SOIL SCIENCE ANNUAL
2022, 73(4), 152484

https://doi.org/10.37501/soilsa/152484

Alluvial soils – a stream into soil awareness

Magdalena Urbańska*, Marcin Świtoniak, Przemysław Charzyński

Nicolaus Copernicus University in Toruń, Department of Soil Science and Landscape Management, Lwowska Str. 1, 87-100, Toruń, Poland

* mgr, Magdalena Urbańska, magdau@onet.eu, ORCID ID numbers: 0000-0003-2175-4189 (M.U.), 0000-0002-9907-7088 (M.Ś.), 0000-0003-1467-9870 (P.Ch.)

Received: 2022-05-26
Accepted: 2022-07-28
Published online: 2022-07-28
Associated editor: C. Kabała

Keywords:

River valleys soils
Fluvisols
Geography textbook
Soil science promotion
Soil education
Polish Soil of the Year 2022

Abstract

Alluvial soils cover about 5% territory of Poland and they are an important part of the environment of floodplains and river valleys. These soils have long been studied by soil scientists around the world. The high school students also have a relatively high knowledge of them in comparison with other soil types. Information about them is readily available in textbooks and on the internet. Is this enough to make alluvial soils the driving force behind efforts to popularize soil science? The aim of this paper is to diagnose the state of knowledge about these soils among high school students of Kuyavian-Pomeranian region as well as the assessment of their suitability in the soil awareness raising. Querying geography textbooks and internet sources as well as a survey method were used as the main research methods. Information on alluvial soils is commonly found in geography textbooks and websites. The awareness of soil distribution within Kuyavian-Pomeranian voivodship is the highest for alluvial soils among all studied types of soils. Respondents correctly assess the value of these soils and can identify ways to increase soil awareness among the public. Among the respondents there is a conviction that there is a need for changes in soil science education, especially in the field of extracurricular activities. Suggestions for such activities are included in this publication. The Year of Alluvial Soils is a good opportunity to introduce new solutions in the popularization of soil science on a regional and national scale.

1. Introduction

Soil is one of the most important environmental components but its importance and threats resulting from human activities are undoubtedly poorly known to a large number of people (Charzyński et al., 2022; Urbańska et al., 2022). One of the challenges of the soil scientists should be to increase social awareness of the soil cover. The soil science knowledge promoter in Poland is the Polish Soil Science Society encouraging public audience to get familiar with soils. One of the most important events under the patronage of this organization since 2018 is the election of the Polish Soil of the Year. In 2022 Alluvial Soil was chosen in this plebiscite. Genesis of these soils is related to the sedimentary action of flowing water. Therefore alluvial soils occur in majority on flooded plains as an result of accumulation of river sediments (e.g. Bednarek and Prusinkiewicz, 1980; Driessen et al., 2001; Paz et al., 2008). Most often, alluvial soils are formed near river beds, on the inside of meanders or at the mouths of larger rivers. Due to their fertility, these soils were the basis for the development of the greatest ancient cultures around the world (Montgomery, 2008). Alluvial soils cover about 5% Poland's territory and they are the most important part of soil cover in Vistula Valley (Prusinkiewicz and Bednarek, 1991). Mentioned soils are also an important component of the environment of the Kuyavian-Pomeranian voivodship, where the "queen of Polish rivers" formed the central axis of the region (Michalski, 2013; Bednarek and Świtoniak, 2017). In case of Toruń – a medieval city founded on the Vistula bank river played a key role (Wroniecki et al., 2021). The location factor was the proximity to the river and the related strengthening of the defensive function as well as economic benefits (e.g. transport route, fees, spatial development of the town). Contemporary the river boulevards closed to the UNESCO-listed old town are an attraction for tourists and local people. Within the floodplain there is also a reserve "Kępa Bazarowa" protecting natural riparian forests located in the immediate vicinity of the old gothic town. It should be considered whether the inhabitants are sufficiently (or at least equally) aware of the fact that the occurrence of typical soils is connected with the river. Is the awareness of their existence, properties and possibilities of their use sufficient among the inhabitants? Since the dawn of agriculture, the high productivity of alluvial soils lining has been known and appreciated. The alluvial soils belong to the youngest soils due to the contemporarily deposition (or recently deposition). River sediments are spatially and vertically very differentiated and the most typical feature of alluvial soils (changes in color, grain size and humus content) is stratification . In young, still forming soils the stratification is visible in their whole profile or starts directly under the well-formed humus horizon. Alluvial soils are commonly used for agriculture,

and often, with proper reclamation and drainage, become highly productive soils. Those that are not used for agriculture form valuable natural and semi-natural habitats of scrub and meadow vegetation, as well as fertile and very varied riparian forest habitats. Due to their diversity and potential use, they are well and widely known to foreign and Polish scientists who have repeatedly studied the properties and occurrence of these soils (Valentin, 1995; Iqbal et al., 2005; Chojnicki, 2002; Sokołowska et al., 2002; Łabaz and Kabała, 2016; Michalski et al., 2018; Kawalko et al., 2018). Floodplains are dynamic spatial mosaics, characterized by multidimensional ecological systems and they are forming a kind of 'bridge' between aquatic and terrestrial environments. They are always connected in some way to an active riverbed and this connection is essential for the floodplains functioning (Thoms, 2003). The integrity of this system depends on the interaction between hydrological, geomorphological, and biological processes (Thoms, 2003; Petts and Amoros, 1996; McAuliffe, 2004; Daniels, 2003; Bullinger-Weber and Gobat, 2006). Because human has inhabited river valleys since the dawn of time, it would seem obvious that alluvial soils would be most familiar to him. However, it should be noted that in the 20th century, nature-dominated environments were changed to human-dominated environments (Messerli et al., 2000; Naveh, 2000). This includes the soil cover, which for residents of urban areas, is often hidden and unknown. Is this really the case? Do the young inhabitants of the Vistula Valley really have enough knowledge about the soil cover they walk on?

The aim of this paper is to diagnose the state of knowledge about alluvial soils among high school students of Toruń and surroundings.

Moreover, the authors set the following research tasks:

– review and evaluation of school textbooks and educational websites in terms of the availability of information on alluvial soils ;
– checking the state of knowledge of alluvial soils among high school students;
– assessment of the suitability of alluvial soils in the soil awareness raising.

2. Materials and methods

2.1. The survey method

A cross-sectional, cohort study was conducted with consecutive sampling using a self-administrated questionnaire through a Google online survey form. Data were collected among high school students in the Kuyavian-Pomeranian province (Toruń and surroundings). The participants were recruited for the study online through a form sent to schools and teachers. The survey covered schools whose students participate in the Geographic Olympiad every year. Procedurally representative (random) sample – respondents were selected using a random sampling scheme. The procedure was based on creating an appropriate list of units belonging to the population under study (high schools in the Kuyavian-Pomeranian region) and drawing an appropriate number of units for the survey. It should be noted that regardless of the level of teaching in secondary school, a student has the same basic knowledge of alluvial soils (acquired in primary school). At this (basic) level of education a student acquires knowledge and skills to distinguish the most important characteristics of alluvial soils, indicate their distribution on a map of Poland and assess their agricultural usefulness (Dz.U. 2017, poz. 356). A total of 305 students completed online Google form shared via email. Data collection began in January 2022 and ended in mid-March 2022. The survey (form) consisted of 6 questions relating to the alluvial soils:

– Match the name of the soil (students could use names of soil types: podzols, alluvial soils, clay-illuvial soils, urbisols, chernozems, rendzinas, black earths) to the mark on the map (the numbers from 1 to 5 indicate areas dominated by urban soils (cities), alluvial soils (flooded plains), podzols (dunes), clay-illuvial soils (undulating morainic plateau) and black earths (flat morainic plateau with poor drainage).
– Which of the following profiles represents alluvial soil? (three profiles to choose from).
– Provide the correct answer (Alluvial soils belong to the 1) azonal/ 2) zonal/ 3) intrazonal soils because: a) they are typical of the warm temperate climate zone, but can also occur in the subtropical climate zone/ b) they have a weakly developed soil profile and their distribution does not show any geographical regularities/ c) they occur in different climate zones and their distribution is related to specific local conditions).
– Select the correct answer (The ecological value of alluvial soils is manifested in: 1) increased biodiversity, due to the low fertility of these soils/ 2) increased biodiversity, due to the high fertility of these soils/ 3) decreased biodiversity, due to the low fertility of these soils/ 4) decreased biodiversity, due to the high fertility of these soils).
– Select the correct answer (Alluvial soil cover: 5%, 10%, 30% of Poland's area).
– Justify the statement that alluvial soils can have an educational value for the inhabitants of the Kuyavian-Pomeranian province. Suggest solutions to popularize soil science by studying local soil cover (open question).

The answers to the first question have been taken for analysis for providing general information on the awareness of distribution soils listed above within Kuyavian-Pomeranian voivodship. The proportion of correct answers was calculated for urbisols, alluvial soils, podzols, clay-illuvial soils and black earths along with the characteristic landscape of their occurrence.

Moreover, the questionnaire included information about the respondents (gender, place of residence). The participants (high school students aged 15–19 years) included 42% males and 58% female. They came from: Toruń 61.3%; Bydgoszcz 6.6%; Inowrocław 3.3%; Włocławek 3%; Grudziądz 2.3%. Nearly one quarter (23.5%) of respondents came from other places. Answers were also analyzed using a quantitative approach to investigate the knowledge about alluvial soils.

2.2. Querying geography textbooks and websites

The content of 17 high school geography textbooks as well as 17 websites were analyzed (first 17 results; search date: 18th April 2021, re-search date: 20th March 2022) after the entry:

"soils of Poland" (in Polish: gleby Polski) in the google search engine). However, it should be noted that the results depend on the history of previous searches so they can vary from user to user. It should be noted that currently only three publishers: "Operon", "Nowa Era", and "Viking" (no alluvial soils topic) offer geography textbooks approved for implementation by the authorities in Poland. Thus, it can be concluded that all possible Polish geography textbooks that schools can use have been analyzed (according to the list of textbooks approved for school use in general education). In all sources (Table 1) information was analyzed for

Table 1
Geography textbooks and internet sources overview

Title	Author	Year of publication	Publishing House
Geography of Poland. Textbook for X class.	Barbag J., Janiszewski M.	1964	Państwowe Zakłady Wydawnictw Szkolnych. Warsaw (in Polish)
Geography of Poland. Textbook for II class of high school and economic school.	Batorowicz Z., Górecka Ł., Prokopek B.	1970	
Physical geography with geology. Textbook for high school.	Stankowski W.	1987	Wydawnictwa Szkolne i Pedagogiczne. Warsaw (in Polish)
Geography. Textbook for bascic vocational school.	Domachowski R., Makowska D.	1987	
Poland i Europe. Geography textbook for high school.	Batorowicz Z., Nalewajko J., Suliborski A.	1990	
The Earth and people. Physical geography textbook for high school.	Makowska D.	1998	
Geography of Poland.	Świtalski E., Preisner Z.	1999	Oficyna Wydawnicza Turpress" Torun [In [Polish]
Outline of knowledge about the Earth. Textbook for high school.	Podgórski Z., Marszelewski W., Becmer K.	2002	Wydawnictwa Szkolne i Pedagogiczne. Warsaw (in Polish)
Physical geography 1. Extended level. Textbook for high school.	Czubla P., Papińska E.	2003	PWN WydawnictwoSzkolne. Warsaw (in Polish)
Geography of Poland. Textbook for high school.	Krynicka-Tarnacka T., Wnuk G.	2005	SOP. Torun (in Polish)
Geography 1. Basic level.	Kop J., Kucharska M., Szkurłat E.	2006	PWN Wydawnictwo Szkolne. Warsaw (in Polish)
Geography. Vademecum.	Stasiak J., Zaniewicz Z.	2013	Wydawnictwo Pedagogiczne Operon. Gdynia (in Polish)
Faces of geography 3. Textbook for high school and technical school. Extended level.	Więckowski M., Malarz R.	2014	Nowa Era. Warsaw (in Polish)
Geography. Repertory for high school graduates.	Biłgoras J., Głowacz A., Koperska-Puskarz D., Mazur M., Mozolewska-Adamczyk M., Srokosz W., Zieliński K.	2014	Wydawnictwa Szkolne i Pedagogiczne. Warsaw (in Polish)
Geography. Repertory for high school graduates.	Łękawa A.	2015	Greg. Cracow (in Polish)
Faces of geography 1. Textbook for high school and technical school. Extended level.	Malarz R., Więckowski R., Kroh P.	2019	Nowa Era. Warsaw (in Polish)
Geography-extended level. Textbook for high school.	Kurek S.	2019	Wydawnictwo Pedagogiczne Operon. Gdynia (in Polish)

Internet sources

https://epodreczniki.pl/a/zroznicowanie-gleb-i-roslinnosci-na-obszarze-polski/DSM0RxNIH (website 1)
https://www.ekologia.pl/wiedza/slowniki/leksykon-ekologii-i-ochrony-srodowiska/ (website 2)
https://pracownik.kul.pl/files/32723/public/pdf/gleba.pdf (website 3)
https://eszkola.pl/geografia/rozmieszczenie-gleb-w-polsce-6778.html https://www.edukator.pl/resources/page/gleby/11165 (website 4)
https://matura100procent.pl/rozmieszczenie-gleb-na-swiecie/ https://geografia.gozych.edu.pl/gleby-w-polsce/ (website 5)
https://opracowania.pl/opracowania/geografia/gleby-w-polsce,oid,1729 https://www.naukowiec.org/wiedza/geografia/gleby-w-polsce-rodzaje_3403.html (website 6)
https://www.bryk.pl/wypracowania/geografia/geografia-fizyczna/8387-gleby-polski.html http://geografia24.pl/gleby-w-polsce/ (website 7)
https://swiatrolnika.info/gleby-w-polsce-rolnictwo (website 8)
https://www.geografia24.eu/geo_prezentacje_rozsz_3/383_1_srodowisko_przyrodnicze/r3_1_08a.pdf (website 9)
https://geografia.na6.pl/warstwa-glebowa (website 10)
https://sciaga.pl/tekst/39463-40-gleby_w_polsce (website 11)
http://geomorawa.ucoz.pl/publ/gleby_i_roslinnosc_polski/1-1-0-228 (website 12)
http://www.pcez-bytow.pl/download/plk/gleby-w-polsce.pdf (website 13)
https://www.edukator.pl/resources/page/gleby/11165 (website 14)
https://geografia.gozych.edu.pl/gleby-w-polsce/ (website 15)
https://www.naukowiec.org/wiedza/geografia/gleby-w-polsce-rodzaje_3403.html (website 16)
http://geografia24.pl/gleby-w-polsce/ (website 17)

the frequency of four kinds of information concerning urban soils, alluvial soils, podzols, clay-illuvial soils and black earths: a) names, b) properties, c) profiles, d) description of soil horizons sequences. The frequency of these information was the basis for assigning "information scores" within each type of soil: a) names x 1 point, b) properties x 2 points, c) profiles – photo or scheme x 3 points, d) description of soil horizons sequences x 3 points. Coefficient of Information Availability (CIA) is the sum of the Partial Coefficient of Information Availability (CIAp) values calculated for every of four information categories (a, b, c, d). The CIAp was calculated according to elaborated formula: $CIAp = \sqrt{(Ti/Tt)} \times ip$ (CIAp – the Partial Coefficient of Information Availability; Ti – the number of textbooks/websites with soil information; Tt – the total number of textbooks/websites; ip – sum of "information points" in particular categories (Urbańska et al., 2021).

An attempt was made to compare and indicate the relationship between the survey results and the analysis of textbooks and online resources.

3. Results and discussion

In spite of their complexity, alluvial soils were the easiest to identify on the map by students (214 correct indications) and were far ahead of the other soil types. As many as 70% of students correctly associate floodplains with the presence of alluvial soils. Even in the case of podzols, which are very extensively described in textbooks, this share was only slightly over 50 percent. It is surprising, however, that only about 30% of students indicated urbisols as typical of cities and built-up areas. After all, it seems that the term "urbanization" is frequently used in geography teaching, and the widespread English proficiency among the younger generation should make the association of the Latin "urbium" with the adjective "urban" obvious (Fig. 1).

Despite not the greatest amount of information on these soils in textbooks, identifying them on the basis of a schematic profile structure did not pose a problem to most students. They were correctly recognized by 69% of the respondents while in the case of other soils, recognizing them did not exceed 30% of correct answers. The specific and easily recognizable layering

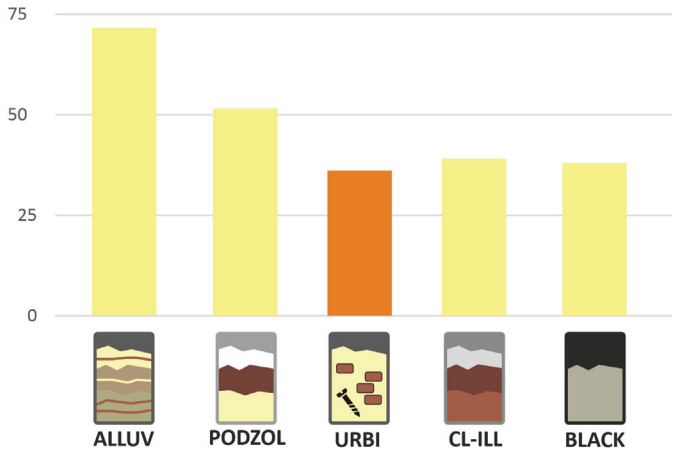

Fig. 1. Proportion of correct answers for selected soil types and their characteristic occurrence landscape

of alluvial soils (Kabała et al., 2013; Macklin and Klimek, 1992; Walker and Coventry, 1976) probably became the most significant factor influencing this result.

55% of respondents are aware that alluvial soils are intrazonal, they occur in different climate zones and their distribution is related to specific local conditions. As many as 69% of school students are convinced that the ecological value of alluvial soils is manifested in increased biodiversity due to the high fertility of these soils. Moreover, 56% of respondents indicated the correct answer concerning the area covered by alluvial soils in Poland. Therefore, it can be assumed that the majority of the respondents have basic (sufficient) knowledge about the discussed soils. Can this knowledge come from school textbooks? Probably yes, because in the analyzed geography textbooks, as well as in the queried websites, one can find a substantial amount of information about these soils (Table 2, 3). Information scores for geography textbooks are high (198) as well as for websites (158) which puts these soils in the second position in both cases. CIA values for these soils for textbooks and websites (respectively 175 and 134) which places them also on second position among the discussed soils (Fig. 2). This indicates a relatively high access in textbooks/websites to educational information on alluvial soils.

An important element was the assessment of the educational value of alluvial soils for the inhabitants of the Kuyavian-Pomeranian voivodship and the suggestion of solutions ways to popularize soil science by studying local soil cover. 67% of respondents point to educational value in alluvial soils and identify various solutions that can help increase local soil awareness (Fig. 3).

Certainly, soil science tours and workshops can provide a wealth of information and are one of the most effective educational method (Malina et. al, 2011; Urbańska et al., 2019; Urbańska and Charzyński, 2021; Urbańska et al., 2021). However, due to organizational problems (no time, no skills, no desire) these types of activities are not always possible. Soil posters that could be placed in various locations within the voivodship would be interesting. In the case of alluvial soils, such posters could be located along the Vistula River. During geography lessons school students of High School No 10 in Toruń prepared (in groups and individually) proposals of such information posters which could make the Philadelphia Boulevard in Toruń (a place along the Vistula River) more attractive for strollers and thus be a certain incentive to explore the knowledge, as well as become a source of soil science information (Fig. 4).

Alluvial soil arouses interest not only in soil scientists (Iqbal et al., 2005; Neal and Sposito, 1989; Valentin, 1991; Cubrinovski and McCahon, 2011) but also in school students as evidenced by the answers concerning the educational and ecological usefulness of these soils. Respondents believe that alluvial soils have great educational value. Due to the location of Kuyavian-Pomeranian province, they are especially important for the inhabitants (in the opinion of school students). The opinions collected testify not only to the knowledge of alluvial soils, but also to the existence of very limited soil awareness among the public. The following three responses show the dominant trend among respondents as well as their proposals for popularization of soil science.

Table 2
Information scores and CIA within urban soils, alluvial soils, podzols, clay-illuvial soils and black earths (geography textbooks)

Geography textbooks (the numbers of textbooks correspond to Table 1)																								
Soil type	Information type	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Sum	Information scores	Sum of information scores	CIAp	CIA
Urban soils	name	0	0	0	0	0	1	0	0	0	0	1	0	0	2	0	0	1	**5**	**5**	**9**	**2.4**	**3.8**
	properties	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	**2**	**4**		**1.4**	
	profile	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**		**0**	
	description	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**		**0**	
Alluvial soils	name	5	5	1	2	1	3	4	3	3	3	5	11	3	10	7	10	4	**80**	**80**	**198**	**80.0**	**175**
	properties	1	1	0	0	0	1	1	1	2	2	4	2	5	2	2	2	3	**29**	**58**		**52.6**	
	profile	0	0	1	0	0	0	1	0	0	0	1	1	1	1	0	3	1	**10**	**30**		**20.6**	
	description	1	1	0	0	0	1	1	0	0	0	1	1	1	1	0	2	0	**10**	**30**		**21.8**	
Podzols	name	9	10	9	2	3	6	6	7	5	5	9	15	5	9	10	7	7	**124**	**124**	**345**	**124.0**	**331.1**
	properties	2	2	1	1	1	2	7	3	1	3	7	2	10	4	2	4	3	**55**	**110**		**110.0**	
	profile	0	1	1	1	0	1	1	1	0	1	2	1	1	3	0	3	4	**21**	**63**		**55.1**	
	description	1	1	1	1	0	1	1	0	0	1	2	1	1	1	0	2	2	**16**	**48**		**42.0**	
Clay-illuvial soils	name	0	0	6	1	0	4	4	6	3	3	2	14	3	9	8	6	1	**70**	**70**	**162**	**63.5**	**134**
	properties	0	0	1	0	0	1	4	2	1	2	2	2	6	2	2	3	3	**31**	**62**		**54.2**	
	profile	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	1	1	**5**	**15**		**8.1**	
	description	0	0	1	0	0	1	1	0	0	0	0	1	0	1	0	0	0	**5**	**15**		**8.1**	
Black earths	name	6	6	1	0	1	2	4	2	3	2	2	9	3	6	3	4	3	**57**	**57**	**132**	**55.3**	**111.4**
	properties	1	1	0	0	0	1	2	2	1	2	2	2	3	2	2	1	2	**24**	**48**		**43.6**	
	profile	0	0	0	0	0	0	1	0	0	0	0	2	0	1	0	0	2	**6**	**18**		**8.7**	
	description	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	**3**	**9**		**3.8**	

Table 3
Information scores and CIA within urban soils, alluvial soils, podzols, clay-illuvial soils and black earths (internet sources)

Internet sources (the numbers of websites correspond to Table 1)																								
Soil type	Information type	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Sum	Information scores	Sum of information scores	CIAp	CIA
Urban soils	name	1	0	0	0	0	0	1	0	0	1	0	0	1	0	0	4	0	8	**8**	**18**	**4.8**	**10.2**
	properties	1	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	0	5	**10**		**5.4**	
	profile	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**		**0**	
	description	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**		0	
Alluvial soils	name	5	3	2	1	3	2	4	1	1	3	2	0	14	4	10	4	8	67	**67**	**158**	**65**	**134**
	properties	1	0	1	1	1	1	1	1	1	3	1	0	2	2	2	1	1	20	**40**		**37.6**	
	profile	1	0	1	0	0	0	1	0	0	0	1	0	4	0	0	1	0	9	**27**		**16**	
	description	1	0	0	0	0	0	1	0	0	0	1	0	2	0	1	1	1	8	**24**		**15.4**	
Podzols	name	5	2	3	2	4	2	4	2	2	4	3	2	16	7	15	4	12	89	**89**	**199**	**89**	**175.5**
	properties	0	0	1	1	1	1	1	1	1	3	1	1	3	2	2	1	2	22	**44**		**41.3**	
	profile	1	0	1	0	0	0	1	0	0	0	1	0	4	0	0	1	2	11	**33**		**21.2**	
	description	1	0	1	0	0	0	1	0	0	1	1	0	3	1	0	1	1	11	**33**		**24**	
Clay-illuvial soils	name	4	3	1	2	3	1	4	2	2	2	1	2	9	1	8	4	11	60	**60**	**99**	**60**	**78.2**
	properties	0	0	0	0	1	0	1	1	1	1	0	0	1	1	0	1	1	9	**18**		**13.1**	
	profile	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	6	**18**		**4.4**	
	description	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	3		0.7	
Black earths	name	4	1	3	1	3	1	4	1	1	3	1	0	5	2	5	4	6	45	**45**	**91**	**43.7**	**73.7**
	properties	0	0	1	0	1	0	1	1	1	3	0	0	1	1	1	1	2	14	**28**		**22.5**	
	profile	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	1	3	**9**		**3.8**	
	description	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	3	**9**		**3.8**	

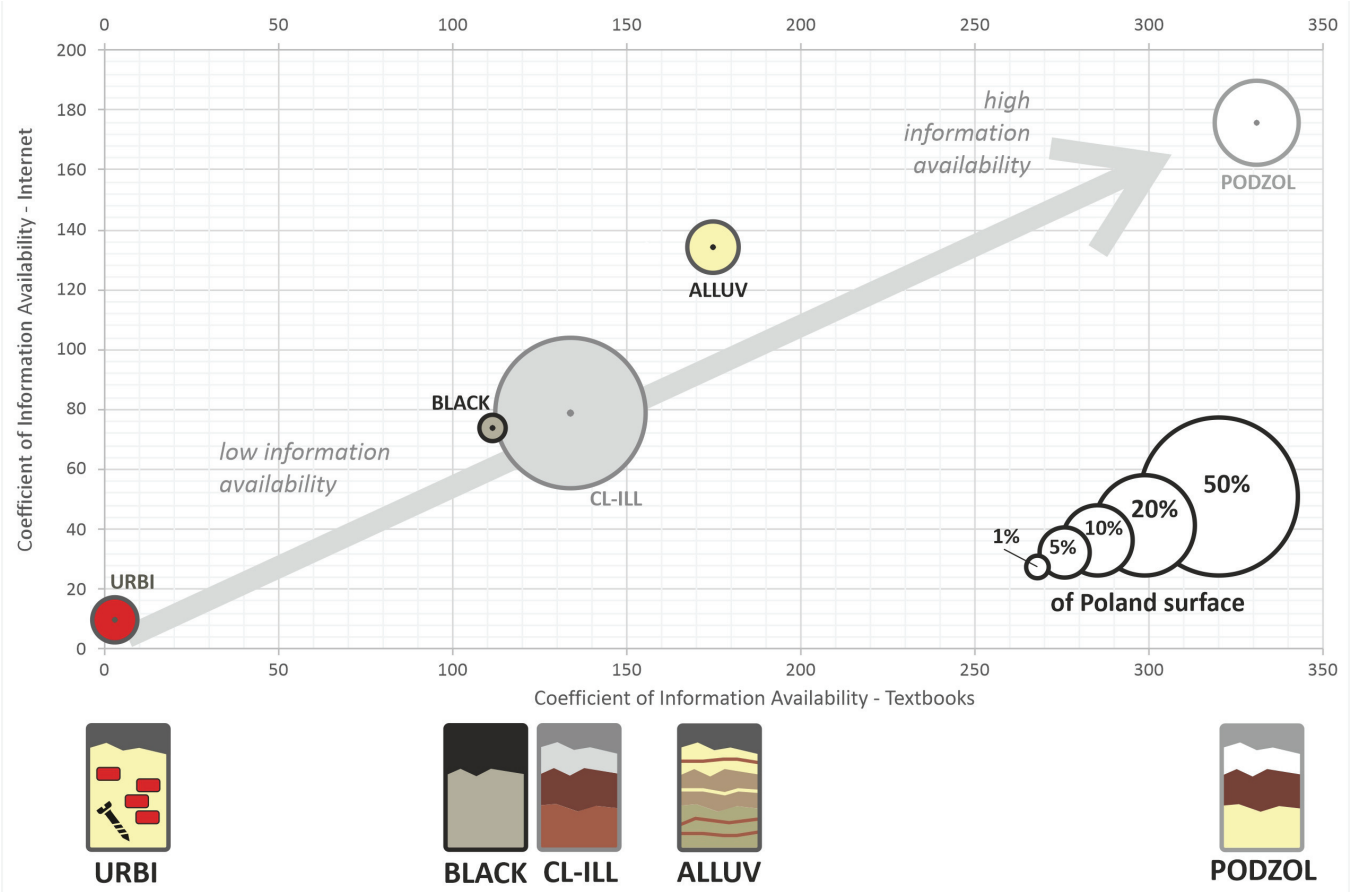

Fig. 2. Comparison of the Coefficient of Information Availability (CIA) of selected soil types (CLay-ILLuvial, PODZOLic, BLACK earths, ALLUVial soils, URBIzems) in textbooks and internet

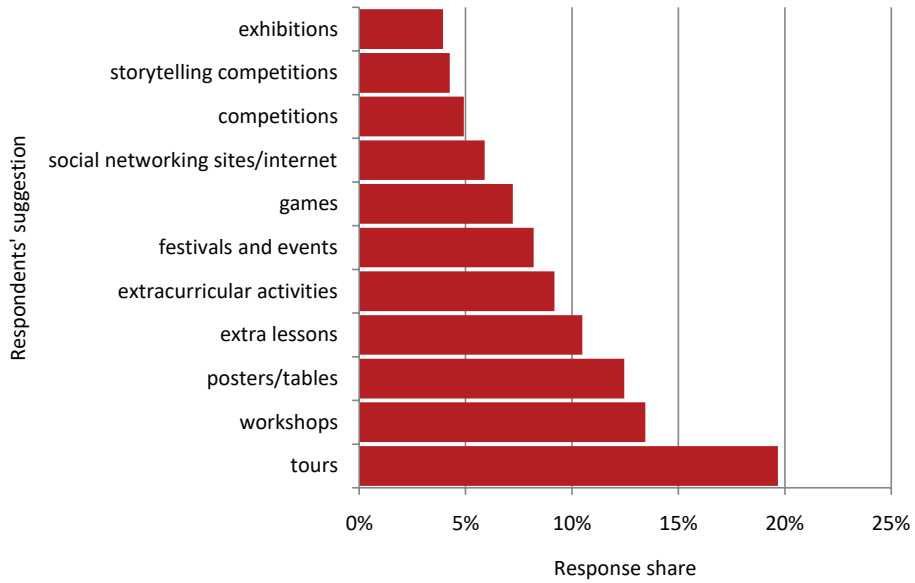

Fig. 3. Solution proposals to increase local soil awareness (school students opinions)

"People should be informed in some way about the importance of soil in our lives, for example by organizing activities or giving lectures on the subject, so that others become aware of how to take care of the soil we walk on".

Alluvial soils can definitely have an educational value, for inhabitants of all areas, as Poles generally have very little knowledge about soils – also about these soils, therefore any form of getting to know them is already a form of education. The solution for the popularization of soil science can be the workshops for children. Children absorb the most through stimuli from the environment. The option of "touching" soils, performing experiments is very appropriate and educational for them. Parents who watch over the children come with them, and whether they like it or not, they learn something from these meetings by "eavesdropping".

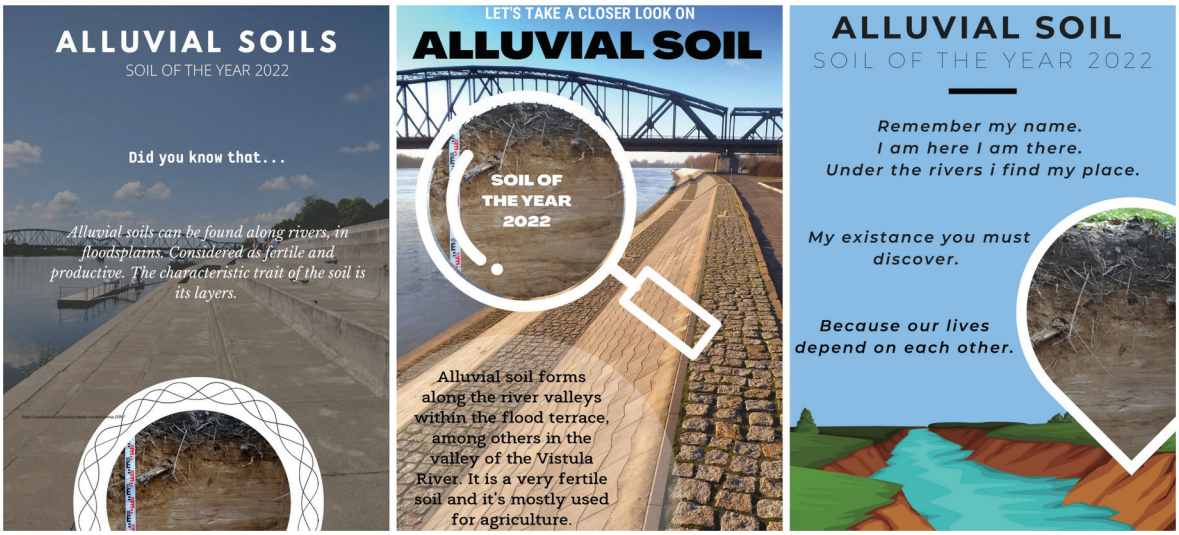

Fig. 4. Soils posters – students' proposals (authors: S. Bień, W. Hasiec, O. Stępniewska, W. Sadowska, A. Żurowska)

Alluvial soil is one of the most fertile soils in Poland, so it is worth talking about and learning more about this important factor in our country, because without good soils there is no life. A solution could be workshops with soil scientists, which would be combined in some way with games and not strictly connected with science itself.

Despite such an optimistic attitude of young people to alluvial soils and the proposal of relatively simple solutions, soil science still remains one of the most "unattractive" sections of geography teaching (Urbańska et al., 2022). Environmental problems the student is aware of before discussing them in school show clear deficiencies in soil science education (also non-formal). It turned out that some problems were sufficiently known to students (from the media or social network), while many other problems did not become known to students until high school (Fig. 5). The best-known issues are related to air pollution and global warming. Students are also quite aware of water pollution and floods. Unfortunately, only a few of them

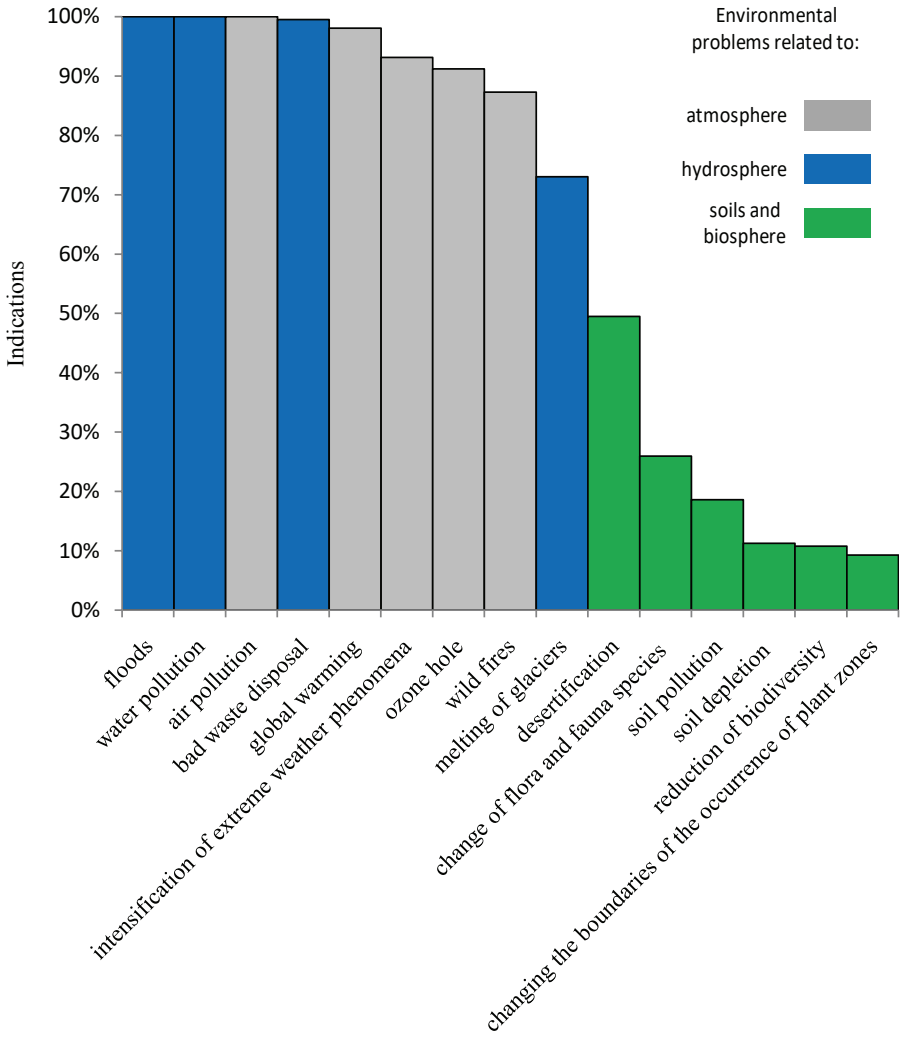

Fig. 5. Students' awareness of environmental problems (based on: Urbańska et al., 2022, modified)

are aware of problems related directly to soils. Students are generally unaware of the effects of deforestation leading to landslides, loss of biodiversity, and ecological soil functions as well as soil pollution and soil depletion. Nevertheless, young people's interest in problems related to floods or water pollution can (and should) be turned into an interest in soil. Alluvial soils seem to be an ideal link between these environmental threats.

This low state of soil science knowledge is also noticed by the respondents of the present study. Among the respondents there were the following answers: *Soils could have educational value because they are a very important part of the environment. People could popularize soil science by publicizing soil pollution and the effects of soil pollution.* This demonstrates the need to deepen the soil science knowledge not only of the school student, but of every inhabitant of our planet. Such a change is crucial not only for a healthy ecosystem, but also for the development of sustainable societies.

4. Conclusions

Alluvial soils are among the most recognizable soils of the soil cover in the Kuyavian-Pomeranian province. The availability of information about them both in geography textbooks and internet sources is also high. High school students are aware of their ecological value and the associated high biodiversity. Taking advantage of the fact that the Kuyavian-Pomeranian region is located in the Vistula Valley, the soil science awareness among the inhabitants may be increased. The soil science community, as well as local governments, should take advantage of the school students' suggestions to promote soil science knowledge. The most effective as well as interesting educational methods are soil science tours and workshops so the number of such events available to the public should increase. Soil posters that could be placed in various locations within the voivodship would be interesting. In the case of alluvial soils, such posters could be located along the Vistula River in commonly visited by locals and tourists recreational areas, e.g. Philadelphia Boulevard in Toruń. Alluvial soils, in their "inflow" nature, could initiate a stream of soil science knowledge in a way that would best reach today's generation – through image and applicability. Soil of the Year 2022 could be a great opportunity for development new and better soil awareness – based on public involvement in educational activities. Only such a proceedings can shape a young world citizen who will be able to face emerging environmental problems. Alluvial soil is a treasure of deeply hidden from human eyes. Soil educators should try to "dig them out" and make them visible to the public. Moreover, just as a river changes its character and course during its journey, societies should also begin to treat the soil with due respect. Taking the right action is crucial. The best way is proper soil science educational activity.

References

Barbag, J., Janiszewski, M., 1964. Geografia Polski. Klasa X (Geography of Poland. Textbook for X class). Państwowe Zakłady Wydawnictw Szkolnych, Warsaw. (in Polish)

Batorowicz, Z., Górecka, Ł., Prokopek, B., 1970. Geografia Polski. Podręcznik dla klasy II liceum ogólnokształcącego i ekonomicznego (Geography of Poland. Textbook for II class of high school and economic school). Państwowe Zakłady Wydawnictw Szkolnych, Warsaw. (in Polish)

Batorowicz, Z., Nalewajko, J., Suliborski, A., 1990. Polska w Europie. Podręcznik geografii dla szkoły średniej (Poland in Europe. Geography textbook for high school). Wydawnictwa Szkolne i Pedagogiczne, Warsaw. (in Polish)

Bednarek R., Prusinkiewicz Z., 1980. Geografia gleb. (Geography of Soils). PWN, Warszawa, 243.

Bednarek, R., Świtoniak, M., 2017. Gleby. [In:] Dzieje regionu kujawsko-pomorskiego. (History of the kujawsko-pomorskie region). Radzimiński A. (Ed.). Toruń, 87–94.

Biłgoras, J., Głowacz, A., Koperska-Puskar, D., Mazur, M., Mozolewska-Adamczyk, M., Srokosz, W., Zieliński, K., 2014. Geografia. Repetytorium – matura. Zakres rozszerzony (Geography. Repertory for high school graduates. Extended level).Wydawnictwa Szkolne i Pedagogiczne, Warsaw. (in Polish)

Bullinger-Weber, G., Gobat, J-M., 2006. (PDF) Identification of facies models in alluvial soil formation: The case of a Swiss alpine floodplain. Available from: https://www.researchgate.net/publication/222824007_Identification_of_facies_models_in_alluvial_soil_formation_The_case_of_a_Swiss_alpine_floodplain (accessed March 31 2022).

Charzyński, P. et al., 2022. A global perspective on soil science education at third educational level; knowledge, practice, skills and challenges. Geoderma 425, 116053. https://doi.org/10.1016/j.geoderma.2022.116053

Chojnicki, J., 2002. Soil-forming processes in alluvial soils of central Vistula valley and Żuławy. Wydawnictwo Fundacja SGGW, Warsaw. (in Polish with English summary).

Cubrinovski, M., McCahon, I., 2011. Foundations on deep alluvial soils. University of Canterbury, Christchurch, 40.

Czubla, P., Papińska, E., 2003. Geografia fizyczna 1. Zakres rozszerzony. Podręcznik dla szkoły średniej (Physical geography 1. Extended level. Textbook for high school). PWN Wydawnictwo Szkolne, Warsaw. (in Polish)

Daniels, J.M., 2003. Floodplain aggradation and pedogenesis in a semiarid environment. Geomorphology 56(3-4) Special Issue, 225–242. https://doi.org/10.1016/S0169-555X(03)00153-3

Domachowski, R., Makowska, D., 1987. Geografia. Podręcznik dla Zasadniczej Szkoły Zawodowej (Geography. Textbook for Basic vocational school). Wydawnictwa Szkolne i Pedagogiczne, Warsaw. (in Polish)

Driessen, P., Deckers, J., Spaargaren, O., 2001. (PDF) Lecture notes on the major soils of the world. World Soil Resources Reports 94. Food and Agriculture Organization of the United Nations, Rome, 334. Available from: https://www.fao.org/3/y1899e/y1899e.pdf (accessed March 31 2022).

Dz.U. 2017 poz. 356. Rozporządzenie Ministra Edukacji Narodowej z dnia 14 lutego 2017 r. w sprawie podstawy programowej wychowania przedszkolnego oraz podstawy programowej kształcenia ogólnego dla szkoły podstawowej, w tym dla uczniów z niepełnosprawnością intelektualną w stopniu umiarkowanym lub znacznym, kształcenia ogólnego dla branżowej szkoły I stopnia, kształcenia ogólnego dla szkoły specjalnej przysposabiającej do pracy oraz kształcenia ogólnego dla szkoły policealnej (http://men.gov.pl/wp-content/uploads/2016/11/geografia-podstawa.pdf, accessed June 26 2019). (in Polish).

Iqbal, J., Thomasson, J.A., Jenkins, J.N., Owens, P.R., Whisler, F.D., 2005. Spatial variability analysis of soil physical properties of alluvial soils. Soil Science Society of America Journal 69(4), 1338–1350. https://doi.org/10.2136/sssaj2004.0154

Kabała, C., Bogacz, A., Łabaz, B., Szopka, K., Waroszewski, J., 2013. Soil diversity, dynamics and threats. (Różnorodność, dynamika i zagrożenia gleb). [In:] Knapik, R., Raj, A. (ed.) Nature of the Karkonosze National Park. (Przyroda Karkonoskiego Parku Narodowego). Karkonoski Park Narodowy, Jelenia Góra, 91–126. (in Polish)

Kawalko, D., Jezierski, P., Kabala, C., 2021. Morphology and Physicochemical Properties of Alluvial Soils in Riparian Forests after River Regulation. Forests 12(3), 329. https://doi.org/10.3390/f12030329

Kop, J., Kucharska, M., Szkurłat, E., 2006. Geografia 1. Zakres podstawowy (Geography 1. Basic level). PWN Wydawnictwo Szkolne, Warsaw. (in Polish)

Krynicka-Tarnacka, T., Wnuk, G., 2005. Geografia Polski – dla uczniów szkół ponadgimnazjalnych (Geography of Poland. Textbook for high school). SOP, Toruń. (in Polish)

Kurek, S., 2019. Geografia – zakres rozszerzony. Podręcznik dla szkół ponadpodstawowych (Geography – extender level. Textbook for high school). Wydawnictwo Pedagogiczne Operon, Gdynia. (in Polish)

Łabaz, B., Kabała, C., 2016. Human-induced development of mollic and umbric horizons in drained and farmed swampy alluvial soils. Catena 139, 117–126. https://doi.org/10.1016/j.catena.2015.12.013

Łękawa, A., 2015. Geografia. Repetytorium maturzysty (Geography. Repertory for high school graduates). Greg, Kraków. (in Polish)

Macklin, M.G., Klimek, K., 1992. Dispersal, storage and transformation of metal contaminated alluvium in the upper Vistula basin, Southwest Poland. Applied Geography 12(1), 7–30.

Makowska, D., 1998. Ziemia i Ludzie. Podręcznik geografii fizycznej dla szkoły średniej (The Earth and people. Physical geography textbook for high school). Wydawnictwa Szkolne i Pedagogiczne, Warsaw. (in Polish)

Malarz, R., Więckowski, R., Kroh, P., 2019. Oblicza geografii 1. Podręcznik dla liceum ogólnokształcącego i technikum. Zakres rozszerzony (Faces of geography 1. Textbook for high school and technical school. Extended level). Nowa Era, Warsaw. (in Polish)

Malina, M.A., Nørreklit, H.S.O., Selto, F.H., 2011. Lessons learned: advantages and disadvantages of mixed method research, Qualitative Research in Accounting and Management 8(1), 59–71, https://doi.org/10.1108/11766091111124702

McAuliffe, J.R., 1994. Landscape evolution, soil formation, and ecological patterns and processes in Sonoran Desert Bajadas. Ecological Monographs 64, 111–148.

Messerli, B., Grosjean, M., Hofer, T., Nunez, L., Pfister, C., 2000. From nature-dominated to human-dominated environmental changes. Quaternary Science Reviews, 19(1–5), 459–479. https://doi.org/10.1016/S0277-3791(99)00075-X

Michalski, A., 2013. The problem of protection of organic carbon stocks in plough soils of the Lower Vistula floodplain. Episteme 18, 329–337.

Michalski, A., Bednarek, R., Dybowski, R., 2018. Soil maturity sequence within a flooded zone of the lower Vistula River valley (Toruń Basin, Poland). [In:] Świtoniak, M., Charzyński, P., (Eds.) Soil Sequences Atlas III. Machina Druku, Toruń.

Montgomery, D., 2012. Dirt: The Erosion of Civilizations. University of California Press, 285.

Naveh, Z., 2000. What is holistic landscape ecology? A conceptual introduction. Landscape and Urban Planning 50(1–3), 7–26. https://doi.org/10.1016/S0169-2046(00)00077-3

Neal, R.H., Sposito, G., 1989. Selenate adsorption on alluvial soils. Soil Science Society of America Journal 53(1), 70–74.

Paz, C.G. et al., (2008). Fluvisols. In: Chesworth, W., (Eds) Encyclopedia of Soil Science. Encyclopedia of Earth Sciences Series. Springer, Dordrecht. https://doi.org/10.1007/978-1-4020-3995-9_234

Petts, G.E., Amoros, C., 1996. Fluvial Hydrosystems. Chapman and Hall, London.

Podgórski, Z., Marszelewski, W., Becmer, K., 2002. Geografia 1. Zarys wiedzy o Ziemi. Podręcznik dla liceów ogólnokształcących (Geography 1. Outline of knowledge about the Earth. Textbook for high school). Wydawnictwa Szkolne i Pedagogiczne, Warsaw. (in Polish)

Prusinkiewicz, Z., Bednarek, R., 1991. Gleby. (Soils). [In:] Starkel, L., (Ed.), Geografia Polski, środowisko przyrodnicze. (Geography of Poland. Natural environment). PWN, Warszawa, 387–412.

Sokołowska, Z., Borówko, M., Reszko-Zygmunt, J., Sokołowski, S., 2002. Adsorption of nitrogen and water vapor by alluvial soils. Geoderma 107(1–2), 33–-54. https://doi.org/10.1016/S0016-7061(01)00137-9

Stankowski, W., 1987. Geografia fizyczna z geologią. Podręcznik dla szkoły średniej. (Physical geography with geology. Textbook for high school). Wydawnictwa Szkolne i Pedagogiczne, Warsaw. (in Polish)

Stasiak, J., Zaniewicz, Z., 2013. Geografia. Vademecum (Geography. Vademecum). Wydawnictwo Pedagogiczne Operon, Gdynia. (in Polish)

Świtalski, E., Preisner, Z. (Eds.), 1999. Geografia Polski (Geography of Poland). Oficyna Wydawnicza Turpress, Toruń. (in Polish)

Thoms, M.C., 2003. Floodplain–river ecosystems: lateral connections and the implications of human interference. Geomorphology 56(3–4), 335–349.

Urbańska, M., Charzyński, P., Kolejka, J., Yilmaz, D., Sahin, S., Peter, K., Gatsby, H., 2022. Environmental Threats and Geographical Education: Students' Sustainability Awareness—Evaluation. Education Sciences 12(1). https://doi.org/10.3390/educsci12010001

Urbańska, M., Charzyński, P., 2021. SUITMAs as an archive of the human past: educational implications. Journal of Soils and Sediments 21, 928–1937. https://doi.org/10.1007/s11368-021-02886-2

Urbańska, M., Sojka, T., Charzyński, P., Świtoniak, M., 2019. Digital media in soil education. Geography and Tourism 7(2). https://doi.org/10.36122/GAT20190704

Urbańska, M., Świtoniak, M., Charzyński, P., 2021. Rusty soils–"Lost" in school education. Soil Science Annual 72(4), 143466. https://doi.org/10.37501/soilsa/143466

Valentin, C., 1991. Surface crusting in two alluvial soils of northern Niger. Geoderma, 48(3–4), 201–222.

Walker, P.H., Coventry, R.J., 1976. Soil profile development in some alluvial deposits of eastern New South Wales. Soil Research 14, 305–317. https://doi.org/10.1071/SR9760305

Więckowski, M., Malarz, R., 2014. Oblicza geografii 3. Podręcznik dla liceum ogólnokształcącego i technikum. Zakres rozszerzony (Faces of geography 3. Textbook for high school and technical school. Extended level). Nowa Era, Warsaw. (in Polish)

Wroniecki, P., Molewski, P., Uziembło, R., 2021. Revealing the first location of abandoned medieval town Toruń, Poland, with the use of integrated noninvasive research. Archaeological Prospection, 1–18.

website 1: https://epodreczniki.pl/a/zroznicowanie-gleb-i-roslinnosci-na-obszarze-polski/DSM0RxNIH

website 2: https://www.ekologia.pl/wiedza/slowniki/leksykon-ekologii-i-ochrony-srodowiska/gleba

website 3: https://pracownik.kul.pl/files/32723/public/pdf/gleba.pdf

website 4: https://eszkola.pl/geografia/rozmieszczenie-gleb-w-polsce-6778.html

website 5: https://matura100procent.pl/rozmieszczenie-gleb-na-swiecie

website 6: https://opracowania.pl/opracowania/geografia/gleby-w-polsce,oid,1729

website 7: https://www.bryk.pl/wypracowania/geografia/geografia-fizyczna/8387-gleby-polski.html

website 8: https://swiatrolnika.info/gleby-w-polsce-rolnictwo

website 9: https://www.geografia24.eu/geo_prezentacje_rozsz_3/383_1_srodowisko_przyrodnicze/r3_1_08a.pdf

website 10: https://geografia.na6.pl/warstwa-glebowa

website 11: https://sciaga.pl/tekst/39463-40-gleby_w_polsce

website 12: http://geomorawa.ucoz.pl/publ/gleby_i_roslinnosc_polski/1-1-0-228

website 13: http://www.pcez-bytow.pl/download/plk/gleby-w-polsce.pdf

website 14: https://www.edukator.pl/resources/page/gleby/11165

website 15: https://geografia.gozych.edu.pl/gleby-w-polsce/

website 16: https://www.naukowiec.org/wiedza/geografia/gleby-w-polsce-rodzaje_3403.html

website 17: http://geografia24.pl/gleby-w-polsce/

Gleby aluwialne – strumieniem wiedzy gleboznawczej

Słowa kluczowe

Gleby aluwialne
Gleby dolin rzecznych
Podręczniki geograficzne
Promocja gleboznawstwa
Edukacja gleboznawcza
Polska Gleba Roku 2022

Streszczenie

Gleby aluwialne (mady) zajmują około 5% powierzchni Polski i stanowią ważny element środowiska równin zalewowych i dolin rzecznych. Gleby te od dawna stanowią przedmiot badań gleboznawczych na całym świecie. Wiedza uczniów szkół średnich na temat mad jest szersza niż w przypadku innych typów gleb. Informacje na temat gleb aluwialnych są stosunkowo łatwo dostępne w podręcznikach i wśród zasobów internetowych. Czy to wystarczy, aby gleby aluwialne stały się przyczynkiem do działań popularyzujących gleboznawstwo? Celem niniejszego opracowania jest diagnoza stanu wiedzy uczniów szkół średnich ogólnokształcących województwa kujawsko-pomorskiego na temat mad oraz ocena przydatności tych gleb w popularyzacji gleboznawstwa. Głównymi metodami badawczymi zastosowanymi w opracowaniu była kwerenda podręczników geografii i źródeł internetowych oraz metoda ankietowa. Wyniki badań wskazują, że informacje o glebach aluwialnych są powszechnie dostępne zarówno w książkach, jak i mediach internetowych. Świadomość wartości ekologicznej tych gleb na terenie województwa kujawsko-pomorskiego jest wysoka. Respondenci prawidłowo oceniają przydatność mad i potrafią wskazać sposoby zwiększenia społecznej świadomości gleboznawczej. Wśród respondentów panuje przekonanie o potrzebie zmian w edukacji gleboznawczej, zwłaszcza w zakresie zajęć pozalekcyjnych i pozaszkolnych. Propozycje takich działań zostały zawarte w niniejszej publikacji. Rok Gleb Aluwialnych jest dobrą okazją do zaproponowania nowych rozwiązań w zakresie popularyzacji gleboznawstwa zarówno w skali regionalnej, jak i krajowej.