, has been improved not only in cities but also in villages and towns, thus downplaying this factor.

### ***Student's Educational Level***

The students involved in this survey have diverse educational level from basic study; 4-year grammar study, multi-year grammar study to secondary school of agriculture. The influence of students' education level exhibited significance difference ( $p < 0.05$ ) only in Q5 (i.e. good environmental conditions are of public interest) and this was observed in gymnasium Humpolec and gymnasium Jihlava schools. The Q20 that states more educational programs focusing on environmental issues are needed at schools also had significant difference among the students in gymnasium Jihlava School. However, no significance difference was observed among the students in 22 out of 24 questions (data not shown).

Our hypothesis (i.e. *there will be statistically significant difference among students' educational levels with respect to perceptions of ES*) is rejected because about 92 percent of the questions responded by the students indicated that differences in educational level did not affect their environmental perceptions. This is in contrary with other studies reported by Magtorn and Hellden (2007) and Woodworth et al. (2011) on high school students' perception towards ES. The possible reason for non-significance of the level of education among the students could be partly that only 10 percent of the students were attending agriculture course who are more exposed to environment-related courses than the majority of the students (i.e. 90 percent) who are following the general education program where environment is not a focus.

### ***Student's Specialization***

About 80 percent of the surveyed students (in the four schools) attend general education courses, 10 percent are specialized in sport and 10 percent in agriculture. The students' specialization exhibited significance difference ( $p < 0.05$ ) in their environmental perception, and this was observed only in 8 of the questions in Gymnázium Jihlava school. These questions were Q3 and Q5 (basic environment education), Q8 and Q9 (environmental impacts), Q13, Q16, Q17 and Q21 (environmental measures). The responses to the rest 16 out of 24 questions were non-significant ( $p < 0.05$ ).

Our hypothesis (i.e. *there will be statistically significant difference among students' school specialization with respect to perceptions of ES*) is rejected as a whole because about 63 percent of the questions responded by the students indicated that differences in specialization have not influenced significantly ( $p < 0.05$ ) their perceptions towards the environment. However, when evaluating the data for individual schools, the specialization factor was significant only in



the case of Gymnázium Jihlava School focusing on sport-oriented classes. On the other hand, when combing the data for all schools, a strong correlation was observed in only 6 out of 24 questions (i.e. for Q3, Q5, Q7, Q8, Q11 and Q21). This finding of the study contradicts with the findings of (e.g. Woodworth et al., 2011) who reported that offering more environmental courses in school curriculum has positive effect on students' perception of ES. One of the reasons for this could be that there is no as such specialized environmental courses offered to the students apart from their basic fields and most of these students attend general education courses.

### ***Integration of Factors Influencing Student's Perceptions***

It is assumed that the combined effects of any respondent's characteristic (i.e. students' *gender, age, residence, education and/or specialization*) may be more significant than the effect of single factor on one' action or perception (Tarrant and Cordell, 1997). In this study, the most significant effect was found only for Q5, Q9, Q24 and for cumulative Q16-20 (data not shown). The rest 21 out of 24 questions did not show significant effect on students' environmental perception. The combined effect of *gender and educational level* in response to Q5 (i.e. good environmental conditions are of public interest) is significant ( $p < 0.05$ ). The same holds true also for *gender and age* plus *gender and specialization* in response to Q9 (i.e. the overuse of fertilizers and pesticides contributes to the deterioration of the environment).

The combined effect of *age and education level* in response to Q24 (i.e. engagement in voluntary science activities at school) was significant ( $p < 0.05$ ) in gymnázium Humpolec school. This interaction occurred despite the fact that the respondents of 4-year grammar study from gymnázium Humpolec school were within the range age of 17-19 years.

The combined effect of *gender and educational level* was also significant in case of gymnázium Jihlava School. Basic statistical analysis (using pivot tables and graphs; data not shown here) shows that females evaluate this question more positively than males, both in 4-year grammar study and multi-year grammar study. Moreover, females and males of multi-year grammar study assess the question more positively than the 4-year grammar study. Based on these results, we can infer that students of multi-year grammar study in gymnázium Jihlava School seem to have higher environmental awareness and more positive relation to the environment than students in 4-year grammar study. This difference in perception can be attributed to the long-term year effect of multi-year grammar study in the education process.

Basic statistical analysis of *gender and age* interaction related to the Q9 (for all schools) proved that females interpret Q9 more positively than males. It also appears that difference in perception between females and males is slightly higher for 13-15 years old students and above 18 years old and somewhat small for the age group 16-18 years.

The combined effect of *gender and specialization* for cumulative variable Q16-Q20 was significant ( $p < 0.05$ ) in Agri. Sec. Sch. Humpolec. Surprisingly, males assess the related questions more positively than females. In this case, the specialization factor has very weak significance ( $p < 0.1$ ). However, the combined interaction *gender and specialization* appeared to be more significant ( $p < 0.05$ ) due to the stronger effect of the gender factor.

### Variation Among Schools in Perception of ES

The number of questions showing significance levels ( $p < 0.05$ ) on factors affecting student environmental perceptions in the four schools are shown in Figure 7. The highest number of significant difference ( $p < 0.05$ ) was recorded in gymnasium Jihlava school (in students' gender, education and specialization) > gymnasium Humpolec school (in students age) > Č. Z. A school (student's residence).

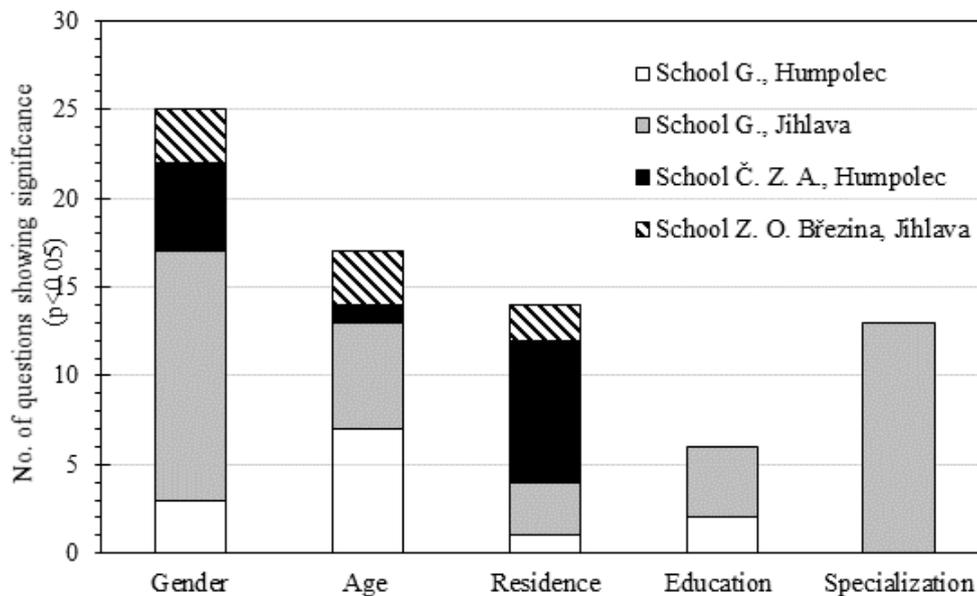


Figure 7.

The influence of gender on students' perception of ES is strongly significant in the gymnasium Jihlava but it is rather weak in gymnasium Humpolec School. In the case of Agri. Sec. Sch. Humpolec, the gender factor is significant for Q12-15 and Q16-20, which are related to measures improve the environment. While it is non-significant for questions related to the basic environmental education (Q1-Q6). The gender factor is significant for Q3 (basic environmental education) and Q22-Q24 (questions related to attitude / engagement) in basic school Z. O. Březina, Jihlava and gymnasium Jihlava school. The age factor is rather insignificant in both of these schools.

The influence of residence on students' perception of ES is significant for Q16 (in all schools except gymnasium Jihlava), for Q13 (in the gymnasium Jihlava school and Č.Z.A., Humpolec school) and for Q24 (in the Č.Z.A., Humpolec school). In general, this factor cannot be regarded as decisive for the students' responses to the various environmental issues raised in this study.

The influence of education on students' environmental perception is significant for Q5 (in gymnasium Humpolec and gymnasium Jihlava schools) and for Q20 (in gymnasium Jihlava school). A stronger interaction has been identified between gender and education in gymnasium Jihlava School. Whereas, significant interaction between age and education was observed in the case of gymnasium



Humpolec school. The specialization factor has been significant for 8 out of 24 questions in the gymnasium Jihlava School.

### Concluding Remarks

The results of our study indicate that, in general, the students (in the four high schools) perceived the effect of agricultural activities on the environment and measures to reduce the negative impacts on environmental services. For instance, all students recognized that intensive farming is one of the major cause for environmental degradation and hence there is an urgent need for nature protection and biodiversity enhancement. Living in a traditional agrarian highland region, no significant difference ( $p < 0.05$ ) was observed between students from the four different schools located in rural and urban areas in their attitudes towards the environment. However, gender appeared to be the most influential factor among the other factors (age, place of residence, educational level and specialization) in determining student's environmental perceptions particularly those related to basic environmental education. In this regard, female students responded more positively than males. There is a need for more environmental courses to be offered in the schools in addition to outdoor activities that raise environmental awareness. Future research should include detail environmental surveys targeting school students and teachers across the Czechia.

### Contribution of This Paper to The Literature

- Current status of four high school students in (Czechia) with regard to their environmental perceptions and awareness,
- Students perceptions of the environmental impacts caused by agriculture- related activities and measures required to improve the ES, and
- Differences and commonalities among students differing by gender, age, place of residence, educational level and specialization) on environmental perceptions and factors influencing their decision-making.

It is worth noting here that caution should be taken when interpreting the result of this study to other regions of Czechia since the survey was conducted in only one school year in a localized region of the country.

### Acknowledgements

We would like to thank the financial assistance given by the EEA- Norway grants for Czechia to carry out the research project LaPlaNt (Project No. 8900.5). We thank Dr. Jiří Vojar for his help with statistical analyses. We also gratefully acknowledge the students for their willingness to participate in the interview and the teachers and rectors of the studied schools who devoted their time and for facilitating the process.

### Disclosure statement

No potential conflict of interest was reported by the authors.

### Notes on contributors

**Mehreteab Tesfai** holds a PhD in science education and now is an associate professor at Norwegian Institute of Bioeconomy Research, Norway.

**Udaya Sekhar Nagothu** holds a PhD in science education and now is an associate professor at Norwegian Institute of Bioeconomy Research, Norway.

**Josef Šimek** holds a PhD in science education and now is an associate professor at METCENAS, o.p.s., Czech Republic.

**Petr Fučík** holds a PhD in science education and now is an associate professor at Research Institute for Soil and Water Conservation, Prague, Czech Republic.

## References

- Adejoke, O.C., Mji, A., & Mukhola, M.S. (2014). Students' and Teachers' awareness of and attitude towards environmental pollution: A multivariate analysis using biographical variables. *J. Hum. Ecol.*, 45(2), 167-175.
- Alcott, E., Ashton, M.S., & Gentry, B.S. (2013). *Natural and Engineered Solutions for Drinking Water Supplies: Lessons from the Northeastern United States and Directions for Global Watershed Management*. CRC Press, 303p. Retrieved from <https://books.google.cz/books?id=UUXSBQAAQBAJ>
- Alp, E., Ertepinar, H., Tekkaya, C., & Yilmaz, A. (2006). A study on children's environmental knowledge and attitudes: The effect of grade level and gender. *International Research in Geographical and Environmental Education*, 15, 210-223.
- Bradley, J. C., Waliczek, T. M. & Zajicek, J. M. (1997). Relationship between demographic variables and environmental attitude of high school students. *J. Nat. Resour. Life Sci. Educ.*, 26, 102-104.
- Burger, J.; Sanchez, J.W.; & Gochfeld, M. (1998). Gender differences in recreational use, environmental attitudes, and perceptions of future land use at the Savannah River site. *Environ. Behav.*, 30, 472-486.
- Crawley, M. J. (2007). *The R Book*. Chichester: John Wiley & Sons Ltd. Retrieved from <ftp://ftp.tuebingen.mpg.de/pub/kyb/bresciani/Crawley%20-%20The%20R%20Book.pdf>
- Davidson, D. J., & Freudenburg, W. R. (1996). Gender and Environmental risk concerns. *Environ. Behav.*, 28, 302-339.
- Dunlap, R.E., van Liere, K.D., Mertig, A.G. & Jones, R.E. (2000). Measuring Endorsement of the New Ecological Paradigm: A Revised NEP scale. *Journal of Social Issues*, Vol. 56 (3), 425-442.
- Eagles, P.F.J. & Demare, R. (1999). Factors influencing children's environmental attitudes. *The Journal of Environmental Education*, Vol. 30 (4), 33-37.
- Erdogan, N. (2013). Environmental worldviews in higher education: a case study of Turkish college students. *Procedia-Social and Behavioral Sciences*, 106, 1086-1095.
- Falkenmark, M., (2003). Freshwater as shared between society and ecosystems: from divided approaches to integrated challenges. *Philosophical Transactions of the Royal Society of London B: Biological Sciences*, 358(1440), 2037-2049. Retrieved from <http://dx.doi.org/10.1098/rstb.2003.1386>
- He, X-E., Hong, T., Liu, L., & Tiefenbacher, J. (2011). A comparative study of environmental knowledge, attitudes and behaviours among university students in China. *International Research in Geographical and Environmental Education*, Vol. 20 (2), 91-104.
- Hoalst-Pullen, N., Lloyd, M.R. & Parkhurst, M.E. (2012). Environmental attitude and perceptions: A comparison of Peru and the United States. *Journal of Global Initiatives*, Vol.7(2), 167-181.
- Jenkins, E.W. & Pell, R.G. (2006). Me and the environmental challenges: a survey of English secondary school students' attitudes towards the environment. *International Journal of Science education*, 28(7), 765-780.
- Karásek, P., Stejskalová, D., & Ulčák, Z. (2014). Analysis of Rural Social Aspects in the Context of Land Consolidations and Land Use Planning, the Case Study, Czechia. *Acta Univ. Agric. Silvic. Mendelianae Brun.*, 62, 507-515. Retrieved from <http://dx.doi.org/10.11118/actaun201462030507>
- Lindemann-Matthies, P., Keller, D., Li, X. & Schmid, B. (2013). Attitudes toward forest diversity and forest ecosystem services- a cross-cultural comparison between China and Switzerland. *Journal of Plant Ecology*, 1-9. Doi:10.1093/jpe/rtt015
- Lyon, E. & Breakwell, G. H. (1994). Factors predicting environmental concerns and in differences in 13-16 yrs. *Environment and Behavior*, 26(2), 223-238.
- MacDonald, W.L. and Hara, N. (1994). Gender differences in environmental concern among college students. *Sex Roles*, 31, 5-6.
- Magntorn, O., & Hellden, G. (2007). Reading New Environments: Students' ability to generalise their understanding between different ecosystems. *International Journal of Science education*, 29(1), 67-100.



- Malkus, A.J., & Musser, L.M. (1997). *Environmental concern in school-age children: Elementary and Childhood Education*. ERIC Document Reproduction Service No. ED 407099.
- MEA (Millennium Ecosystem Assessment) (2005). *Environmental and Human Well-Being: Synthesis*. Washington D.C: Island Press.
- Mohai, P. (1992). Men, Women and the Environment: An examination of gender gap in environmental concern and activism. *Soc. Natur. Resour.*, 5, 1-19.
- Mohai, P., & Taight, B.W. (1987). Age and environmentalism: An elaboration of the Buttel model using national survey evidence. *Soc. Sci.*, 68, 798-815.
- Moseley, C. (2000). Teaching for environmental literacy. *Clearing House*, 74 (1), 23-25.
- Müdrerrisođlu, H. & Altanlar, A. (2011). Attitudes and behaviour of undergraduate students toward environmental issues. *Int. J. Environ. Sci. Tech.*, 8(1), 159-168.
- Musser, L., & Diamond, K. (1999). The children's attitudes toward the environment scale for preschool children. *Journal of Environmental Education*, 30 (2): 23-29.
- Oweis, T., & Hachum, A. (2006). Water harvesting and supplemental irrigation for improved water productivity of dry farming systems in West Asia and North Africa. *Agric. Water Manag.*, 80, 57-73. doi:10.1016/j.agwat.2005.07.004
- Rappaport, A. (2008). Campus greening: behind the headlines. *Environment: Science and Policy for Sustainable Development*, 50, 6-17.
- Robertson, R.A., & Burdge, R. J. (1998). Size of place of residence and encounters with the adverse consequences of and support for commercial/ industrial development. Proceedings of North-eastern Recreation Research Symposium, GTR-NE-255. Randor PA: USDA Forest Service, *North-eastern forest experiment station*, 81-85.
- Sasidharan, V., & Thapa, B. (1999). An exploration of the influence of gender and locality on environmental attitudes, using the new ecological paradigm (NEP) scale. Proceeding of the Northeastern Recreation Research Symposium. Bolton Landing, New York, *The Pennsylvania State University*, 57-61.
- Shobeiri, S.M. (2005). *A comparative study of environmental awareness and attitude of teachers and students of secondary schools in India and Iran*, PhD thesis, Department of Education, University of Mysore, 165-181.
- Shobeiri, S.M., Omidvar, B., & Prahallada, N. N. (2007) A comparative study of environmental awareness among secondary school students in Iran and India. *Int. J. Environ. Res.*, 1(1), 28-34.
- Strumse, E. (1996). Demographic differences in the visual preferences for agrarian landscapes in western Norway. *Journal of Environmental Psychology*, 16, 17-31.
- Swanwick, C. (2009). Society's attitudes to and preferences for land and landscape. *Land Use Policy*, 265, 562-575.
- Tarrant, M.A and Cordell, H.K. (1997). The Effect of Respondent Characteristics on General Environmental Attitude-Behavior Correspondence. *Environment and Behaviour*, vol. 29(5), 618-637. doi: 10.1177/0013916597295002
- Taskin, O. (2009). The environmental attitudes of Turkish senior high school students in the context of post materialism and the new environmental paradigm. *International Journal of Science Education*, 31, 481-502.
- Tehrani, S. M., Karbassi, A. R., Ghoddosi J., Monavvari, S. M. and Mirbagheri, S. A. (2009). Prediction of energy consumption and urban air pollution reduction in e-shopping adoption. *J. Food. Agric. Environ.*, 7 (3-4), 898-903.
- Tehrani, S. M., Karbassi, A. R., Monavari, S. M., Mirbagheri, S. A. (2010). Role of e-shopping management strategy in urban environment. *Int. J. Environ. Res.*, 4(4), 681-690.
- Thapa, B. (1999). Environmentalism: A study of undergraduate students. Proceedings of the North-eastern recreation research symposium. Bolton Landing, New York, *The Pennsylvania State University*, 41-50.
- Thapa, B. (2001). Environmental concern: a comparative analysis between students in recreation and management and other departments. *Environmental Education Research* 7(1), 39-53.
- Tikka, P.M., Kuitunen, M.T & Tynys, S.M. (2000). Effects of educational background on students' attitudes, activity levels, and knowledge concerning the environment. *The Journal of Environmental Education*, 31(3): 12-19.
- Tuncer, G., Ertepinar, H., Tekkaya, C. & Sungur, S. (2005). Environmental attitudes of young people in Turkey: Effects of school type and gender. *Environmental Education Research*, 11, 215-233.



- Vihervaara, P., Ronka, M., & Walls, M. (2010). Trends in ecosystem service research: early steps and current drivers. *Ambio*, 39, 314-324.
- Wang, H.X., Xu, W., & Pei, Jin-Jing. (2012). Leisure activities, cognition and dementia. *Biochimica et Biophysica Acta 1882*: 482-491.
- Woodworth, B.L., Steen-Adams, M.M. & Mittal, P. (2011). Role of environmental studies course on the formation of environmental worldviews: a case study of a core curriculum requirement using the NEP scale. *Journal of Environmental Studies and Sciences*, 1(2): 126-137.
- Yılmaz, O., Boone, J.W., & Andersen, O.H. (2004). Views of elementary and middle school Turkish students toward environmental issues. *International Journal of Science Education*, 26: 1527-1546.