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Sustainable Management in River Valleys, Promoting Water Retention—The Opinion of Residents of South-Eastern Poland

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Abstract: Sustainable development is implemented not only at the global level, but primarily in local environments. Shaping the space of river valleys becomes particularly important in the face of climate change and growing water deficit. The article therefore addresses the issue of the social perception of water management in the context of climate change. The aim was to answer the questions: what is the social awareness of water management in the face of climate change, and what sustainable solutions are socially accepted? The research was carried out in the south-eastern part of Poland, in the Podkarpackie and Lublin voivodeships. The diagnostic survey method, an original survey form, and the CAWI technique were used. The study group analyzed the perception of global, negative megatrends, and challenges related to water retention in the context of climate change. The task was to identify respondents' awareness of new sustainable management methods in river valleys. Due to the fact that the studied area is largely agricultural, differences in the perception of the studied items were sought, depending on the place of residence. It was assumed that inhabitants of rural areas have greater contact with nature, which may change their perception, and differences were looked for depending on the region of residence. Differences in the perceptions of the studied phenomena were also searched for, depending on the respondent's sex. The calculations show that the place of residence (urban–rural) and the regions (Podkarpackie–Lublin voivodeships) do not differentiate the perceptions of most of the examined items. However, sex primarily affects the perception of global megatrends and the perception of climate change. The results indicate the respondents' lack of awareness about natural forms of water retention. Respondents expected the implementation of outdated technical forms of flood protection. Expectations focused mainly on flood embankments and large dam reservoirs. There was strong belief among respondents regarding global megatrends and their impacts on social and economic life. A knowledge deficit was identified in relation to sustainable management methods in river valleys that favor water retention.

Keywords: water management and retention; climate change; sustainable development of river valleys; economics and public goods; south-eastern Poland

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1. Introduction

Water security can be defined as the adaptive capacity to ensure the sustainable availability and safe use of adequate, reliable, and resilient water quantity and quality for health, livelihoods, ecosystems, and a productive economy, and for disaster risk reduction [1]. Ensuring water security involves managing too much or too little water and its quality. Water security refers to the growing importance of the sustainable management of water resources in a way that protects against any water-related disasters. Water security concerns both ecosystem health and economic development [2]. In environmental–ecological terms, water security shows the amount of water needed to maintain or improve environmental quality [3]. Available water resources are under pressure from many sectors, such as agriculture, industry, tourism, transport, and energy. The issue of water security is also the subject of activities of the European Union [4]. The EU pays particular attention to the allocation and use of water resources, in particular, in sensitive economic sectors [5]. Currently, it is equally important to reduce the risk of floods, but also to limit the effects of drought.

All investment decisions, regarding flood protection, are mainly based on the results of a cost benefit analysis. This analysis can answer the questions related to economic efficiency, investment outlays, replacement costs of operation, and maintenance of technical infrastructure, as well as social and environmental costs related to changes in the conditions of natural ecosystems, biodiversity, and landscape [6]. Expenditures on flood protection measures in EU countries were estimated at a total of EUR 2.5 billion per year. In turn, expenditure under the European Regional Development Fund and the Cohesion Fund, in 2014–2020, intended for adaptation to climate change, and the prevention and management of climate-related risks, including floods and droughts, amounted to approximately EUR 6.3 billion. This presents an average of approximately EUR 0.9 billion per year [7]. In light of the presented challenges, the sustainable management of river valleys, with particular emphasis on natural water retention mechanisms, becomes of great importance [8].

1.1. The Impact of the Economy on Strategies to Ensure Water Security

Proper water management is becoming increasingly important, especially in the context of observed climate changes. Modern climate change includes an increase in air temperature on Earth, which, in turn, may affect other elements that shape the climate. According to some authors [9], in the years 2011–2020, the average temperature of the Earth was 1.09 °C higher, compared to the pre-industrial period, i.e., in the years 1850–1900. A change in one factor can, in turn, create a new set of conditions, which, in turn, can secondarily drive changes in the weather and climate elements. Currently, for example, there are intense droughts, water shortages, and serious fires on the one hand, and on the other hand, there are melting glaciers, rising sea levels, floods, catastrophic storms, and similar weather phenomena. The abovementioned phenomena have an impact on the environmental economy and are perceived differently, socially, in different regions of the world [10–12]. Changes in water resources and the biodiversity of water and land reservoirs are just some of the effects of violent weather phenomena. However, they imply a negative impact on agriculture and forestry [13], and on human health [14].

According to [15], an author who used 12 climate models for quantitative analysis, describing the impact of climate effects on global water resources; there will be an increase in the impact of climate effects on water resources in eastern Equatorial Africa, North America, and Eurasia, and in the La Plata Basin in South America. This increase will be in the range of 10–40% in 2050. In turn, the described dependence will decrease by 10–30% in Southern Europe, the Middle East, the western part of North America, and the Republic of South Africa [16]. Some authors [17] conducted research aimed at linking climate change and the chemical composition of groundwater. The research shows that seasonal floods, caused by extreme precipitation, are responsible for biochemical and geochemical redox processes, which result in groundwater contamination in post-flood areas. However, another author [18] concluded that the sustainable development of river valleys has a retention function and ensures safety both during floods and droughts. Riparian meadows can also be a source of biomass for fodder, or an energy carrier. Moreover, flood meadows can be an ecological buffer, capturing excess nutrients from surface runoff [18]. In turn, other authors [19] conducted a case study to show how to solve water scarcity problems resulting from climate change. These authors presented a hydro-economic model that combines elements of hydrology, economics, and the environment. This model was applied to arid and semi-arid regions in Spain. The research results indicate that the occurring drought phenomena have a significant impact on social wellbeing, and in the conditions examined by the abovementioned authors, there was a reduction in net agricultural production. Agriculture is the sector that consumes the most water in the world and needs it to feed humanity [20]. Energy is also highly dependent on water, making electricity production one of the main drivers of global water scarcity [21]. In fact, it is difficult to imagine any human activity that is independent of water [22,23].

Hydrological droughts and forecasts of their occurrence in the future are becoming a serious challenge due to the complex interactions between climate, hydrology, and humans [24]. In many parts of the world, there are heated discussions about expanding reservoirs to counteract droughts and water shortages. However, contrary to popular belief, in some cases, the construction of reservoirs increases the risk of susceptibility to drought threats, and this, in turn, increases the potential damage associated with the construction of such water storage facilities [25]. Dam reservoirs operate mainly at points, which leads to an increase in the groundwater level, only in a limited area around the reservoir. At the same time, the groundwater level lowers downstream. As a result, this leads to local droughts. Still water retained in a reservoir evaporates faster, compared to water moved by a river current or retained in a wetland. Paradoxically, dam reservoirs contribute to a faster loss of water that should be retained in the environment. It is also often associated with the need to relocate entire settlements. Areas with high historical, cultural, agricultural, and natural values are therefore irretrievably lost. The construction of dam reservoirs is not a solution to the water deficit because, most often, it does not solve the problem of drought, but only transfers its effects to the lower sections of the river. The construction of water stages and dam reservoirs also disrupts the ecological continuity of a river, i.e., the transport of trailing debris, and interrupts the movement routes of fish and other animal species. In this situation, the properties of water, its temperature, oxygenation, and fertility also change, contributing to the threat and elimination of the lives of typical river organisms [26,27]. On the other hand, projections of the impact of climate change on flood characteristics are very sensitive to the detailed nature of these changes. The hydrological cycle is expected to be intensified by global warming, which is likely to increase the intensity of extreme rainfall events and the risk of flooding. It is also estimated that extreme rainfall and flooding may occur in all climatic regions. These phenomena may result in an excessive supply of various nutrients and pollutants to wetlands [28,29].

There are examples of synergies and antagonisms between the risk of floods and droughts and the actions limiting their impacts on the environment [30]. The very concept of a multifunctional dam reservoir illustrates just such a conflict. In order to reduce the risk of flooding, a given empty volume of the warehouse must be maintained, and thus, a possible flood wave is taken into account. However, the flood control measures described above mean the loss of the ability to store larger amounts of water, which may be very valuable in the event of a hydrological drought [31]. Therefore, to prevent drought, a "wet" reservoir would be preferred, while, to reduce flood risk, a "dry" reservoir (polder) would be preferred, collecting a larger amount of flood water. Therefore, what is better for reducing flood risk may not be good for reducing drought risk.

To ensure sustainable management in river valleys, the restoration of catchment areas is important. It involves restoring the flooding of coastal areas by moving flood embankments away. Activities of this type are also important for flood protection by slowing down water outflow. On the scale of the entire catchment area, it is important to protect wetlands in the water management system. The basis for ensuring proper water conditions in wetlands is to maintain the natural hydrological regime of the river, including periods of elevated water levels. It should be emphasized that drainage is one of the main causes of the destruction of wetlands. It is therefore necessary to limit water runoff as the primary method of protecting them. Natural riparian meadows are a very important element of sustainable management in river valleys. An important element of natural valleys of large rivers are ecosystems shaped by floodplains, complexes of rushes, thickets, and riparian forests. These ecosystems, now often cut off from the river by flood embankments, are subject to degradation and evolving into distorted land systems [32,33].

Hence, river restoration techniques, such as moving embankments by increasing their span and creating polders, may be beneficial in both cases [34].

Water retention—storing water when it is abundant and releasing it when it is scarce—is an essential measure to reduce the risks of floods and droughts [35,36]. The effectiveness of different types of flood storage systems should be considered in the context of their impact on reducing the volume of flood runoff. Created forests and other green areas, as well as small reservoirs or polders, can serve as integrated solutions and reduce the risk of flooding for many years. In turn, reducing the risk of long-term floods (e.g., by protecting against 100-year floods) requires the renaturalization of river spaces (i.e., "space for the river") and ensuring a large retention capacity in reservoirs [37]. To reduce the risk of floods and droughts, it is necessary to increase the capacity of various types of storage facilities, both natural and artificial [38]. These plans should also take into account water retention in the river valley landscape or soil retention, which is based on the assumption that an increase in the content of organic matter in the soil results in an increase in water storage [39]. The storage capacity of aquifers and the possibility of their recharge by abundant floodwaters should also be taken into account [40]. The appropriate connection of retention activities must be adapted to the actual hydrological, geological, and environmental conditions, as well as the existing and planned infrastructure in the river basin [41]. It also requires monitoring the effectiveness of such activities within local and regional systems, and adapting them to spatial development plans [42].

Public awareness that water management is a political issue is growing. Therefore, there is currently a tendency to talk about tasks related to water management as water resources management [43]. Water management, in particular, rainwater management in urbanized areas, seems to be the main challenge in the era of climate transformation [44]. Despite imprecise legal regulations, many Polish cities—especially those exposed to the effects of river floods or, in general, to the effects of flash floods—have started implementing organizational and legal changes to find and create an appropriate model for rainwater management in their area. This is a model that is intended to reduce the risk of floods and minimize the effects of drought, while enabling the cofinancing of their occurrence [45].

Polish legal regulations specify that flood protection is achieved, in particular, by: "(1) shaping the spatial development of river valleys or flood areas, mainly areas of particular flood risk; (2) rational water retention and use of flood protection structures, as well as control of water flows; (3) ensuring the functioning of the early warning system against dangerous phenomena, occurring in the atmosphere and hydrosphere, and flood forecasting; (4) preservation, creation and restoration of water retention systems; (5) construction, reconstruction and maintenance of flood protection structures; (6) conducting icebreaking campaigns and (7) conducting information policy, regarding flood protection and limiting its effects" [46]. Polish legal conditions are consistent with the European Union Directive [47].

Growing concerns related to climate change have focused spatial management in cities on mainly flood protection. As a consequence of such actions, cities are often not prepared for water shortages [48]. There are also studies on the maximization of water resources, but they are less concerned with the control and management of its demand. Achieving synergies and benefits in urban agglomerations, in the case of rainwater collection and reuse systems, are presented as topics requiring development, not only from the point of view of design, but also from the points of view of the management, decision making, and preparation of the final consumer for the "new water" that can be used in the context of the circular economy [49]. According to some authors [50], the implementation of green and blue urban infrastructure (GBI) is a positive undertaking because it ensures carbon dioxide sequestration, water retention, regulation, thermal comfort, and the improvement of biodiversity in the built environment, as well as around urban settlements [51]. Other studies have found that water quality in cities has improved significantly, as it has decreased, the number of waterborne diseases [52,53]. Moreover, the quality and availability of recreational facilities in urban surroundings have also increased [54].

Ecologists and landscape historians, as well as flood managers, attach more and more importance to the protection of flood meadows. They are valued as heritage, have ecological potential, and provide opportunities for local flood management [55]. According to some authors [56], flood meadows are characterized by specific flora and fauna that have settled and flourished, partly due to the humid environment and partly due to specific management practices. Some other authors [57] found that vegetation succession is controlled by water table configuration. The proper management of flood meadows therefore allows for more sustainable hay yields [58]. According to the report [59], an important task is to increase the availability of water in small river valleys through traditional irrigation. This type of treatment should also be treated as a proecological factor.

Most studies also indicate a positive relationship between species diversity and biomass production in flood meadows [60–62]. However, some studies have shown that managing grasslands to maintain high biodiversity is often incompatible with managing them to obtain maximum economic profit [63]. Therefore, even if the production conditions and quality of biomass are limited, the benefits for biodiversity and potentially for other ecosystem services fully justify the use and appropriate management of grasslands. It is also important that, in these areas, there are diversified subsidy systems, developed in accordance with European programs and subsidies to maintain the high value of natural grasslands [64]. Moreover, economic aspects are always important when investing in new irrigation networks or the modernization of existing irrigation systems [65]. On the one hand, the costs of investment, maintenance of the irrigation system, management expenses, and water prices should be taken into account, and on the other hand, the benefits resulting from increasing or stabilizing biomass yields [66].

1.2. Management in River Valleys to Promote Water Retention

Human settlements and the development of a country's economy are closely dependent on rivers. An example of such a relationship is ancient Egypt, or the cultures of Mesopotamia. Nowadays, especially in the context of climate change, the proper management of river valleys is becoming more and more important. Water retention solutions concern water supply for residents, industry, flood safety, and limiting the effects of drought. The use of various forms of retention, including natural (protection of water resources and the restoration or maintenance of natural ecosystems), significantly contribute to reducing the sensitivity of society, the environment, and the country's economy to the effects of climate change. Providing an appropriate amount of water in conditions of high climatic uncertainty, through its rational use, will allow the water needs of all users to be met. Water retention activities are aimed at limiting and slowing down the outflow of water from the catchment area [67]. Water retention solutions existing in Poland, but also in other European Union countries, require a transformation and adaptation to new challenges [68].

Poland's water resources are much smaller, compared to other European countries. The average amount of rainfall in our country is approximately 630 mm [44]; therefore, among other things, the country's spatial development should take into account increased water retention. The most well-known division of retention includes the distinction of whether water is stored in natural or manmade forms. This is how a distinction is made between natural and artificial retention [63]. Water retention capacity is an important element of the landscape in river valleys. In turn, the thickness of the humus layer has a significant impact on the soil's retention capacity [69]. Therefore, the proper development of agriculture is an element of increasing the retention capacity of the area.

The development of urbanization and technical transformation of river valleys contributed to the reduction in the water retention capacity [70]. The unfavorable environmental effects of river transformations have become an impulse to modify river management methods and search for more effective solutions. Among these activities, the restoration of rivers deserves attention [71] and, where possible, preserving their natural character. Restoring rivers to their natural state helps reduce the speed of water flow, which is slowed down by aquatic vegetation as well, as the diversified course of the riverbed.

However, technical flood protection methods do not provide the expected safety and are very expensive. Additionally, they often accelerate the outflow of water from the catchment area. High flood embankments cause water to accumulate, and the narrow area between the embankments increases the risk of catastrophic floods because there is no room to store a large mass of water in a small volume. The embankments limit the alluvial process, which reduces the fertility of alluvial soils in the river valley. The consequences are the accumulation of sediments in the embankment area and the aggradation of the bed. Additionally, it increases the risk of flooding because, sometimes, the river flows higher than the bottom of its valley [72].

In order to increase water retention, flood areas are to be excluded from intensive agricultural production and are to be allocated to extensive meadows or areas excluded from use, left to recreate the natural plant community's characteristic of a given area [73]. Technical flood management strategies that produce unsatisfactory results find an alternative in natural flood management. Strategies of this type are implemented, by leaving space for rivers and increasing the retention capacity of the river valley [32].

Therefore, the development of valleys should be adapted to current environmental conditions [72], for example, giving up the construction of groans and embankments that limit the free shaping of the riverbed, then natural riverbed systems will be reconstructed. Moreover, the area between the embankments can be significantly expanded by moving flood embankments or eliminating them altogether in areas that may experience local flooding. This will allow the river to freely shape its bed (returning to the meandering, braided, or ridged nature of the river), and will slow down the water outflow [71]. It is also possible to expand the area between embankments in the mouth sections of tributaries to enable the deposition of carried material in their valleys. A good way is to create polders for the periodic retention of flood waters. The removal of trees and shrubs from the area between the embankments should also be abandoned to enable the regeneration of natural riverside ecosystems. In addition, drainage should be improved so that fields and meadows can be irrigated when there is a lack of moisture in the soil. It is also necessary to withdraw settlements and infrastructure from the flood terrace [59]. Revitalization and restoration make it possible to manage flood risk and reduce the risk of flooding caused by too deeply incised riverbeds and the inability to dissipate the energy of flood waters, and reduce flood loss caused by accelerated water runoff, due to a lack of retention in flood areas. Restoration reduces the threat of drought, resulting from accelerated runoff, and the lack of resistance of regulated rivers to low flows resulting from the lack of differentiation in hydromorphological conditions. As a result, restored rivers do not require maintenance activities and their valleys constitute an important element of water retention [74].

It should be emphasized that restoration activities are expensive, so wherever the river has a nature close to natural, it is necessary to preserve this character. Local communities should be made aware of this because they decide what local space development looks like. Spatial management is shaped according to the principles established at the national level, but is implemented at the lowest level of administration, i.e., in municipalities. Moreover, spatial development plans are subject to public consultations, so the way the space is shaped largely depends on society's expectations. However, social expectations depend on the level of public awareness; therefore, the research problem presented in this scientific article can be formulated as a general question: "what is society's awareness of water management in the situation of climate change, and what solutions are socially accepted?".

2. Materials and Methods

Based on the main question, presented at the end of the previous chapter, detailed research questions were asked:

- How do respondents perceive water deficit amid negative megatrends?
- Do respondents understand the need to increase water retention?
- How do respondents imagine the proper management of river valleys to ensure water security?

- Is the free flow of flood waters perceived by respondents as an element of proper water management?
- Do the respondents' sex and place of residence influence the perception of water resources management?

Table 1 presents the research items that were posed to respondents in the survey questionnaire. These items were divided into three groups: (i) regarding megatrends; (ii) relating to water management; and (iii) regarding climate change. In the respondents' answers, attempts were made to find correlations within each group and between the mentioned groups of items.

Table 1. List of studied items.

Items Related to Megatrends
1. The most important global problem is environmental pollution;
2. The most important global problem is poverty and misery;
3. The most important global problem is hunger;
4. The most important global problem is water deficit;
5. The most important global problem is lifestyle diseases;
6. The most important global problem is climate change;
7. The most important global problem is the depletion of non-renewable energy sources;
8. The most important global problem is the growing world population;
Items Related to Water Management
9. Poland is facing a deep water deficit;
10. here is a need to increase small water retention;
11. Several large dams need to be built on major rivers;
12. Cities lack water retention infrastructure;
13. Developed riverside areas should be embanked;
14. Riverside areas used for agriculture should be embanked;
15. Undeveloped riverside areas should allow flood waters to flow freely;
16. Rivers need regulation;
17. Agricultural development of flood areas favoring water retention should be co-financed from the state budget;
18. Flood embankments in agricultural areas should be limited;
19. Development of flood plains should be prohibited;
Items Related to Climate Change
20. Climate change is currently one of the greatest threats to modern civilization;
21. Climate change has a direct impact on people's lives;
22. There are many issues more important than climate change and they require action first;
23. Climate change is a natural phenomenon, therefore it does not require our intervention;
24. Climate change is now virtually unstoppable;
25. Climate change causes fear and anxiety;
26. Humanity is transforming the landscape and consuming natural resources at a rate that makes their natural reproduction impossible;
27. The average temperature on our planet depends on the amount of solar radiation, absorbed by the Earth's surface and atmosphere, and on the amount and type of greenhouse gases in the atmosphere;
28. Current human activity significantly changes the state of the climate system, and the functioning of natural processes;
29. The increase in greenhouse gas emissions is closely related to the development of human civilization

The CAWI (Computer-Assisted Web Interview) technique was used in the diagnostic examination. Respondents were invited by sending them a link to the survey form. There were several dozen people in both voivodeships (Lubelskie and Podkarpackie). At the same time, an invitation to participate in the study was posted on social media, and a survey was sent to enterprises and institutions cooperating with the authors of this publication. Then, the respondents also invited their friends who met the conditions regarding place of residence in one, or another voivodeship, to participate in the study. The survey was partial, nonprobabilistic, each participation was voluntary, and anonymous, and each respondent could stop filling out the form at any time. Therefore, it is not possible, to locate each respondent in a specific place on the map of each voivodeship (Scheme 1). Of the 825 collected questionnaires, 732 were accepted by the authors, because they were completely reliably and met the requirements of the respondent's place of residence in the surveyed voivodeships.

Scheme 1. Research area—marking the number of respondents in voivodeships [75].

The target group was adults aged ≥18 years old. They were residents of south-eastern Poland, from the voivodeships mentioned in the previous paragraph of the description. The study area was selected due to the agricultural and natural environmental values in both regions [76]. Moreover, both voivodeships are located in the temperate climate zone, with elements of maritime and continental climates [77,78]. However, according to the Köppen–Geiger classification [79,80], some regions in eastern Poland were classified as Dfb (snow climate). In both studied voivodeships, average winter temperatures range from −2 to −3 °C, and in summer the average temperature is about 18 °C, while average annual rainfall is 500–650 mm in the Lublin region, and 750–800 mm in Podkarpacie [81]. When characterizing the research regions, it should be emphasized that, despite many environmental similarities, we observed some differences. In the context of this research, the fact that there is a greater number and frequency of floods and flooding in the Podkarpackie voivodeship, compared to the Lublin voivodeship, may be significant. However, in the Lublin voivodeship, we experience droughts more often [82,83]. This assumption was taken into account by the authors of this publication, which is why a different number of surveys was deliberately collected in individual regions (Scheme 1). Therefore, the last detailed research question, included at the beginning of this chapter, concerns the place of residence, not only in the urban–rural context, but also in the context of the region from which the respondent came. The authors of this publication also assumed that respondents from rural areas, regardless of the voivodeship, have a slightly different view of the existence of floods and flooding in agricultural areas than respondents from cities. Farmers, from both voivodeships, have closer contact with nature and can be included in programs regarding subsidies for retention systems in flood areas, which in turn may be important in the perception of water management issues [84]. Moreover, the studied area of Poland is a microscale, referring to a broader, nationwide problem, because it is known that water in agriculture is crucial in every region.

The survey questionnaire was subjected to reliability analysis using the Cronbach's alpha test. The test result was 0.709491, which is a satisfactory level [85,86]. The study was correlational in nature as it looked for relationships between individual groups of items, as well as between items in each group, without the possibility of influencing the level of individual variables. Since the study was not probabilistic in nature, the conclusions apply only to the surveyed group of respondents. To evaluate individual items, a five-point Likert scale, with a neutral value, was used [87]. The values on the scale are marked as follows: 1—definitely not; 2—probably not; 3—neither yes nor no; 4—probably yes; and 5—definitely yes. The structure of the response scores was calculated and analyzed. A simple Pearson correlation (r) between the examined items was also calculated, with a significance level of 0.05. In order to verify the answers to the research questions regarding the differences between qualitative variables, such as sex and place of residence (urban–rural), regardless of the voivodeship, and in the context of residence in a given voivodeship (Lubelskie–Podkarpackie), regardless of origin from an urban or rural area, a chi-squared test of independence was performed [88,89]. Categorized charts of the average scores of the tested items were also prepared. The results are presented in the tables and figures in the next section.

3. Results

The research group consisted of 732 people. Women constituted 67% of the respondents and men 33%. A total of 48% of all respondents lived in cities and 52% in rural areas; these percentages were the same by sex. Figures 1–3 present the structure of item ratings and the cumulative percentage of positive and negative ratings.

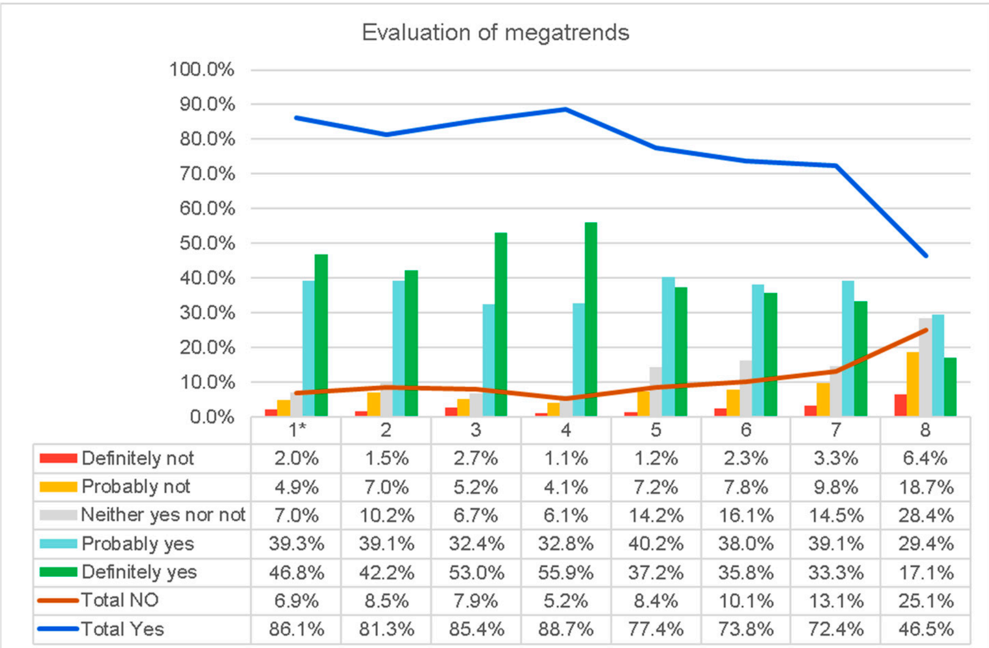


Figure 1. Structure of assessments of diagnostic items regarding megatrends. *—The names of the items are included in Table 1.

All, of the abovementioned negative megatrends were appreciated by the respondents (Figure 1). Water deficit (item 4; 88.7% of responses), hunger (item 3; 85.4%), and environmental pollution (item 1; 86.1%) were considered the most important on a global scale. It is worth emphasizing that all global problems were clearly noticed by the respondents, except for the issue of the overpopulation of the planet (item 8). In this case, the answers were more diverse than in the case of the other megatrends. These results indicate that the study group was highly aware of water shortages on a global scale. However, we assessed the same phenomenon differently on a national scale. The problem of water deficit in Poland (item 9) was noticed by 47.7% of the respondents, most of whom assessed this fact with some uncertainty, while 29.8% of people adopted a neutral, undecided attitude.

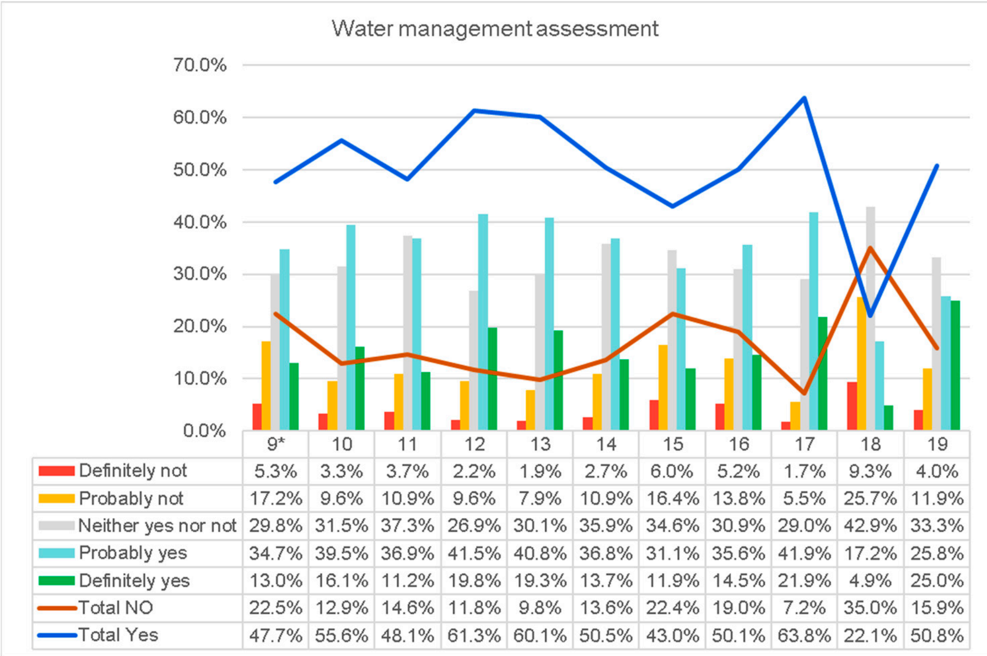


Figure 2. Structure of ratings for items relating to water management in Poland. *—The names of the items are included in Table 1.

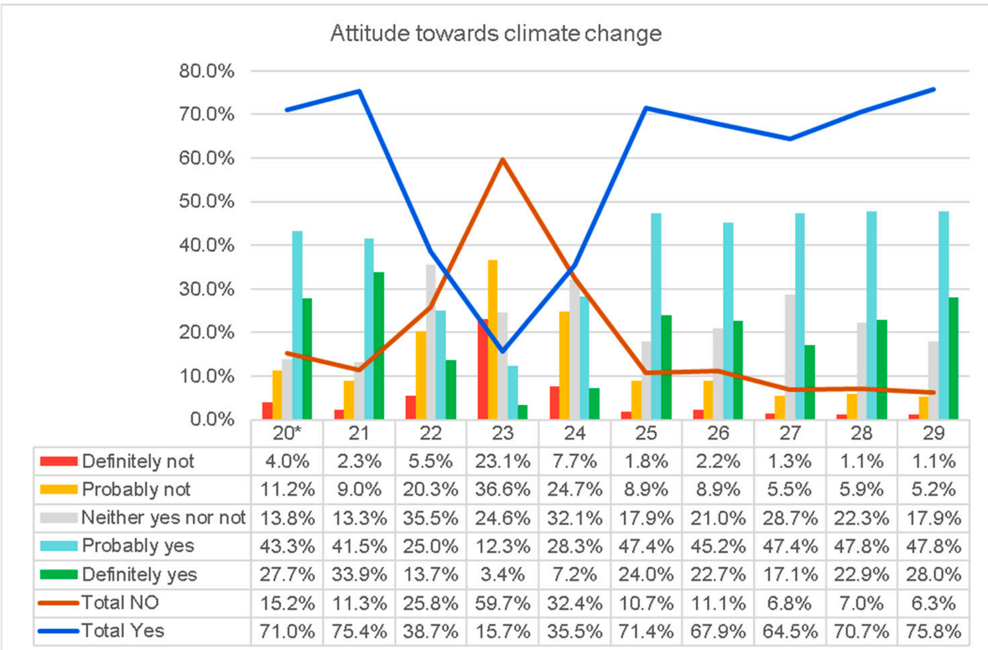


Figure 3. Structure of ratings for items relating to climate change. *—The names of the items are included in Table 1.

In the assessment of water management (Figure 2), the highest support was received for agricultural co-financing for the development of flood areas that favors retention (63.8% of support, item 17). This means that respondents expect state intervention in activities that increase water retention. However, 35% of the respondents are against the liquidation of flood embankments in agricultural areas (item 18), which contradicts the implementation of the decision of including riverside areas used for agriculture into the organized small retention system. It is worth emphasizing that the respondents expect the construction of flood embankments to protect built up areas (60.1% of responses; item 15), which could indicate a lack of the respondents' sense of security. It should be emphasized that the respondents' belief in the effectiveness of flood embankments in ensuring safety contradicts the actions that increase water retention and slow down its outflow. On this basis, it can be concluded that the studied community still expects the implementation of a negatively verified strategy to withdraw people's access to water.

It is worth emphasizing that, in the assessment of item 15, relating to the free flow of flood waters in undeveloped riparian areas, 43% of respondents assessed such solutions positively, however over 1/3 of the respondents (34.6%) showed a neutral attitude. "Neither yes nor not". Such results indicate the need to conduct educational activities that increase the level of knowledge about the benefits resulting from the alluvial process in meadows and pastures, and from slowing down the outflow of water from river catchments. At the same time, an important aspect of shaping the development of river valleys, favoring water retention, are economic incentives encouraging farmers to change the form of land use.

More than half of the respondents (61.3%) also noted the lack of retention infrastructure in cities (item 12). This opens up another area of research related to green–blue urban infrastructure, which is important, not only for aesthetic reasons, but, above all, for limiting the formation of heat islands in cities.

In the part of the study regarding the perception of climate change, the vast majority of respondents (75.8%; item 29) expressed a belief in the anthropogenic causes of this phenomenon. At the same time, opinions were expressed about the direct impact of climate change on people's lives (75.4%; item 21), and it was indicated that climate change causes fear and anxiety (71.4% of affirmative answers; item 25).

Item 23, relating to the natural causes of climate change, was opposed by the respondents (59.7% of respondents). However, the vast majority of respondents were convinced that human activity changes the state of the climate system (70.7%; item 28), and that the increase in greenhouse gas emissions is closely related to the development of human civilization (75.8%; item 29). These data indicate the respondents' strong belief in the anthropogenic causes of climate change (Figure 3).

The respondents' belief regarding the causative role of humans in shaping natural phenomena may also concern flood safety. The trust of respondents in the technical flood protection measures discussed above makes it difficult to implement the strategy of leaving space for rivers. This is related to the development of the technical expansion of rivers, maintaining a false sense of security, and maintaining a vicious circle of flood protection.

A simple Pearson correlation analysis was performed in the collected research material. Its aim was to identify the relationships between the ratings of individual items. Tables 2–5 use a color scale to indicate the strength of correlation, according to the scale, presented by some authors [89]. Table 2 shows the correlation coefficients between item ratings regarding negative megatrends. A strong, positive correlation was found between respondents' perception of water deficit (item 4) and the perceptions of environmental pollution problems (item 1), poverty (item 2), hunger (item 3), and lifestyle diseases (item 5). A strong correlation was also found between the perception of climate change (item 12) and the depletion of non-renewable energy sources (item 13). The above correlation coefficients were positive, which proves the high level of ecological sensitivity of the respondents. This is also confirmed by the results presented in Figure 1.

Table 2. Correlation coefficients (r) between items, regarding threats resulting from civilization development *.

Rated Items	1 *	2	3	4	5	6	7
2	0.318 $p = 0.000$						
3	0.311 $p = 0.000$	0.731 $p = 0.000$					
4	0.461 $p = 0.000$	0.465 $p = 0.000$	0.559 $p = 0.000$				
5	0.306 $p = 0.000$	0.326 $p = 0.000$	0.312 $p = 0.000$	0.408 $p = 0.000$			
6	0.534 $p = 0.000$	0.148 $p = 0.000$	0.170 $p = 0.000$	0.358 $p = 0.000$	0.348 $p = 0.000$		
7	0.340 $p = 0.000$	0.249 $p = 0.000$	0.182 $p = 0.000$	0.348 $p = 0.000$	0.356 $p = 0.000$	0.504 $p = 0.000$	
8	0.211 $p = 0.000$	0.065 $p = 0.079$	0.074 $p = 0.046$	0.193 $p = 0.000$	0.132 $p = 0.000$	0.282 $p = 0.000$	0.335 $p = 0.000$

Explanation of the color scale

None	Negligible	Weak	Moderate	Strong	Very Strong	Perfect	Statistically significant coefficient
<0.1	0.1–0.2	0.2–0.3	0.3–0.4	0.4–0.7	0.7–0.9	0.9–1	$p \leq 0.05$

*—The names of the items are included in Table 1.

Table 3. Correlation coefficients (r) between issues related to the assessment of Poland's water management.

Rated Items	9	10	11	12	13	14	15	16	17	18
10	0.515 $p = 0.000$									
11	0.371 $p = 0.000$	0.443 $p = 0.000$								
12	0.357 $p = 0.000$	0.462 $p = 0.000$	0.361 $p = 0.000$							
13	0.189 $p = 0.000$	0.216 $p = 0.000$	0.317 $p = 0.000$	0.407 $p = 0.000$						
14	0.091 $p = 0.014$	0.201 $p = 0.000$	0.267 $p = 0.000$	0.261 $p = 0.000$	0.550 $p = 0.000$					
15	0.119 $p = 0.001$	0.128 $p = 0.001$	0.069 $p = 0.064$	0.154 $p = 0.000$	0.182 $p = 0.000$	0.073 $p = 0.050$				
16	0.064 $p = 0.084$	0.114 $p = 0.002$	0.328 $p = 0.000$	0.159 $p = 0.000$	0.258 $p = 0.000$	0.280 $p = 0.000$	−0.010 $p = 0.781$			
17	0.179 $p = 0.000$	0.267 $p = 0.000$	0.181 $p = 0.000$	0.258 $p = 0.000$	0.286 $p = 0.000$	0.305 $p = 0.000$	0.163 $p = 0.000$	0.269 $p = 0.000$		
18	0.084 $p = 0.024$	0.082 $p = 0.026$	0.046 $p = 0.212$	0.111 $p = 0.003$	−0.046 $p = 0.217$	−0.112 $p = 0.002$	0.183 $p = 0.000$	0.014 $p = 0.698$	0.015 $p = 0.694$	
19	0.164 $p = 0.000$	0.224 $p = 0.000$	0.122 $p = 0.001$	0.214 $p = 0.000$	0.210 $p = 0.000$	0.094 $p = 0.011$	0.138 $p = 0.000$	0.032 $p = 0.390$	0.194 $p = 0.000$	0.160 $p = 0.000$

Explanation of the color scale

None	Negligible	Weak	Moderate	Strong	Very Strong	Perfect	Statistically significant coefficient
<0.1	0.1–0.2	0.2–0.3	0.3–0.4	0.4–0.7	0.7–0.9	0.9–1	$p \leq 0.05$

*—The names of the items are included in Table 1.

Table 4. Correlation coefficients (r) between issues related to climate change.

Rated Items	20	21	22	23	24	25	26	27	28
21	0.6203								
	$p = 0.000$								
22	−0.2853	−0.1945							
	$p = 0.000$	$p = 0.000$							
23	−0.3693	−0.3300	0.3454						
	$p = 0.000$	$p = 0.000$	$p = 0.000$						
24	−0.0664	−0.0836	0.1697	0.3754					
	$p = 0.073$	$p = 0.024$	$p = 0.000$	$p = 0.000$					
25	0.4559	0.4543	−0.1800	−0.2442	0.0073				
	$p = 0.000$	$p = 0.000$	$p = 0.000$	$p = 0.000$	$p = 0.844$				
26	0.3291	0.2848	−0.0808	−0.0998	0.0952	0.3956			
	$p = 0.000$	$p = 0.000$	$p = 0.029$	$p = 0.007$	$p = 0.010$	$p = 0.000$			
27	0.1951	0.2709	0.0577	−0.0137	0.0594	0.2455	0.3468		
	$p = 0.000$	$p = 0.000$	$p = 0.119$	$p = 0.712$	$p = 0.109$	$p = 0.000$	$p = 0.000$		
28	0.3750	0.3577	−0.1296	−0.2407	−0.0532	0.3286	0.3423	0.3094	
	$p = 0.000$	$p = 0.000$	$p = 0.000$	$p = 0.000$	$p = 0.150$	$p = 0.000$	$p = 0.000$	$p = 0.000$	
29	0.2904	0.2804	−0.0036	−0.1820	0.0202	0.2441	0.3392	0.3628	0.5116
	$p = 0.000$	$p = 0.000$	$p = 0.921$	$p = 0.000$	$p = 0.585$	$p = 0.000$	$p = 0.000$	$p = 0.000$	$p = 0.000$

Explanation of the color scale

None	Negligible	Weak	Moderate	Strong	Very Strong	Perfect	Statistically significant coefficient
<0.1	0.1–0.2	0.2–0.3	0.3–0.4	0.4–0.7	0.7–0.9	0.9–1	$p \leq 0.05$

*—The names of the items are included in Table 1.

Table 5. Correlation coefficients (r) between the assessment of water management and the perception of the problem of climate change.

Rated Items	20	21	22	23	24	25	26	27	28	29
9	0.320	0.240	−0.104	−0.164	−0.067	0.185	0.151	0.120	0.183	0.157
	$p = 0.000$	$p = 0.000$	$p = 0.005$	$p = 0.000$	$p = 0.070$	$p = 0.000$	$p = 0.000$	$p = 0.001$	$p = 0.000$	$p = 0.000$
10	0.292	0.307	−0.077	−0.189	−0.059	0.200	0.132	0.115	0.243	0.178
	$p = 0.000$	$p = 0.000$	$p = 0.038$	$p = 0.000$	$p = 0.108$	$p = 0.000$	$p = 0.000$	$p = 0.002$	$p = 0.000$	$p = 0.000$
11	0.230	0.213	−0.074	−0.118	0.011	0.197	0.114	0.050	0.187	0.137
	$p = 0.000$	$p = 0.000$	$p = 0.044$	$p = 0.001$	$p = 0.775$	$p = 0.000$	$p = 0.002$	$p = 0.174$	$p = 0.000$	$p = 0.000$
12	0.255	0.269	−0.074	−0.124	−0.011	0.233	0.145	0.048	0.199	0.161
	$p = 0.000$	$p = 0.000$	$p = 0.047$	$p = 0.001$	$p = 0.762$	$p = 0.000$	$p = 0.000$	$p = 0.194$	$p = 0.000$	$p = 0.000$
13	0.200	0.236	0.052	−0.057	−0.013	0.190	0.163	0.143	0.172	0.128
	$p = 0.000$	$p = 0.000$	$p = 0.157$	$p = 0.123$	$p = 0.724$	$p = 0.000$	$p = 0.000$	$p = 0.000$	$p = 0.000$	$p = 0.001$
14	0.183	0.185	−0.022	−0.114	−0.040	0.230	0.131	0.086	0.191	0.117
	$p = 0.000$	$p = 0.000$	$p = 0.557$	$p = 0.002$	$p = 0.280$	$p = 0.000$	$p = 0.000$	$p = 0.020$	$p = 0.000$	$p = 0.001$
15	0.058	0.104	0.086	0.056	0.024	0.055	0.097	0.131	0.026	−0.005
	$p = 0.119$	$p = 0.005$	$p = 0.020$	$p = 0.129$	$p = 0.517$	$p = 0.134$	$p = 0.008$	$p = 0.000$	$p = 0.477$	$p = 0.901$
16	0.180	0.148	0.028	−0.085	−0.038	0.148	0.098	0.023	0.100	0.054
	$p = 0.000$	$p = 0.000$	$p = 0.445$	$p = 0.021$	$p = 0.306$	$p = 0.000$	$p = 0.008$	$p = 0.544$	$p = 0.007$	$p = 0.145$
17	0.170	0.226	−0.021	−0.075	0.017	0.206	0.149	0.183	0.165	0.228
	$p = 0.000$	$p = 0.000$	$p = 0.575$	$p = 0.041$	$p = 0.656$	$p = 0.000$	$p = 0.000$	$p = 0.000$	$p = 0.000$	$p = 0.000$
18	−0.002	0.012	0.069	0.097	0.133	−0.031	−0.047	−0.019	−0.073	0.010
	$p = 0.955$	$p = 0.755$	$p = 0.064$	$p = 0.009$	$p = 0.000$	$p = 0.400$	$p = 0.207$	$p = 0.611$	$p = 0.048$	$p = 0.779$
19	0.096	0.103	0.034	−0.082	−0.027	0.084	0.107	0.093	0.079	0.104
	$p = 0.009$	$p = 0.005$	$p = 0.359$	$p = 0.026$	$p = 0.465$	$p = 0.024$	$p = 0.004$	$p = 0.012$	$p = 0.033$	$p = 0.005$

Explanation of the color scale

None	Negligible	Weak	Moderate	Strong	Very Strong	Perfect	Statistically significant coefficient
<0.1	0.1–0.2	0.2–0.3	0.3–0.4	0.4–0.7	0.7–0.9	0.9–1	$p \leq 0.05$

*—The names of the items are included in Table 1.

Table 3 presents the results of a simple correlation, calculated between items, regarding water management in Poland. A strong positive correlation was found between the respondents' perception of the need to increase low retention (item 10), the awareness of water deficit (item 9), and the belief in the lack of reference infrastructure in cities (item 12). It is worth emphasizing that there was a strong correlation between the belief in the need to increase small retention (item 10) and the belief in the need to build large dam reservoirs (item 11). These results indicate a certain dissonance, because modern space development, which favors water retention, is moving away from the construction of large dam reservoirs to the development of all forms of small retention. The obtained results may indicate that the level of awareness of the surveyed society is too low. This observation is also confirmed by the results of a strong correlation between expectations regarding the construction of flood embankments to protect built up areas (item 13) and agricultural areas (item 14). This proves that respondents believe that flood embankments provide effective protection. In this context, however, it is worth emphasizing the existence of a medium-degree correlation between respondents' expectations regarding river regulation (item 16) and the belief in the need to build large dams (item 11).

It is worth emphasizing that no significant correlations were found between the assessment of the possibility of flood waters spreading freely in coastal areas (item 15) and other elements of the water management assessment. In the light of the results presented in Table 3 and Figure 2, it can be concluded that respondents expect the introduction of rational management in river valleys, but based on river regulation, the construction of flood embankments and large retention reservoirs.

Table 4 contains the results of a simple correlation analysis between the ratings of items regarding the issue of climate change. The data in the Table 4 show that respondents who considered climate change to be one of the most important threats to modern civilization (item 20) also admitted that these changes have a direct impact on people's lives (item 21) and are the reasons for anxiety and even fear (item 25). These people also believe that we are currently dealing with excessive consumption (item 26), and they see human activity as the cause of changes in the climate system (item 28). A significant number of respondents (see Chart 3) were convinced that human activities are causing climate change and that it is possible to stop this change. Some respondents (less than 16%; Figure 3), however, believe that climate change is a natural phenomenon and does not require human intervention.

It is worth emphasizing that there was a correlation between the assessments of the anthropogenic impact on climate change (item 28) and the recognition of these changes as the main problem concerning civilization (item 20). This was confirmed by the respondents' recognition of the direct impact of climate change on humans (item 21) and other items (25, 26, 27, and 29) regarding the threats resulting from these changes.

The analysis of correlations between items relating to the assessment of water management and the assessment of negative megatrends did not indicate any strong dependencies. A weak correlation was found between the assessment of water deficit on a global scale (item 4) and water deficit in Poland (item 9), $r = 0.2042$. A similar relationship was determined in relation to the perception of climate change (item 6) and the need to increase low retention (item 10), $r = 0.2297$. There was also a weak correlation between the items regarding the lack of infrastructure to retain water in the city (item 12) and environmental pollution (item 1), $r = 0.02158$, and the perception of climate change (item 6), $r = 0.2007$. All correlation coefficients listed here were statistically significant.

Table 5 shows the results of a simple correlation between the items on water management and the items on the perception of climate change. A weak and moderate correlation was found between the perception of climate change, as the main civilization problem (item 20) and the belief in the direct impact of climate change on people's lives (item 21), as well as between the awareness of water deficit (item 9), the need for development small retention (item 10), the belief in the need to build large dams (item 11), or awareness of the lack of water retention in cities (item 12).

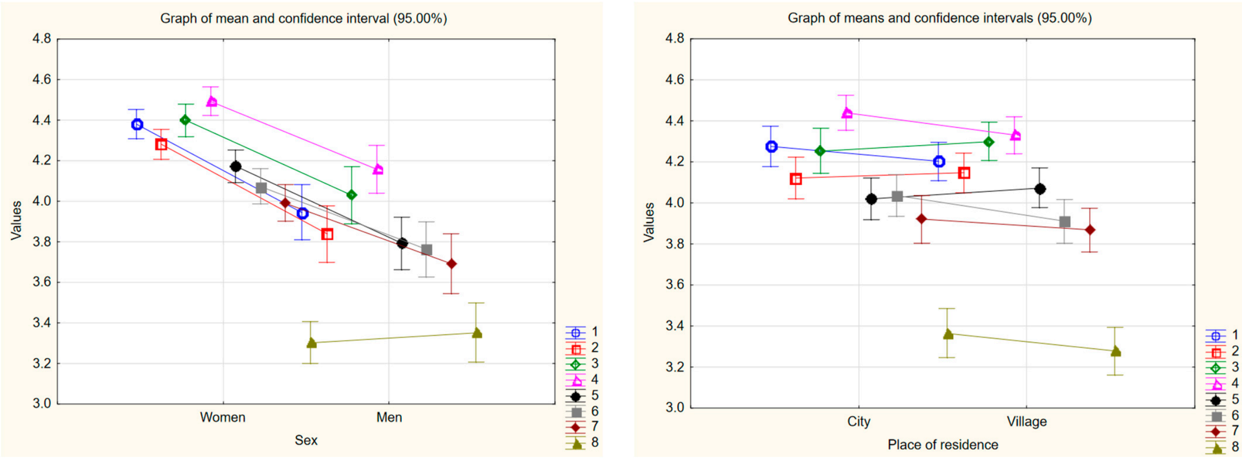
This research showed that the majority of respondents believed in the anthropogenic causes of climate change pointing to the negative effects of human activity. However, with regard to water management, there is no such reflection. Simple correlation coefficients calculated between the assessment of the need to limit flood embankments (item 18), the assessment of the need to exclude flood areas from development (item 19) and issues related to climate change (items 20 to 29) indicated no or insignificant correlations. Therefore, it can be assumed that the respondents are not aware of the negative effects of improper land use in flood areas. However, in relation to climate, there is an awareness of human errors. Therefore, the conclusion is that intensive educational work is needed in the field of proper management in river valleys.

At the conceptualization stage, it was assumed that the respondents' sex and place of residence were determinants of the perception of the surveyed items. Place of residence was defined in two ways. First of all, the calculations were carried out in relation to cities and villages, and secondly in relation to the region from which the respondents came. Therefore, the null hypothesis (H0) of no relationship and the alternative hypothesis (H1) were formulated, according to which the variables are explained under the influence of determinants. In order to verify the H0 hypothesis, the chi-squared test of independence was calculated, and categorized charts were prepared. The results are presented in Table 6 and Figures 4–7.

Table 6. Results of the chi-squared test regarding the independence of the influence of respondents' sex and place of residence on the obtained results (N = 732).

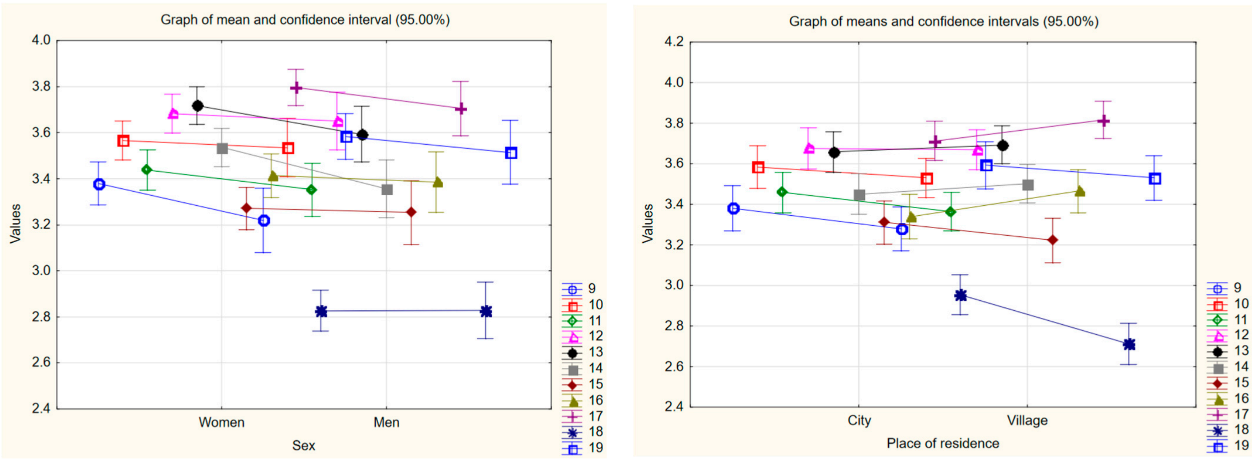
Item **	Sex			Place of Residence Town/Village			Region of Residence		
	χ^2	df	p	χ^2	df	p	χ^2	df	p
Items related to megatrends									
1	38.899	df = 4	p = 0.00000 *	4.980	df = 4	p = 0.28938	0.6210	df = 4	p = 0.96070
2	36.267	df = 4	p = 0.00000 *	0.334	df = 4	p = 0.98754	3.749	df = 4	p = 0.44110
3	24.249	df = 4	p = 0.00007 *	7.154	df = 4	p = 0.12799	1.405	df = 4	p = 0.84339
4	30.439	df = 4	p = 0.00000 *	8.393	df = 4	p = 0.07819	3.093	df = 4	p = 0.54242
5	26.367	df = 4	p = 0.00003 *	3.042	df = 4	p = 0.55082	2.269	df = 4	p = 0.68638
6	16.409	df = 4	p = 0.00252 *	6.821	df = 4	p = 0.14564	11.344	df = 4	p = 0.02295 *
7	20.426	df = 4	p = 0.00041 *	2.992	df = 4	p = 0.55924	2.997	df = 4	p = 0.55840
8	1.082	df = 4	p = 0.89709	1.670	df = 4	p = 0.79619	1.630	df = 4	p = 0.80339
Items related to water management									
9	4.274	df = 4	p = 0.37013	2.275	df = 4	p = 0.68533	8.693	df = 4	p = 0.06926
10	4.654	df = 4	p = 0.32471	4.852	df = 4	p = 0.30278	1.568	df = 4	p = 0.81450
11	5.688	df = 4	p = 0.22366	3.624	df = 4	p = 0.45926	10.273	df = 4	p = 0.03607 *
12	4.401	df = 4	p = 0.35442	3.355	df = 4	p = 0.50032	4.507	df = 4	p = 0.34167
13	3.194	df = 4	p = 0.52593	0.399	df = 4	p = 0.98258	3.659	df = 4	p = 0.45414
14	13.642	df = 4	p = 0.00853 *	0.921	df = 4	p = 0.92159	12.876	df = 4	p = 0.01190 *
15	1.656	df = 4	p = 0.79863	4.846	df = 4	p = 0.30348	1.759	df = 4	p = 0.77990
16	1.577	df = 4	p = 0.81291	6.831	df = 4	p = 0.14511	10.387	df = 4	p = 0.03438 *
17	3.295	df = 4	p = 0.50977	4.289	df = 4	p = 0.36828	5.3485	df = 4	p = 0.25337
18	2.000	df = 4	p = 0.73567	18.304	df = 4	p = 0.00108 *	7.612	df = 4	p = 0.10686
19	4.157	df = 4	p = 0.38521	2.486	df = 4	p = 0.64710	0.7387	df = 4	p = 0.94647
Items related to climate change									
20	27.478	df = 4	p = 0.00002 *	2.147	df = 4	p = 0.70867	1.963	df = 4	p = 0.74261
21	18.000	df = 4	p = 0.00123 *	4.474	df = 4	p = 0.34562	8.654	df = 4	p = 0.07037
22	10.884	df = 4	p = 0.02790 *	2.511	df = 4	p = 0.64269	7.512	df = 4	p = 0.11118
23	24.071	df = 4	p = 0.00008 *	1.750	df = 4	p = 0.78170	0.934	df = 4	p = 0.91969
24	3.700	df = 4	p = 0.44808	0.598	df = 4	p = 0.96330	3.867	df = 4	p = 0.42425
25	22.517	df = 4	p = 0.00016 *	3.793	df = 4	p = 0.43479	1.976	df = 4	p = 0.74025
26	9.532	df = 4	p = 0.04909 *	3.438	df = 4	p = 0.48729	1.560	df = 4	p = 0.81606
27	3.852	df = 4	p = 0.42635	6.095	df = 4	p = 0.19218	8.336	df = 4	p = 0.08003
28	7.219	df = 4	p = 0.12478	6.056	df = 4	p = 0.19497	7.692	df = 4	p = 0.10354
29	13.480	df = 4	p = 0.00915 *	0.483	df = 4	p = 0.97511	3.727	df = 4	p = 0.44414

*—Statistically significant coefficient. **—The names of the items are included in Table 1.



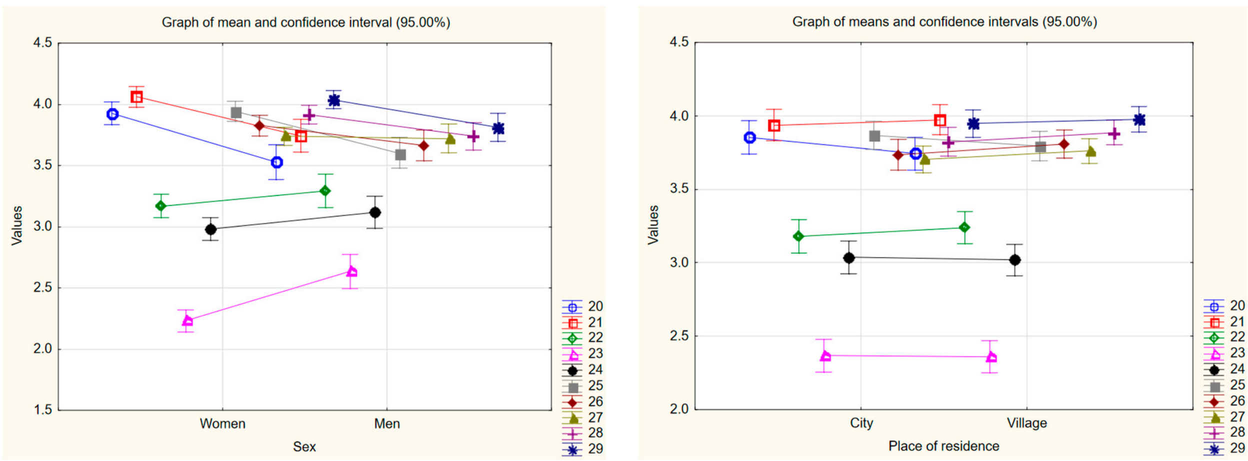
(**a**) (**b**)

Figure 4. Average ratings for megatrend items. Chart divided by (**a**) sex and (**b**) place of residence of respondents (urban–rural). The names of the items are listed in Table 1.



(**a**) (**b**)

Figure 5. Average ratings for water management items. Chart divided by (**a**) sex and (**b**) place of residence of respondents (urban–rural). The names of the items are listed in Table 1.



(**a**) (**b**)

Figure 6. Average ratings for climate change items. Chart divided by (**a**) sex and (**b**) place of residence of respondents (urban–rural). The names of the items are listed in Table 1.

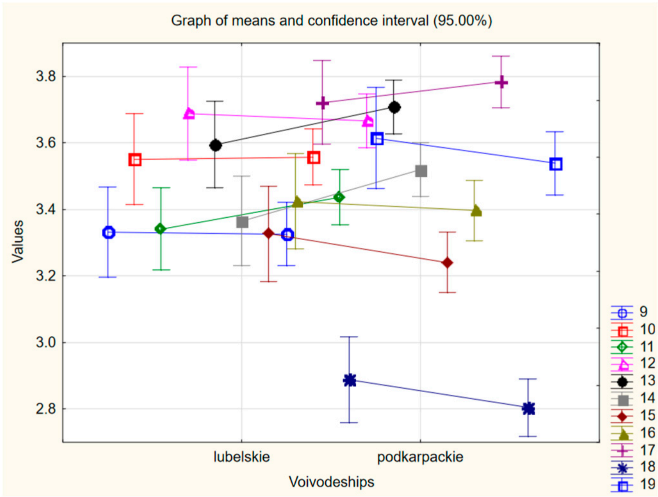


Figure 7. Average ratings for items regarding water management. Chart categorized by respondents' regions of residence (Lublin–Podkarpackie voivodeships). The names of the items are listed in Table 1.

The calculations show that the sex of the respondents differentiates the perception of negative megatrends (Table 6). Women had a higher level of sensitivity to negative phenomena on a global scale, which is confirmed by the data in Figure 4a. In the scale used, the value of 3.0 was a neutral position, so it is worth emphasizing that all average ratings indicate a confirmation of the existence of a given problem. The lowest averages related to the issue of planet overpopulation (item 8). In this case, no differences were found between the respondent's sex and opinions on this subject.

In the conducted research, the perception of negative megatrends was not determined by the respondents' place of residence. Although the average ratings differed slightly between rural and urban residents, these differences were not statistically significant (Table 6 and Figure 4b).

Among the items relating to water management, sex did not generally determine the perception of the examined issues. Only in relation to the construction of flood embankments to protect agricultural land (item 14) was there a difference between the assessments of women and men. In this case, women showed greater acceptance of such investments (Figure 5a). Therefore, when planning educational campaigns aimed at promoting a security strategy that involves leaving space for rivers, it should be considered that it should be addressed primarily to women.

The respondents' place of residence was not a factor differentiating the perception of water management in Poland (Table 6 and Figure 5b). Only in relation to the limitation of flood embankments in agricultural areas, statistically significant differences were found between urban and rural inhabitants. It should be emphasized that the average ratings for this item were lower than 3.0, which means that such activities are not accepted. In this case, rural residents expressed a more determined opposition to the liquidation of flood embankments in agricultural areas.

When looking for differences in the assessment of water management, depending on the region where the respondents lived, the chi-squared test in most cases confirmed the null hypothesis (H0) of no differences (Table 6). This means that the perception of most of the studied water management items was similar in both regions. Statistically significant differences were noted only for three items (Figure 7). The data presented in Figure 7 show that respondents living in the Podkarpackie voivodeship assessed the need to build large dam reservoirs on main rivers (item 11) and the need to embank the riverside areas used for agriculture more highly than respondents from the Lublin region. However, respondents living in the Lublin voivodeship assessed the need to regulate rivers more highly (item 16). It is worth emphasizing that the cases discussed concerned the implementation of an outdated strategy for ensuring water security. The differences indicated here concern average ratings that were above the neutral value and, therefore, were positive assessments of ineffective actions.

In the group of items regarding climate change, most of the ratings varied, depending on the sex of the respondents (Table 6 and Figure 6a). Comparing the average ratings of the examined items categorized by sex, it can be concluded that women expressed greater concerns about climate change (items 20 and 21) and a greater belief that human actions will influence the observed changes (item 23). However, the respondents' place of residence did not determine their perception of the issue of climate change (Table 6 and Figure 6b). This may mean that the perception of global phenomena, such as climate change, was shaped by more than local factors. This can be treated as a guideline for creating educational campaigns regarding strategies to increase water retention. Popularization of this issue, and reliable and easily accessible knowledge on this subject, would create a positive social climate, conducive to activities that increase low water retention.

4. Discussion

4.1. Perception of Sustainable Management in River Valleys

The third decade of the 21st century is characterized by tensions and difficulties of a social, military, and natural nature. The observed climate changes are characterized by an increasingly frequent occurrence of extreme phenomena, such as floods, droughts, hurricane winds, and long periods of high temperatures [28,63,78,81]. Per capita water availability is decreasing around the world. This decline varies across regions of the world, with Europe having the lowest one [90]. Since this is a relative measure for demographic reasons in European countries, this coefficient is decreasing more slowly than, for example, in Africa. Therefore, an important issue is to determine social perceptions of issues related to water management.

Nearly a quarter of a century ago, in 2000, the World Commission on Dams Report was published, in which the authors point out the need to change the strategy for ensuring water safety [27]. This report drew attention to the growing flood losses resulting from increased technical development in flood areas. The negatively verified strategy of moving water away from people, consisting of building large dams, regulating rivers, and building flood embankments, must gradually be replaced by a strategy of increasing water retention, by leaving space for rivers [64]. The research was intended to identify society's awareness of water management.

The area of research conducted is specific for two reasons. Firstly, in Poland, during the period of communism and a centrally controlled economy, spatial development was carried out, aimed at limiting wetlands. Flood prevention activities primarily focused on accelerating water outflow [37,40]. Secondly, the south-eastern part of Poland is agricultural in nature, with a fragmented spatial structure of arable fields [76,91], which can be used to increase soil and landscape retention. Knowledge of the social perceptions of negative megatrends, climate change, and water management is a cognitive gap that this study aims to fill, at least partially.

Water security covers not only the availability of water, but also situations of its excess, i.e., floods [92]. Research by other authors [27,93,94] indicates that dams create a false sense of security among the local community. Therefore, it is important not only to learn about the social perception of water safety, but also to provide education addressed to both residents and decision makers. At the same time, the hydrological effects of large dams vary. It sometimes happens that negative consequences occur in the part of the river located below the dam [95]. It should also be emphasized that large dams have a negative impact on fishing and agriculture, and often have negative social effects [96]. Our research identified respondents' attitudes regarding their trust in dams as a means of ensuring safety.

It is worth emphasizing that, in the study area, there is a complex of large dams in the towns of Solina and Myczkowce. Therefore, some respondents live in areas that are protected against flooding by infrastructure measures. Research conducted in Switzerland [94] shows that the best security effects are achieved by combining infrastructure measures with non-structural measures, such as spatial planning and river restoration, focused on natural security mechanisms. The authors of these studies emphasize the role of the social perception of flood risk in shaping an appropriate safety policy. The analysis of our research shows that respondents underestimate non-structural measures.

In the research conducted in neighboring countries (Germany, the Czech Republic, and Slovakia) [97], the authors pointed out the important role of natural landscapes in shaping water retention. Natural remedies have been shown to retain water in the soil, increasing crop productivity and helping to cool the landscape. However, in our research, landscape retention measures were not appreciated by the respondents. The research shows that the construction of large retention reservoirs was expected.

The perception of many phenomena, e.g., climate change, depends, on the place of residence and profession [98]. Farmers who, while performing their work, are in close contact with nature on a daily basis, have a good understanding of the human–environment relationship [99].

4.2. Factors Differentiating the Perception of Sustainable Management in River Valleys

Adaptation activities that improve water security, especially in the context of climate change, include traditional activities. They involve proper agricultural management and space management in a way that increases water retention. Even though these activities are traditional methods, they are treated as innovative [8].

The research area of south-eastern Poland included two voivodeships that share many similarities [76,81]. However, there are differences in terms of hydrology and flood risk. The Podkarpackie voivodeship is at greater risk of flooding than the Lublin voivodeship [82]. Therefore, one might expect differences in the approach to water management, depending on the region of residence of the respondents. A statistical confirmation of these differences was noted in this research, only in relation to methods of ensuring flood safety. The surveyed inhabitants of the Podkarpackie voivodeship expected the construction of large retention reservoirs and embankments of agricultural land in flood areas to a greater extent than the inhabitants of the Lublin voivodeship. The inhabitants of the Lublin voivodeship expected river regulation, to a greater extent.

Differences in the perception of water management, depending on the place of residence, have not been confirmed. Residents of both rural and urban areas perceived the studied items in a similar way. However, differences were found in the perceptions of negative megatrends and climate change, depending on the sex of the respondents. In this case, women showed a level of concern about global problems and the state of the Earth's climate. The obtained results confirm the research of other authors [100,101]. However, in relation to the perception of water management, the sex of the respondents did not play a significant role.

In the light of these results, it can be concluded that the message regarding climate change effectively shapes the public's perception of this phenomenon. However, with regard to effective methods of ensuring flood safety and mitigating the effects of drought, a gap in the public's awareness was identified. Therefore, knowledge should be disseminated regarding the possibility of increasing retention through the proper management of river valleys. This is a task for government and local government authorities, as well as scientific associations and communities of practice [42].

Economic mechanisms used by state authorities could contribute to increasing retention in rivers, thanks to permanent grasslands cultivated in riparian areas. Recognizing meadows and pastures in riparian areas, increasing water retention as public goods co-financed from the state budget, could encourage farmers to change the way, they use riverside areas [39]. For this to happen, first of all, it is necessary to change the perception of water management and popularize the strategy of ensuring flood safety, which involves leaving space for rivers.

5. Summary and Conclusions

In terms of the first two research questions regarding water deficit and the need to increase water retention based on the conducted research, it can be concluded that the respondents are well informed about global, negative megatrends. These phenomena also include water deficit. The people surveyed were aware of the growing water deficit, both on a global and national scale. Women have shown greater sensitivity to global issues. Similar conclusions can be drawn regarding the perception of climate change. The surveyed people were convinced that climate change is one of the most important problems of the modern world. At the same time, they had a strong belief in the anthropogenic causes of these changes and the possibility of limiting them. Items containing information about the natural causes of climate change, and the impossibility of stopping it, were met with fierce opposition. This means that activities shaping the perception of climate issues and social sensitivity to major, negative, global megatrends have effectively shaped the perception of these topics.

The respondents' perception of water management varied, but most of them were views and expectations that were part of the strategy of moving water away from people. The respondents noticed the water deficit in Poland and were aware of the lack of water retention infrastructure in cities. However, they associated the issue of water retention mainly with the construction of large retention reservoirs. The respondents widely expected the construction of flood embankments. Measures to slow down water runoff by allowing rivers to flow freely have met with a lack of acceptance. Yes, the respondents expected financial support from the state authorities, but the allocation of riparian areas to meadows and pastures was not understood by them. These type of meadows can constitute an element of water retention, only if they are not embanked and the river can flow freely. Meanwhile, the respondents proposed the construction of flood embankments along agricultural areas.

Based on the collected data, the following conclusions were formulated:

1. The surveyed community noticed the problem of growing water deficit.
2. The study group was aware of the need to increase water retention, but the knowledge regarding the methods of implementing this task was outdated and limited.
3. Respondents expected government support in activities increasing water retention, but they also expected activities to accelerate the rate of water outflow.
4. A cognitive gap was identified in the study group regarding the benefits of the free flow of flood waters in riparian areas.
5. An extensive information campaign is necessary, increasing the public's awareness of the need to develop small retention and eco-innovative developments of river valleys.
6. The research showed that the place of residence (urban–rural) and the regions (Podkarpackie–Lublin voivodeship) do not differentiate the perception of most of the examined items. However, sex primarily affected the perception of global megatrends and the perception of climate change.

6. Contributions and Limitations

The contribution of this study to the development of science is to fill the gap in identifying the perception of proper water management by the inhabitants of one of the poorest regions in Poland. The contribution of the research to the development of science is also the identification of the lack of awareness of respondents regarding new sustainable management methods in river valleys. The research results can be a source of information for decision makers, as they can be used to shape public perception of the challenges related to spatial management, which promotes increased water retention, and social education to reduce the negative effects of floods and droughts. Greater attention should also be paid to education related to the ecological and buffer roles of flood meadows.

The limitations of this study are that all the variables were measured simultaneously, so the study is cross-sectional, and greater attention may be needed concerning other causes of the phenomena under study. Further research in this direction would provide a clearer picture. Moreover, the exploratory nature of the study provides important insights, but these should be interpreted as general results.

We propose repeating this study several times in the future. This would provide an image of changes, over time, in the perception of sustainable management in river valleys. To continue this work, we suggest that future studies be carried out in a larger area covering the entire country and take into account the nature of river valleys. We also propose probabilistic sampling, which will better reflect the demographics of the study area.

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