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In harmony or against each other? Czech farmers' and residents' attitudes towards nature-based solutions on agricultural land

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Abstract

Climate change affects both urban areas and rural landscapes, with issues such as drought, soil erosion, and flash floods becoming increasingly prevalent. Although the scientific community has long advocated for nature-based solutions (NBS), their adoption in agricultural practice remains limited. This study explores the preferences of farmers and residents regarding NBS on agricultural land, examines the level of social acceptance, and identifies barriers to NBS implementation from the farmers' perspective. A questionnaire survey conducted in the Oleška River Basin, Czech Republic, assessed preferences for 12 measures. The results reveal partial agreement between the two groups: for example, grassing along streams and baulks is appreciated aesthetically by both. However, differences exist in perceived functionality. Farmers, drawing from practical experience, evaluate the aesthetics and functionality of measures such as contour tillage and afforestation differently than residents. Both groups perceived measures like retention pools as less effective for flood regulation. The findings highlight that financial constraints and complex landowner-farmer relationships hinder NBS implementation. This research emphasizes the need for land-use strategies that address both stakeholder preferences and practical challenges, enabling more effective adoption of NBS to mitigate climate impacts. As the evaluation of the measures shows, some practices – such as maize cultivation – are considered by both stakeholder groups to be the least aesthetic and least effective for flood regulation, and their support is therefore not justified. In contrast, afforestation is perceived positively by both groups, being seen as both highly aesthetic and effective in flood protection. These insights underline the importance of incorporating stakeholder preferences into policy design, particularly when developing financial incentives for NBS, and avoiding the promotion of agricultural practices that are neither visually appealing nor beneficial in terms of ecosystem services.

Highlights for public administration, management and planning:

- Preferences of farmers and residents on the aesthetics and effectiveness of the nature-based solutions are studied from a flood regulation perspective.
- Farmers perceive higher disparity between the aesthetics and functionality of the measures.
- Given the high aesthetic appreciation of linear measures by both residents and farmers, their wider implementation in landscape planning is recommended.
- Policymakers and planners should integrate aesthetic preferences of local communities in the decisions to increase public support, enhance social acceptance, and facilitate the successful implementation of flood regulation measures.

Keywords

Floods,
Nature-based solutions,
Aesthetic preferences,
Residents' perception,
Perceived effectiveness of measure

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1 Introduction

Climate change has profoundly impacted the agricultural sector, bringing challenges such as drought, soil erosion, flash floods, salinization, biodiversity loss, and water scarcity (Furtak & Wolińska 2023; van Tilburg & Hudson 2022; Bogunović & Filipović 2023). This situation leads to land degradation and crop yield losses (Meierová & Chvátalová 2022), prompting countries to adopt policies that support adaptation measures to climate extremes (Rizzo et al. 2023). Adaptation often involves the implementation of measures on agricultural land, including nature-based solutions (NBS), which are inspired by and rely on natural processes (Raška et al. 2022, Calliari et al. 2022) and *"help societies address a variety of environmental, social and economic challenges in sustainable ways"* (European Commission 2015:p. 5).

Measures to support the fight against climate change in the landscape have often taken the form of technical solutions. However, in recent years, nature-based and hybrid measures have begun to play an increasingly irreplaceable role (Rizzo et al. 2023; Bezak et al. 2024). Compared to traditional technical measures, NBS are seen as more cost-effective and provide broader environmental, social, and economic benefits in the form of ecosystem services (Albert et al. 2019; Miralles-Wilhelm 2021; Mancuso et al. 2021; Sowińska-Świerkosz & García 2022; Haines-Young 2023). However, a significant challenge remains: the lack of awareness about NBS among key stakeholders, particularly farmers and local residents, who play a crucial role in their implementation (Calliari et al. 2022). To ensure the effective design and adoption of NBS, it is essential to engage both farmers and residents, as these solutions must be not only functional but also socially accepted (Mumtaz & Puppim de Oliveira 2023; Abas et al. 2023; Slavíková & Milman 2023). As described by Grothmann & Patt (2005), and later by Zobeidi et al. (2022), in addition to low awareness, the perception of transaction costs (i.e. time and money required to implement measures) can also play a major role. Combined with other barriers, this may lead stakeholders to disregard climate threats altogether and refrain from implementing any measures, including NBS.

Conflicts often arise between different stakeholder preferences, for example, between those prioritizing soil and flood regulation and others focused on maximizing agricultural profits (Pulido-Velazquez et al. 2023). Stakeholders' limited understanding of the effectiveness of these measures (Valencia Cotera et al. 2023), along with their aesthetic perceptions of landscape changes, may also influence their willingness to adopt NBS (Faivre et al. 2017; Albaladejo-García et al. 2023).

Although NBS are considered multifunctional measures, this paper investigates in detail how farmers and residents perceive the aesthetic and functional qualities (regarding flood regulation) of 12 NBS and agricultural practices on farmland. It explores differences in perception as well as the social acceptance of these measures. Surveys were conducted among 10 farmers and 241 residents in the Oleška River Basin, Czech Republic.

The paper is organized as follows: Section 2 reviews literature on farmers' and residents' attitudes toward NBS as agricultural adaptation measures. Section 3 outlines the methodology and data collection process, including details about the case study and the surveys. Section 4 presents the results, followed by a discussion in Section 5. The paper concludes with a summary of key findings and recommendations in Section 6.

2 Attitudes and preferences of farmers and residents

The successful implementation of adaptation measures on agricultural land largely depends on the preferences of both farmers and non-farming landowners, who often lease their land. These preferences are shaped by factors such as the regulatory environment (Nesshöver et al. 2017), economic capacity (Macháč et al. 2020), awareness of available measures (Macháč et al. 2022), and perceptions of necessity or functionality (Karki et al. 2019; Dang et al. 2019), and aesthetics (Häfner et al. 2017; Albaladejo-García et al. 2023). Addressing these diverse preferences is key to the effective implementation of NBS. For example, a survey of Czech farmers (Krčmářová et al. 2021) showed that trees on agricultural land are valued for both their functional and aesthetic benefits, whereas other measures may not be perceived as positively.

According to many authors (e.g. Han & Kuhlicke 2019; Anderson et al. 2021), public acceptance of NBS is considered crucial to their success. While there is extensive research on preferences for NBS in urban areas (e.g. Macháč et al. 2022; Phillips et al. 2023), studies focusing on agricultural land are less common. However, several recent studies (e.g. Viti et al. 2023; (Gullino et al. 2023) highlight the importance of involving local actors, including residents and farmers, in the selection, design, and implementation of NBS to maximize their effectiveness (Viti et al.

2023). Zandersen et al. (2021) similarly emphasized the need to engage local stakeholders, including farmers and municipalities, to ensure successful agricultural adaptation. Public preferences in open landscapes were examined by Anderson et al. (2022), who found that the risk and uncertainty surrounding the effectiveness of NBS led residents to favour hybrid and grey measures. However, wildlife habitats and aesthetics were also recognised as important co-benefits. Results from of a choice experiment (Macháč et al. 2021) indicated that residents preferred the implementation of NBS over scenarios lacking such measures in the landscape. Afforestation, grassing along streams, and polders were among the most favoured measures. The same study also demonstrated that, overall, NBS were preferred to technical measures, such as changes in agricultural technologies, including changes in crop types.

A major barrier to NBS implementation on agricultural land is the high transaction cost associated with stakeholder cooperation, particularly the reluctance to engage in communication (Meierová 2020). However, this obstacle may gradually diminish as stakeholders become increasingly aware of the pressing climate challenges, such as soil erosion and drought (Vávra et al. 2019). Farmers have observed the impacts of climate change on their land (Teff-Seker et al. 2022; Meierová & Chvátalová 2022), yet their perspectives on NBS acceptance remain underexplored. Some studies (e.g.Orduño Torres et al. 2020) suggest that farmers may prefer technical measures, such as improved equipment and changes in crop types, over NBS. At the same time, several researchers (e.g. Grothmann & Patt 2005; Zobeidi et al. 2022) have highlighted the issue of additional transaction costs incurred by farmers, which often lead them to disregard climate change and maintain the status quo without adopting any NBS.

In the Czech context, farmers´ willingness to adopt adaptation measures is often influenced by the land ownership structure (Meierová & Chvátalová 2022). Administrative barriers and mistrust between stakeholders further complicate the implementation of NBS. Land in the Czech Republic is highly fragmented, with around 80 % of farmers leasing land under short-term contracts (Sklenička et al. 2015). Additionally, ownership is often divided among multiple parties, making it difficult to reach consensus. By contrast, countries like the Netherlands show higher levels of adaptation awareness and implementation, largely due to greater familiarity with climate risks (van Tilburg & Hudson 2022). Dutch farmers are experienced in applying various adaptation measures on their land, and there is a clear correlation between greater awareness of extreme weather events and more proactive adaptation efforts.

3 Data and methods

3.1 Case study description

The case study was conducted in the Oleška River Basin, which has a total length of 36.4 km and a catchment area of 171 km^2 (see Fig. 1). The river flows from SE to NW, mostly through the foothills of the Krkonoše Mountains (Povodňový portál Libereckého kraje 2020). The basin is predominantly composed of agricultural land, with some built-up areas. Arable land accounts for 25% of the area, while forests (34%) and permanent grasslands (29%) represent a larger share (CTU 2020). The Oleška river basin includes 16 municipalities with a total population of approximately 26000 residents. The broader area encompasses an additional 11 municipalities with 17000 inhabitants. The area is characterized by low and uneven population density, with settlements primarily concentrated along the river. This settlement pattern increases the area's vulnerability to flooding, particularly from torrential rainfall and spring snowmelt. Agriculture in this region faces significant impacts from climate change, including soil dryness and more frequent torrential rainfall, which exacerbate water erosion (Třebický et al. 2020). According to the regional Action Plan (Třebický et al. 2020), agriculture can help mitigate these effects by implementing measures that enhance water retention, promote landscape cooling, and prevent soil degradation. Based on Macháč et al. (2022), floods in the region are currently addressed primarily through water reservoirs, bank reinforcements, and land readjustment. Land-use plans of the concerned municipalities (Vrabcová 2017; Vojtěch 2015; Koutová 2022) highlight issues related to insufficient riverbed capacity and flash floods, which are further intensified by erosion. As a result, these plans place strong emphasis on agriculture and forestry, which are expected to implement effective measures to reduce flood risk and erosion. Among the potential adaptation measures identified in the area (e.g. CTU 2019), the most relevant include grassing, contour tillage, crop selection and composition, tree species composition, swales, and grassing along the streams.

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Fig. 1 Location of the Oleška River Basin

3.2 Survey description

The study examined preferences and attitudes through two surveys conducted among local residents and farmers in the case study area. The first survey, carried out in August 2019, involved face-to-face interviews with 241 residents. The second survey, conducted online in 2020 due to COVID-19 restrictions, included responses from 10 farmers. Although the farmer sample size is relatively small, these 10 individuals manage approximately three-quarters of the arable land in the catchment. As such, their perspectives provide valuable insights into land use preferences and agricultural practices in the region.

The residents' survey included a questionnaire covering three main areas: (i) attitudes toward agriculture and its functions, (ii) evaluations of various NBS and cultivated crop types based on aesthetics and effectiveness in flood regulation, and (iii) socio-economic data, including previous flood experiences. For the farmer survey, the questionnaire was adapted to include two additional topics: (iv) collaboration with stakeholders in the implementation of NBS measures, and (v) perceived barriers to adopting NBS within the Czech context.

To evaluate various NBS and agricultural practices, twelve measures were selected and assessed based on their aesthetics and perceived effectiveness in flood regulation. These measures were chosen from a catalogue of adaptation strategies proposed by Czech authorities (CTU 2019) to address key environmental challenges in the study area, including flood regulation, water retention, and soil erosion. The selected measures comprised both NBS and agricultural practices related to the type of cultivated crops (TCC), which directly influence erosion control and water retention in the landscape. An overview of these measures is provided in Fig. 2. The evaluation aimed to capture participants' visual and functional perceptions of the implementation of these measures. Given the potential bias introduced by varying photographic or graphic quality in visual assessments (Tinio et al. 2011), we used standardized illustrated images of each measure, developed in collaboration

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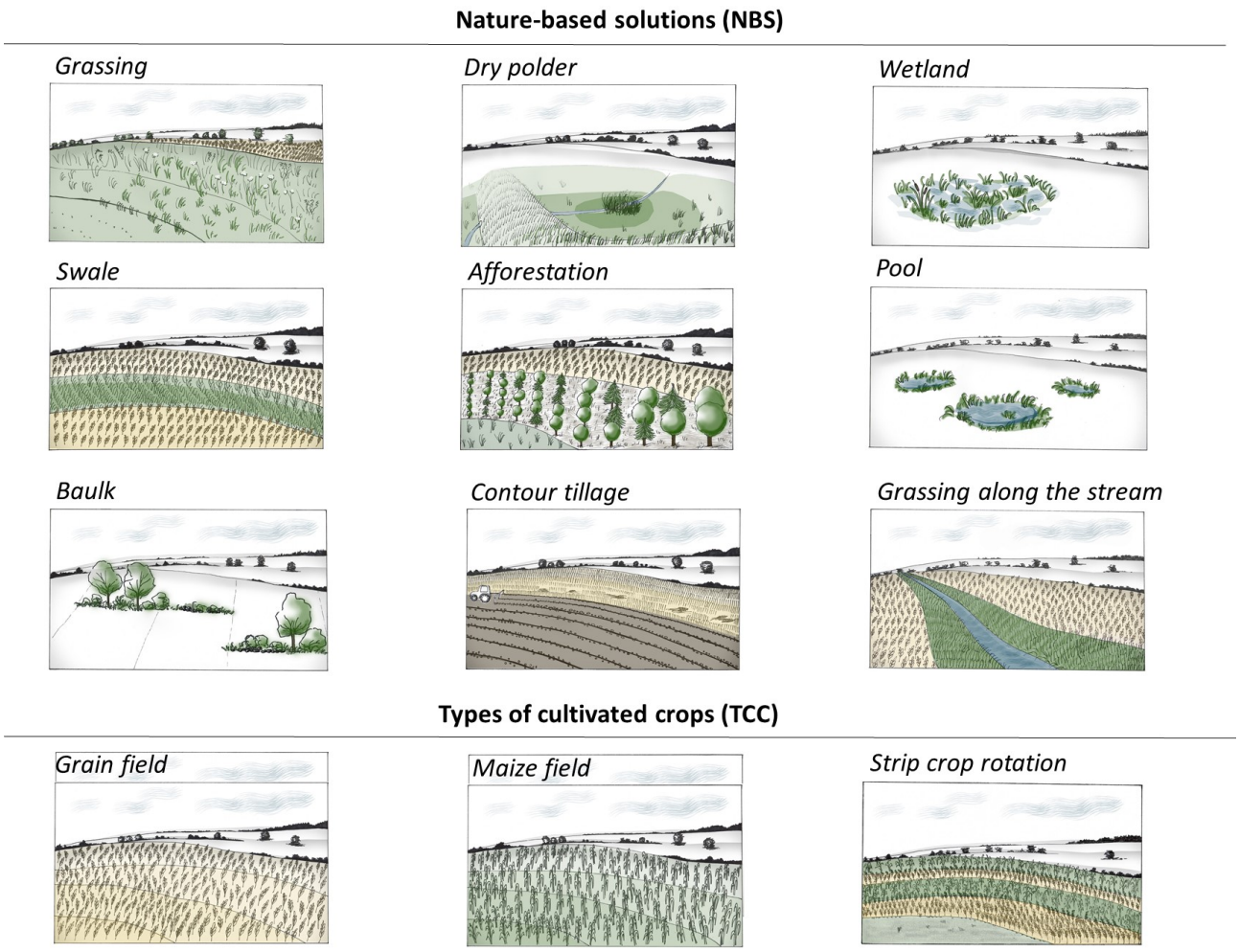

Fig. 2 Illustration of measures (NBS and TCC) assessed in this study

with a graphic designer. These illustrations were unified in terms of style, background, and colour scheme to minimize visual bias.

All the measures presented in Fig. 2 were evaluated by both resident and farmer respondents on a scale from 1 (lowest) to 10 (highest), reflecting the extent to which they personally appreciated the aesthetic (visual) appeal of each measure in the landscape. Subsequently, respondents identified the three measures they considered most effective for flood regulation in the case study area.

The data were analysed using basic statistical methods. For each measure, average aesthetic scores were calculated to rank them by perceived visual value. Additionally, the percentage of respondents who selected each measure among the top three most effective for flood regulation was used to assess the relative perceived functionality of each measure. This analysis was applied uniformly to both non-farming residents and farmers, allowing for a direct comparison of preferences between the two groups.

4 Results

4.1 Measures preferred by local residents

A total of 842 people in the area of interest were contacted for the survey, of whom 241 agreed to be interviewed. The results revealed that 54% of residents had personal experience with flooding. The average age of respondents was 42 years, and 62% were women. The survey also showed that, in terms of aesthetics, NBS were generally preferred over TCC. The most appreciated measures were afforestation, grassing along streams, and baulks (see Fig. 3). Conversely, strip crop rotation and expansive fields of grain and maize re-

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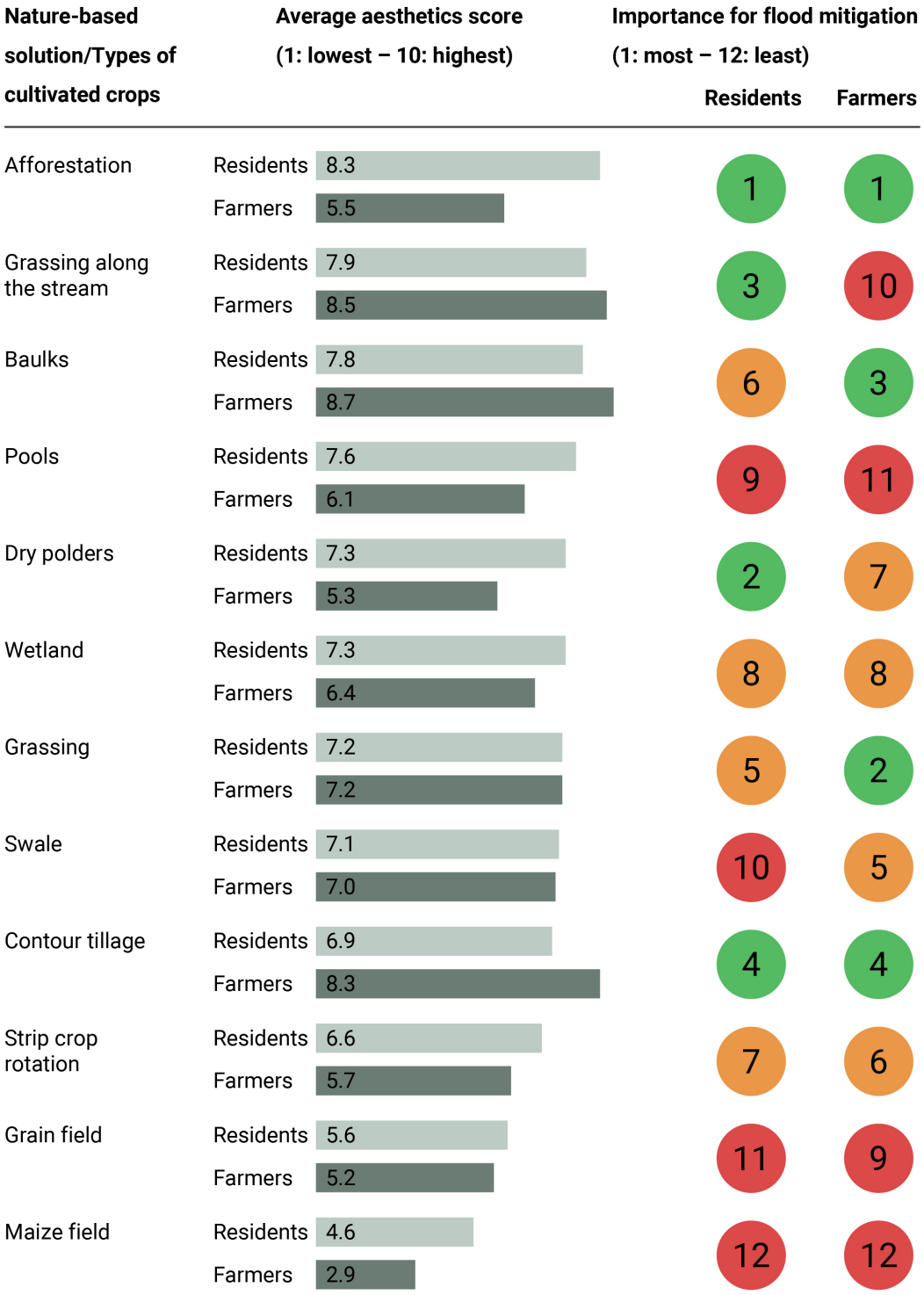

Fig. 3 Measures preferred by farmers and residents

ceived the lowest aesthetic rating among residents of the Oleška River Basin.

After expressing their aesthetic preferences, respondents were asked to select the measures they considered most functional for flood regulation. The majority identified afforestation (52.7%), dry polders, and grassing along streams as the most effective. As a result, afforestation and grassing along streams emerged as the two measures perceived by residents as both the most aesthetically pleasing and the most effective for flood regulation. The results are summarised in Fig. 3.

4.2 Measures preferred by farmers

More than 100 farmers or farming entities in the study area were initially identified for the survey. Of these, 29 farmers were successfully contacted using publicly available databases and web directories. From the contacted individuals, 10 completed questionnaires were received. The respondents included an equal number of private farmers and legal entities engaged in agricultural activities, such as corporations, cooperatives, and limited liability companies. Most of the participants managed arable or grassland areas of up to 1,000 hectares in total.

The proportion of arable to livestock farming was evenly balanced among the respondents. All farmers practised conventional farming, with the exception of one respondent engaged in organic farming and the production of organic food. Most of the surveyed farmers reported experiencing negative impacts of climate change associated with torrential rainfall, most commonly soil erosion, either through soil loss or changes in soil structure. Despite the frequent flooding in the basin, the majority of respondents did not perceive themselves as being at risk from floods.

As with the residents, farmers were first asked to express their preferences regarding the aesthetic value of different measures in the landscape. The elicitation process used the same question and graphical representation of individual measures as presented in Fig. 2. The results indicated that farmers generally appreciated the landscape aesthetics of all the assessed measures, with the exception of large maize fields, which were viewed negatively. The most frequently preferred measures were baulks, grassing along streams, and contour tillage (see Fig. 3).

In terms of perceived flood regulation functionality, farmers showed a clear preference for afforestation, grassing and baulks. Conversely, large maize fields, pools and grassing along streams were considered the least functional. Farmers' evaluations were influenced by their practical experience, as they were particularly familiar with the implementation and outcomes of grassing and baulks.

4.3 Comparison of preferences

According to the survey results (Fig. 3), NBS for flood regulation were supported by local residents not only for their contribution to the visual appeal of the landscape, but also due to their perceived positive impact on water retention. However, the perceived importance of the measures differed when comparing aesthetic value and functional effectiveness in flood regulation. Overall, NBS were rated more favourably than TCC in terms of their flood regulation functionality. Measures such as strip crop rotation and grain fields received neutral ratings, whereas maize fields were perceived negatively.

Although farmers were represented by a much smaller sample compared to residents, and there is a risk of bias, the aesthetic evaluations of individual measures were relatively consistent across both groups. More pronounced discrepancies emerged in the perceived effectiveness of the measures. The survey results indicate that residents and farmers shared similarly positive aesthetic perceptions of grassing along streams and baulks. While grassing along streams was aesthetically appreciated by both groups, residents ranked it among the most effective measures for flood regulation, whereas farmers rated it as one of the least effective based on their practical experiences. There was also aesthetic agreement on measures such as swales, pools, and wetlands. Both farmers and residents regarded pools as having low effectiveness for flood regulation.

Greater differences were observed in the case of afforestation, which residents rated positively in terms of both aesthetics and functionality, while farmers evaluated it less favourably. Conversely, farmers viewed contour tillage positively in both aesthetic and functional terms. These findings suggest that land-use planning could benefit from balancing the preferences of residents and farmers by aligning measures with both shared and divergent priorities for specific areas.

4.4 Barriers to implementation

The survey also included questions regarding farmers' cooperation with other stakeholders in the landscape and their willingness to implement NBS on agricultural land, including perceived barriers.

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The results indicate that most of the surveyed farmers do not cooperate with other stakeholders at the local or national level in the area of flood regulation, and do not consider such cooperation necessary given the current situation. In addition to perceiving cooperation as unnecessary, other reasons for non-cooperation included differing opinions, a belief in the correctness of their own farming methods, and a perceived lack of interest from other stakeholder entities. The farmers identified municipalities, landowners, and river basin managers as the stakeholders most responsible for the implementation of flood regulation measures. Ownership structure was also seen as a barrier, as only about half of the farmers had encountered any interest from landowners in how their land is managed.

The survey also revealed that the potential for farmers to implement additional measures is very low: almost none of the farmers indicated any intention to adopt the NBS covered in the survey. The main reasons cited by farmers (see Tab. 1) included administrative burden, the current legal framework, and complicated relationships with landowners (not only due to a lack of interest on the part of landowners, but also because of fragmented ownership structures, as farmland is often owned by multiple entities). The time required to plan and prepare the implementation of measures was also perceived as a significant limiting factor. Financial aspects of measure implementation (insufficient own resources or low subsidies and reduced yields) were considered less critical than the administrative burden and the legal-ownership complexities. According to the surveyed farmers, financial compensation and a reduction in administrative burden would be the most important incentives for implementing NBS in the future. However, land ownership relations remain a fundamental issue and are perceived as the primary barrier.

5 Discussion

Practical implementation and research often overlook the perspectives of local residents regarding landscape adaptation measures, despite the importance of incorporating diverse stakeholder views to improve decision-making processes. This finding is consistent with Ferreira et al. (2021), who emphasised the need to raise awareness and engage stakeholders in participatory processes. They noted that stakeholders often lack sufficient knowledge about the functionality of NBS and their role in addressing environmental challenges. Similarly, Derkzen et al. (2017) found that increasing public awareness of the benefits of NBS can shift preferences towards more adaptive solutions, particularly once the functionality of such measures is clearly explained. The importance of multi-stakeholder participation, including local resident is also highlighted in the concept of interactive environmental governance (Partelow et al. 2020), where participation is believed to enhance the quality of governance outcomes. This has been confirmed by recent findings from Newig et al. (2023).

It is important to note that despite the undeniable benefits of implementing NBS, there are opinions suggesting that these measures alone may not be sufficient in the fight against the impacts of climate change. Achieving sustainability requires combining them with other options (Tarolli et al. 2024). In practice, natural elements that are part of NBS are often combined with elements of grey, technical measures, resulting in the hybrid measures (Anderson et al. 2022). In the context of agriculture, the distinction between what qualifies as NBS and what does not is sometimes still unclear. In this respect, it would be useful to have a common uniform classification of measures in the future. For the purposes of this paper, we use a classification that distinguishes between NBS and TCC measures, while acknowledging that some measures – such as contour tillage – may lie on the boundary between NBS and hybrid solutions.

Most NBS bring multiple benefits within the concept of ecosystem services (Oppio et al. 2024) and are considered multifunctional solutions (Remme et al. 2024). In this study, the focus was placed on two key ecosystem services – aesthetic value and flood mitigation – which were selected based on their relevance to different stakeholder groups. Aesthetic value represents one of the most immediately perceived benefits by the general public and plays a crucial role in public acceptance and support (Junker & Buchecker 2008; Albaladejo-García et al. 2023). Flood mitigation, on the other hand, is a frequent justification for NBS implementation by governmental and planning authorities. While this approach provides important insights, it also highlights the need for more comprehensive assessments that reflect the full multifunctionality of NBS. Despite the availability of methods for assessing the benefits and costs of individual NBS, substantial inconsistencies exist in the evaluation of their benefits, even in cases relying on the same spatial scale (Chelli et al. 2025). To account for a wider range of aspects in the evaluation of NBS, the application of Multicriteria Decision Analysis (MCDA) is recommended. By as-

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Table 1 Significance of barriers as viewed by farmers (ranked by perceived significance)

Very significant	Moderately significant	Less significant
Administrative burden with implementation (authorization)	Insufficient financial compensation for implementation	Ignorance of measures/lack of information
Current legislative setting	Lack of own financial resources	Someone else should implement it
Complicated landowners' relations	Necessity of maintenance of measures	Reduction in subsidy payments per area
Lack of time for preparation and implementation	Diminishing returns (loss of production)	Doubts about effectiveness/ functionality of measures

signing importance weights to the various aspects, this approach enables the inclusion of a broader spectrum of effects, thereby enhancing the comprehensiveness of the assessment (Saarikoski et al. 2022; Remme et al. 2024; Oppio et al. 2024).

One of the objectives of this study was to examine the divergence between aesthetic appreciation and perceived functionality of adaptation measures. While some measures, such as afforestation, were rated highly by residents for both aesthetic value and effectiveness, others, like grassing along streams, were aesthetically appreciated but considered less effective by farmers. This highlights the subjectivity of perceptions, which are often shaped by individual experience, knowledge, and local conditions, as corroborated by Chen et al. (2020). The discrepancy between perceived and actual effectiveness underscores the need for evidence-based communication strategies aimed at aligning public perception with scientifically validated outcomes.

The results also underscore the importance of balancing diverse stakeholder preferences to achieve adaptation measures that are both socially acceptable and functionally effective. Suppakittpaisarn et al. (2019) demonstrated that successful implementation depends on reconciling the views of various stakeholders, including those responsible for policy enforcement and those directly affected by the measures. The study highlights a conflict between two key stakeholders (farmers and residents) regarding the dual objectives of NBS: aesthetic appeal and functional effectiveness in flood regulation. The divergence in priorities illustrates the challenge of integrating aesthetic and functional considerations in the implementation of NBS, which is crucial for fostering broader acceptance and long-term success in both agricultural and residential contexts. The findings of this study provide actionable insights by identifying measures, such as grassing and afforestation, that balance aesthetic and functional values, offering valuable guidance for landscape management policymakers.

The findings of this study regarding aesthetic preferences are consistent with those of Häfner et al. (2017), who found that residents strongly favoured point and linear features, such as tree lines and hedgerows, over agricultural practices like crop rotation. Similarly, van Berkel & Verburg (2014) demonstrated that tree lines and individual trees were aesthetically appreciated for their recreational and visual benefits, a sentiment echoed by respondents in the Oleška River Basin. Notably, strip crop rotation and maize fields were among the least aesthetically appreciated measures in both the present study and the referenced literature. As mentioned above, for the successful implementation and effective functioning of NBS, it is important to involve the perceptions of farmers and residents in the decision-making process (Mumtaz & Puppim de Oliveira 2023). Given that both groups of key stakeholders in this study consistently consider maize fields not only the least aesthetic but also the least effective flood regulation measure, decision-makers should take this into account when planning. However, despite this perception, maize cultivation remains widespread. This reflects the influence of institutional and market-driven factors that often override environmental or aesthetic considerations. Maize offers high economic returns, benefits from well-established market demand, and fits into existing subsidy frameworks, which do not necessarily reward flood-resilient or visually appealing practices. Furthermore, the absence of targeted disincentives or policy restrictions allows its continued cultivation, even in vulnerable areas. This underscores the need for governance approaches that not only promote NBS but also align agricultural incentives with broader landscape resilience goals (e.g. by discouraging cultivation of less desirable crops in sensitive areas and supporting multifunctional land use strategies). Such findings contribute to the academic debate on stakeholder engagement (e.g. Pulido-Velazquez et al. 2023) as the survey reveals limited cooperation between farmers and other stakeholders – a pattern

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also observed in another region of the Czech Republic (Meierová & Chvátalová 2022).

The reluctance of farmers to implement NBS stems from multiple barriers, including administrative burdens, legal frameworks, and fragmented ownership structures. These findings are consistent with Meierová & Chvátalová (2022), who also identified ownership complexity and administrative challenges as key obstacles. Although financial constraints are often cited as barriers, farmers in this study indicated that subsidies and support programmes could partially offset these concerns. However, the lack of engagement from landowners, compounded by fragmented ownership and complex leasing arrangements, remains a significant challenge.

Improving farmers´ motivation requires addressing these structural barriers. Simplifying administrative processes and shifting financial incentives towards landowners could encourage greater collaboration and investment in NBS. Strengthening landowner involvement, as suggested by previous studies, may also facilitate the implementation of more complex measures, particularly in landscapes characterised by fragmented land tenure.

A limitation of this study is the small sample size of farmers, which constrains the generalisability of the findings. Expanding the study area or including more detailed questions on land ownership could provide a broader and more nuanced understanding of stakeholder preferences and perceived barriers, particularly by examining whether residents' views differ depending on land ownership status. Nevertheless, the insights gained in this study highlight the critical need for inclusive, evidence-based policymaking that considers the perspectives of both residents and farmers in order to promote sustainable land management.

A significant challenge in implementing adaptation measures in the Czech Republic lies in the highly fragmented land ownership structure. A large proportion of agricultural land is leased to farmers by owners who often lack a direct connection to the land, offering farmers little incentive to invest in long-term improvements. More complex measures frequently require landowner consent; however, landowners may be reluctant to approve such measures if they result in a reduction of cultivable area, potentially leading to decreased rental income. A possible solution could involve reallocating subsidies to favour those who actively implement nature-based measures. Additionally, strengthening the role of landowners through targeted support schemes may increase their motivation to promote and approve the adoption of such measures.

6 Conclusion

The aim of this study was to evaluate nature-based solutions as an option for flood regulation from the perspectives of farmers and local residents, and to identify areas of agreement between these stakeholder groups. Using questionnaire surveys conducted in the Oleška River Basin, we explored respondents´ aesthetic and functional preferences by presenting images of 12 different measures. The findings reveal that both residents and farmers expressed the highest aesthetic appreciation for linear measures, particularly baulks and grassing along streams. From a functional perspective, both groups also showed relative agreement, identifying afforestation and grassing as the most effective flood regulation measures. Grassing along streams was also highly valued by residents for its perceived effectiveness; however, this view was not shared by farmers, who considered it one of the least effective options based on their practical experience. A notable insight from the study is that most responding farmers had prior experience with flooding on their land, likely enabling them to assess the functionality of indivindual measures based on personal experience. However, farmers perceived erosion as a more significant threat than flooding, as floods primarily affect those located directly along the watercourse. Beyond financial constraints and administrative challenges, the fragmented and complex land ownership structure emerged as the most critical barrier to the implementation of NBS.

This study adds value by highlighting shared preferences among stakeholders, which can serve as a foundation for fostering collaboration in implementing flood regulation measures. Furthermore, it underscores the importance of addressing structural barriers, such as land ownership and resource allocation, to support the effective and widespread adoption of NBS. Given that both residents and farmers expressed high aesthetic appreciation for linear measures, their broader implementation in landscape planning can be recommended. These measures may positively influence the visual quality of the landscape, thereby increasing public support for climate adaptation efforts. The results indicate a degree of consensus, consistent with the principles of interactive environmental governance, that enables the implementation of acceptable measures, which do not cause conflicts between two key local actors. By integrating stakeholder perceptions with practical constraints, the paper offers a nuanced perspective that can inform policy design and support sustain-

able flood management strategies in rural areas. When designing flood regulation policies and implementing NBS, policymakers and planners should consider not only ecological, technical, and financial factors, but also the aesthetic preferences of residents and farmers. Doing so could enhance social acceptance and facilitate the successful implementation of these measures.

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