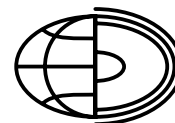


# The internet as a source of knowledge about soil cover of Poland



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**Abstract.** The aim of this paper is to assess the quality and correctness of information on Polish soils available on selected websites. Particular attention was paid to educational portals, which became the subject of evaluation of the information its contains in terms of the correctness, up-to-dateness and reliability. Twenty-five websites representing educational portals and blogs were selected for analysis in terms of their contents (type of subject matter) correctness (substantial value), curenthness (presence of up-to-date information) and completeness. Most of the information on the evaluated educational portals is targeted at high school students. These websites present only basic content. The most frequent issues on the analyzed portals were: soil types and soil systematics, distribution of soils in Poland, definition of soil and also soil valuation classes. Websites addressed to university students constitute a decided minority, could be said, that even an exception. One of those is article on Wikipedia, which has the highest educational value among all analysed websites.

**Key words:**

soils,  
Internet,  
soil science education,  
educational resources

## Introduction

It is already two decades since Welsh (1997) stated that the contemporary massive and turbulent expansion of new information and communication technologies, especially the Internet, would bring qualitative change in practically all aspects of human life. In the era of rapid development of the Internet, mass media and social networking sites, where chaos and excess of information prevails, it is necessary to “extract” reliable content. The skill of finding the information you need and to select, verify and assess its credibility and functionality is extremely important. Increasingly, young and even older people are treating the Internet as their main

source of knowledge, approaching content found on the web uncritically and without a shadow of distrust. The Internet is increasingly replacing traditional sources of knowledge, such as scientific and popular science articles and publications, atlases, maps (Park and Biddix 2008; Dogruer et al. 2011; Marks et al. 2012; Czigány et al. 2017). What is the reason for this? An extremely important aspect of online resources is their ability to be quickly and frequently updated, which in many cases is their main advantage over traditional, paper ones (Sojka et al. 2018). One example is a map of soil types prepared for the online atlas of the Kuyavian-Pomeranian Voivodeship (Bednarek et al. 2015, <http://atlas.kujawsko-pomorskie.pl/>).

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The Internet was introduced into education very quickly. Thus, it became an object of consideration for educators, especially those dealing with the media. Siemieniecki (1998), distinguished several areas of educational use of the Internet. In addition to perceiving it as a source of information, it is also a tool for acquiring information. It also serves as a tool for distance learning. The main assumptions of using the Internet in education according to Koźmińska-Sołósna (2005) are: the implementation of learning opportunities through activity and commitment; stimulating the creativity of teachers and, above all, preparing young people to live in an information society. Nowadays educational website servers provide access to enormous resources of knowledge and a myriad of facts. The global memory in which the gigantic amount of information is stored in various forms is virtually inexhaustible.

The aim of this paper is to assess the quality and correctness of information on Polish soils available on selected websites. Particular attention was paid to educational portals, whose information content was evaluated in terms of correctness, up-to-dateness and reliability. In the research, however, scientific papers, magazines and other on-line publications were omitted. They can be treated equally with traditional analogue (printed) sources, being the same content that is simply distributed in a different, digital version via the Internet.

## Methods

The research covered Internet resources containing information about soils of Poland. The Google search engine was used to conduct investigations. In Poland, and most other parts of the world it is an unrivalled search engine with the highest popularity ([www.eactive.pl/pozycjonowanie-stron/jakie-sa-najpopularniejsze-wyszukiwarki-internetowe-w-polsce-i-na-swiecie/](http://www.eactive.pl/pozycjonowanie-stron/jakie-sa-najpopularniejsze-wyszukiwarki-internetowe-w-polsce-i-na-swiecie/)). This search engine has a 96.5% share on the Polish market, clearly outclassing its competitors, MSN (1.6%) and Yahoo! (1.3%). The starting point for carry out the study was to determine what key word should be used to perform the search of websites. According to Google Trends – the tool used to analyse the number of queries directed to the Google search engine –

the most popular search terms for soil information in Poland is the phrase “soils in Poland”, or “Polish soils” (the Polish terms used were “gleby w Polsce”, “gleby Polski”). This key word was thus used to create the data query. Then the number of sites being researched was determined. From the obtained results, only the first 50 records (5 pages of results) were selected for the analysis. Taking into account results on further positions was not justified, because the majority of Internet users try links only from the first page found. According to Netcraft data, over 90% of Internet users surf only the results on the first search page. The next page is viewed by fewer than 5% of users, and the third by about 1% (<http://www.macmoney.pl/statystyki-internetu-czyli-globalna-siec-w-liczbach/>). Of the first fifty results, twenty-five websites representing educational portals and blogs were selected for further analysis (Fig. 1). Websites with professional scientific papers, films, tests or slide presentations were eliminated from the search records.

The final stage of the study was the analysis of the content of selected educational portals in terms of their contents (type of subject matter) correctness (substantive value), currentness (presence of up-to-date information) and completeness. The analysis

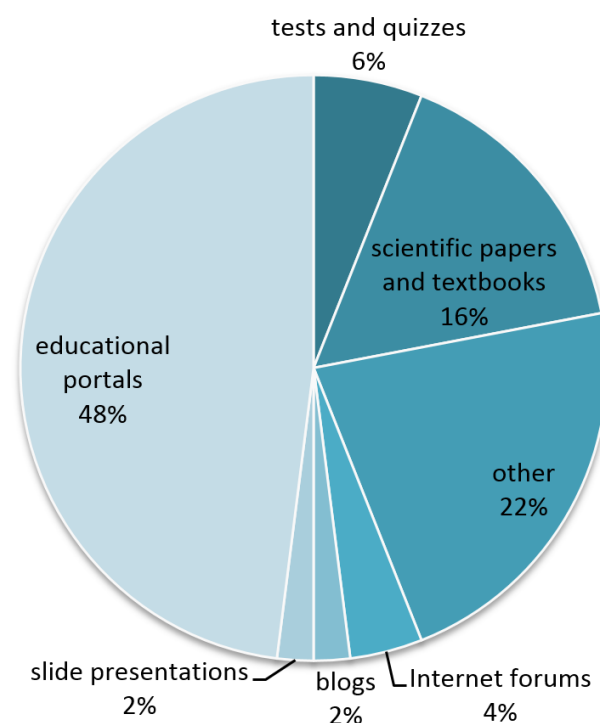


Fig. 1. Types of websites containing content related to Polish soils

was based on the processing and verification of the information available on the websites by comparing it with the knowledge contained in the most current and comprehensive Polish academic textbook "Soil Science" (Gleboznawstwo) (Mocek 2014) and the Polish Soil Classification (2011).

## Results and Discussion

The results of the study are presented in Table 1, where HTML addresses of the websites used for evaluation and a short description of the content is given. Potential recipients of the knowledge from the analysed websites were also identified.

The most frequently placed information on the analysed websites (19) is descriptions of soil types accompanied by basic facts connected with soil classification (Fig. 2). Over 70% of surveyed sites (18) provide a description of the spatial distribution of soils in Poland (soil geography). Definitions of soil, and a description or list of soil forming factors appear in only one third (32–36%) of the researched websites. This indicates a conspicuously small representation of pedological elements, which affects portals' educational value. Soil profiles, genetic horizons, information on soil degradation and fertility, and soil productivity appeared only sporadically.

Our analyses show the general lack of graphic elements on sites devoted to Polish soils. The most interesting and valuable way to show the spatial diversity of the soil cover – use of a map – appears only on eight websites and in most cases these maps are poorly prepared in terms of content and technical quality. The only professional map that can serve as an educational tool for students is not a soil map *sensu stricto*, it is a geoenvironmental map (geoportal, site 21). Other examples are so generalised and incomplete that even at high-school level, they should not be used as educational material. Another graphic element necessary to present basic soil knowledge – soil profiles – was only found on three websites, of which only one (the personal site of a soil science professor) provides reliable information tailored to educational needs at the higher education level. Even such basic and fundamental soil-related information a descriptions of genetic horizons is found on only six websites. In all cas-

es, soil horizon descriptions were inaccurate or outdated (using nomenclature from previous versions of the Polish Soil Classification (1989)) and incomplete. A significant drawback of the most common type of information regarding soil types and their classification was that it was outdated. Taking all this into account, only two websites met the basic criteria for use as a teaching tool for students. Interestingly, the Wikipedia website, which is widely criticised by Polish academics, should be noted for its constant improvement to the quality of information provided on portal and has already been recognised in the didactic processes of other countries such as Greece, Czechia (Jančařík and Jančaříková 2010) and Norway (Brox 2016).

A significant problem with the analysed websites is the fact that most (88%) do not provide the source of their information, which significantly affects the credibility of the presented contents. This is particularly hazardous if we take into account the fact that only 8.3% of respondents assume that the credibility of information posted in the Internet is low, while the vast majority treat it as completely reliable (Szpunar 2007).

The limited scope of information and heavy generalisation of data on Internet sites suggest that even with optimistic assumptions, most them can only be addressed to high-school students.

## Conclusions

Most of the information on the evaluated educational portals is targeted at high-school students. These websites present only basic content. The most frequent issues on the analysed portals include soil types and soil classification, distribution of soils in Poland, definition of soil and also soil valuation classes. Websites addressed to university students constitute a decided minority and, it could be said, even an exception. One of those is the article on Wikipedia, which has the highest educational value among all the analysed websites.

Unfortunately, the vast majority of information on Poland's soils does not meet the basic criteria of correctness, up-to-dateness or data exhaustibility, even at the high-school level:

Table 1. Overview of the analysed websites

No.	HTML address	Contents	Recipients
1.	<a href="http://www.geografia_liceum.republika.pl/pol_gleby.htm">http://www.geografia_liceum.republika.pl/pol_gleby.htm</a>	<ul style="list-style-type: none"> <li>• Factors of soil formation</li> <li>• Soil valuation classes</li> <li>• Map of distribution of soils in Poland</li> <li>• Soil type descriptions</li> </ul>	High-school students
2.	<a href="http://sciaga.pl/tekst/1871-2-gleby_polski">http://sciaga.pl/tekst/1871-2-gleby_polski</a>	<ul style="list-style-type: none"> <li>• Definition of soil</li> <li>• Characteristics of soils distribution in Poland</li> <li>• Causes of soil degradation</li> <li>• Soil types</li> <li>• Soil valuation classes</li> <li>• Factors of soil formation</li> </ul>	High-school students
3.	<a href="http://sciaga.pl/tekst/39463-40-gleby_w_polsce">http://sciaga.pl/tekst/39463-40-gleby_w_polsce</a>	<ul style="list-style-type: none"> <li>• Definition of soil</li> <li>• Factors of soil formation</li> <li>• Characteristics and distribution of soils in Poland</li> <li>• Soil evaluation classes</li> <li>• Soil classification</li> <li>• Devastation and degradation of soils: causes</li> </ul>	High-school students
4.	<a href="https://www.bryk.pl/wypracowania/geografia/geografia_fizyczna/8387-gleby_polski.html">https://www.bryk.pl/wypracowania/geografia/geografia_fizyczna/8387-gleby_polski.html</a>	<ul style="list-style-type: none"> <li>• Definition of soil</li> <li>• Factors of soil formation</li> <li>• Characteristics and distribution of soil types</li> <li>• Soil genetic horizons</li> </ul>	High-school students
5.	<a href="http://www.gegra.pl/liceum/Typy-gleb-w-Polsce/notatka/137/">http://www.gegra.pl/liceum/Typy-gleb-w-Polsce/notatka/137/</a>	<ul style="list-style-type: none"> <li>• Soil classification spatial distribution of soil types,</li> <li>• soil geography</li> <li>• Soil types and their characteristics</li> </ul>	High-school students
6.	<a href="http://geografia.opracowania.pl/gleby_w_polsce/">http://geografia.opracowania.pl/gleby_w_polsce/</a>	<ul style="list-style-type: none"> <li>• Soil types</li> <li>• Soil distribution description</li> </ul>	High-school students
7.	<a href="http://www.wiking.edu.pl/article.php?id=46">http://www.wiking.edu.pl/article.php?id=46</a>	<ul style="list-style-type: none"> <li>• Soil types</li> <li>• Characteristics of distribution of soils</li> <li>• Spatial distribution of soil types in Poland: pie chart</li> <li>• Map of distribution of soils in Poland</li> </ul>	High-school students
8.	<a href="http://www.geomatura.pl/index.php/geografia-polski-3/54-gleby-w-polsce">http://www.geomatura.pl/index.php/geografia-polski-3/54-gleby-w-polsce</a>	<ul style="list-style-type: none"> <li>• Definition of soil</li> <li>• Factors of soil formation</li> <li>• Types of soils in Poland and their occurrence</li> <li>• Spatial distribution of soil types in Poland: pie chart</li> <li>• Map of distribution of soils in Poland</li> <li>• Soil valuation classes</li> <li>• Evaluation of soil fertility in Poland</li> </ul>	High-school students
9.	<a href="https://pl.wikipedia.org/wiki/Systematyka_gleb">https://pl.wikipedia.org/wiki/Systematyka_gleb</a>	<ul style="list-style-type: none"> <li>• Polish Soil Classification 2011</li> <li>• Polish Soil Classification 1989</li> <li>• WRB soil classification</li> <li>• Soil Taxonomy</li> <li>• General division of soils</li> </ul>	High-school students / University students
10.	<a href="http://geografia.na6.pl/szata-roslina-i-gleby-w-polsce">http://geografia.na6.pl/szata-roslina-i-gleby-w-polsce</a>	<ul style="list-style-type: none"> <li>• General information about forests</li> <li>• Types of forests in Poland</li> <li>• Characteristics of forest communities</li> <li>• Distributions of plants in Poland</li> <li>• Definition of soil</li> <li>• Soil types</li> <li>• Characteristics of distribution of Polish soils</li> <li>• Typology of soil valuation classes</li> </ul>	High-school students

Table 1. Overview of the analysed websites (continued)

No.	HTML address	Contents	Recipients
11.	<a href="http://www.geografia24.eu/index.php?strona=_opracowania/geo_290g-pol">http://www.geografia24.eu/index.php?strona=_opracowania/geo_290g-pol</a>	<ul style="list-style-type: none"> <li>• Definition of soil</li> <li>• Soil-forming processes</li> <li>• Map of distribution of selected soil types in Poland</li> <li>• Characteristics of soils and description of their occurrence</li> </ul>	High-school students
12.	<a href="http://www.geografia24.eu/index.php?strona=_opracowania/geo_270ty_g">http://www.geografia24.eu/index.php?strona=_opracowania/geo_270ty_g</a>	<ul style="list-style-type: none"> <li>• Soil processes</li> <li>• Soil horizons description</li> <li>• Fertility of soils</li> <li>• Soil types and their distribution</li> <li>• Typology of soil valuation classes</li> <li>• Factors of soil formation</li> </ul>	High-school students
13.	<a href="http://www.edukator.pl/Gleby,17.html">http://www.edukator.pl/Gleby,17.html</a>	<ul style="list-style-type: none"> <li>• Soil varieties</li> <li>• Soil distribution description</li> </ul>	High-school students
14.	<a href="http://encyklopedia.pwn.pl/haslo/Polska-Warunki-naturalne-Gleby;4575155.html">http://encyklopedia.pwn.pl/haslo/Polska-Warunki-naturalne-Gleby;4575155.html</a>	<ul style="list-style-type: none"> <li>• Soil genetic classes</li> <li>• Soil distribution characteristics</li> </ul>	High-school students
15.	<a href="http://karnet.up.wroc.pl/~kabala/SGP5_Soils.html">http://karnet.up.wroc.pl/~kabala/SGP5_Soils.html</a>	<ul style="list-style-type: none"> <li>• Polish Soil Classification 2011</li> </ul>	University students
16.	<a href="http://sciaga.onet.pl/12581,61,176,143,1,21241,sciaga.html">http://sciaga.onet.pl/12581,61,176,143,1,21241,sciaga.html</a>	<ul style="list-style-type: none"> <li>• Definition of land capability</li> <li>• Soil valuation classes in Poland</li> </ul>	High-school students
17.	<a href="https://pl.wikibooks.org/wiki/Wikipedysta:Krzysiu_Jarzyna/Geografia_Polski/Terytorium/Gleby">https://pl.wikibooks.org/wiki/Wikipedysta:Krzysiu_Jarzyna/Geografia_Polski/Terytorium/Gleby</a>	<ul style="list-style-type: none"> <li>• Percentages of soil varieties in Poland</li> <li>• Soil evaluation classes</li> </ul>	High-school students
18.	<a href="http://eszkola.pl/geografia/gleby-polski-rodzaje-6777.html">http://eszkola.pl/geografia/gleby-polski-rodzaje-6777.html</a>	<ul style="list-style-type: none"> <li>• Soil varieties</li> <li>• Causes of soil degradation</li> </ul>	High-school students
19.	<a href="https://prezi.com/wffrjjjn2zif/gleby-polski/">https://prezi.com/wffrjjjn2zif/gleby-polski/</a>	<ul style="list-style-type: none"> <li>• Definition of soil</li> <li>• Factors of soil formation</li> <li>• Soil varieties</li> <li>• Soil horizons (layers)</li> <li>• Soil valuation classes</li> <li>• Causes of soil erosion and its occurrence</li> </ul>	High-school students
20.	<a href="http://www.interklasa.pl/portal/index/strony?mainSP=sub-jectpages&amp;mainSRV=geografia&amp;method=9157863&amp;page=article&amp;article_id=319157">http://www.interklasa.pl/portal/index/strony?mainSP=sub-jectpages&amp;mainSRV=geografia&amp;method=9157863&amp;page=article&amp;article_id=319157</a>	<ul style="list-style-type: none"> <li>• Map of distribution of soils in Poland</li> <li>• Definition of soil</li> <li>• Pie chart of soil composition</li> </ul>	High-school students
21.	<a href="http://geoportal.pgi.gov.pl/srodowiskowa/mapy/geosrodowiskowa">http://geoportal.pgi.gov.pl/srodowiskowa/mapy/geosrodowiskowa</a>	<ul style="list-style-type: none"> <li>• Geoenvironmental map of scale 1:50,000</li> <li>• List of information on the map</li> </ul>	University students
22.	<a href="http://www.zielonewrota.pl/art_v.php?art=2768&amp;p">http://www.zielonewrota.pl/art_v.php?art=2768&amp;p</a>	<ul style="list-style-type: none"> <li>• Information on soil degradation in Poland</li> </ul>	High-school students
23.	<a href="http://www.nks-umwelttechnologien.de/zagrozenia-i-ochrona-srodowiska/zasoby-gleb-w-polsce">http://www.nks-umwelttechnologien.de/zagrozenia-i-ochrona-srodowiska/zasoby-gleb-w-polsce</a>	<ul style="list-style-type: none"> <li>• Definition of soil</li> <li>• Factors of soil formation</li> <li>• Soil types in Poland</li> <li>• Soil distribution description</li> </ul>	High-school students
24.	<a href="http://mojasciaga.pl/wypracowanie/1619/gleby_polski">http://mojasciaga.pl/wypracowanie/1619/gleby_polski</a>	<ul style="list-style-type: none"> <li>• Definition of soil</li> <li>• Soil varieties and their occurrence in Poland</li> </ul>	High-school students
25.	<a href="https://notatek.pl/gleby-polski">https://notatek.pl/gleby-polski</a>	<ul style="list-style-type: none"> <li>• Distribution and genesis of soils in Poland</li> </ul>	High-school students

Table 2. Evaluation of the quality of soil science information on the analysed websites

Website	Soil classification			Soil description and geography of soils			Definition of soil		Soil valuation classes		Soil maps			Soil degradation		Genetic horizons			Soil fertility		Factors of soil formation		Soil profile morphology		References		
	P	A	K	P	A	K	P	K	P	K	P	A	K	P	K	P	A	K	P	K	P	K	P	K			
1	Y	R	R	Y	Y	R			Y	R	Y	R	Y									R	R			R	
2	R	R	R				Y	R	Y	R				Y	R								R	R			R
3	Y	Y	R	R	R	R	Y	R	Y	Y				Y	Y	R	R	R	Y	Y		Y	R			R	
4				R	R	R	R	R								R	R	R				R	R			R	
5	R	R	R	Y	R	R																				R	
6	Y	R	R	Y	R	R																				R	
7	Y	R	R	Y	Y	R					R	R	R													R	
8	Y	R	R	Y	R	R	Y	R			R	R	R			R	R	R				Y	R			R	
9	G	G																								G	
10	R	R	R	R	R	R	Y	R	Y	Y																R	
11	R	R	R	R	R	R	Y	R			R	R	R											Y	R	R	
12	R	R	R	R	R	R	Y	Y			R	R	R			R	R	R	Y	Y		R	R	Y		R	
13	Y	Y	Y	Y	Y	Y																				R	
14	Y	R	R	Y	R	R																				R	
15	G	G																						G	G	G	
16									Y	Y										Y	R					R	
17	R	R	R	R	R	R																				R	
18	R	R	R											Y	R											G	
19	R	R	R				Y	R	Y	R	Y	Y	Y			R	R	R				Y	Y			R	
20				R	R	R					R	R	R	Y	R											R	
21											G	G	G													R	
22	R	R	R	R	R	R								Y	R											R	
23				R	R	R	Y	R								R	R	R				Y	R			R	
24	Y	R	R	R	R	R																				R	
25*																											

P – correctness, A – up-to-dateness (of Polish Soil Classification version used), K – completeness, \* subscription-only website – no possibility to verify information, Colors: red – No, yellow - Yes – high-school level, green - Yes – university level, gray - Issue not present.

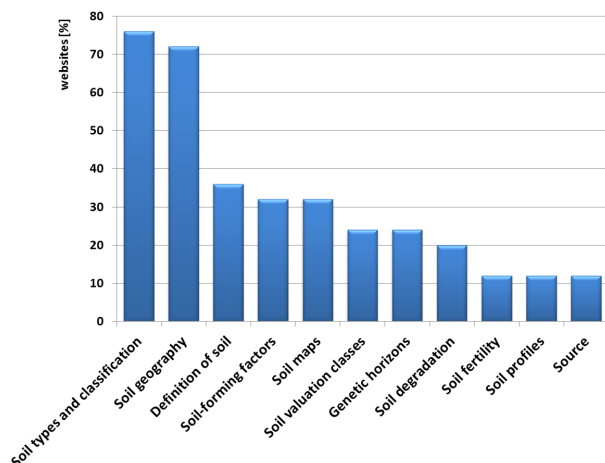


Fig. 2. Type of soil science information provided on the analysed websites

- texts on many websites contain factual, terminological, grammatical or stylistic errors, which greatly reduces the quality of the information provided;
- the division and naming of soils and the legends of the maps refer in the majority of cases to the Polish Soil Classification of 1989, which is seven years out of date;
- graphical and cartographic information are rare. In particular, this concerns the issue of the morphology of soil profiles, which is so important from the educational point of view. There is a lack of infographics that would enable easier understanding of the subject of pedology;
- in most cases no references are provided, which makes it impossible for Internet users to reliably evaluate the correctness of the presented data.

In summary, there is an urgent need to intensify the activities of Higher Education Institutions and Soil Science Societies to promote and disseminate up-to-date knowledge in the field of pedology through the Internet. One example of good practice is the FACES project co-financed by Erasmus+, which aims at creating modern educational tools to teach WRB soil classification through an Internet-based soil database (Fig. 3; [www.soils.umk.pl](http://www.soils.umk.pl)). This portal also contains a large number of soil profiles with distinguished horizons and basic ana-

lytical data, which is information that is poorly represented on the analysed websites (Fig. 3).

The lack of extensive activities of this kind means that the increasingly popular medium of the Internet, which currently carries outdated and incorrect content, will consequently lead to the marginalisation of soil science and, as a result, will damage society.

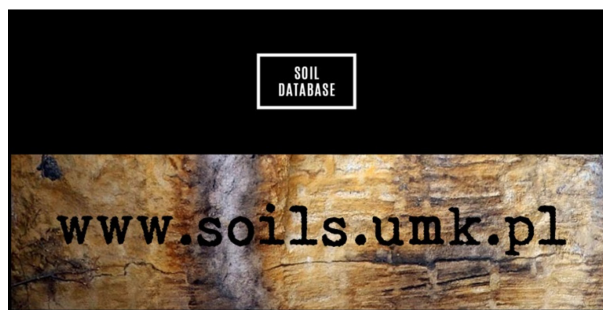


Fig. 3. Soil database banner

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