diversity

MDPI

Article

Spatial Forecasting and Social Acceptance of Human-Wildlife Conflicts Involving Semi-Aquatic Species in Romania

Alexandru Gridan [1], Claudiu Pașca [1,*], Georgeta Ionescu [1], George Sîrbu [1], Cezar Spătaru [1], Ovidiu Ionescu [1,2] and Darius Hardalau [2]

[1] Department of Wildlife, National Institute for Research and Development in Forestry "Marin Drăcea", 500040 Brasov, Romania; gridanalex@gmail.com (A.G.); titi@icaswildlife.ro (G.I.); sirbugeorgeeugen@gmail.com (G.S.); sptrcezar@yahoo.com (C.S.); o.ionescu@unitbv.ro (O.I.)

[2] Silviculture Department, Faculty of Silviculture and Forest Engineering, Transilvania University of Brasov, 500036 Brasov, Romania

* Correspondence: claudiu_tasi@yahoo.com

Abstract

Human-Wildlife conflict (HWC) presents a growing challenge for wildlife conservation, especially as species recover and reoccupy human-dominated landscapes, creating tensions between ecological goals and local livelihoods. Such conflicts are increasingly reported across Europe, including Romania, involving semi-aquatic species like the *Eurasian beaver* (*Castor fiber* L.) and Eurasian otter (*Lutra lutra* L.). Enhancing coexistence with wildlife through the integration of conflict mapping, stakeholder engagement, and spatial analysis into conservation planning is therefore essential for ensuring the long-term protection of conflict species. A mixed-methods approach was used, including structured surveys among stakeholders, standardized damage report collection from institutions, and expert field assessments of species activity. The results indicate that while most respondents recognize the legal protection of both species, a minority have experienced direct conflict, primarily with beavers through flooding and crop damage. Tolerance varied markedly among demographic groups: researchers and environmental agency staff were most accepting, whereas farmers and fish farm owners were the least accepting; respondents with no personal damage experience and those with university or post-secondary education also displayed significantly higher acceptance toward both species. Institutional reports confirmed multiple beaver-related damage sites, and through field validation, conflict forecast zones with spatial clustering in Harghita, Brașov, Covasna, and Sibiu counties were developed. These findings underscore the importance of conflict forecasting maps, understanding the coexistence dynamics and drivers of acceptance, and the need to maintain high acceptance levels toward the studied species. The developed maps can serve as a basis for targeted interventions, helping to balance ecological benefits with socioeconomic concerns.

Keywords: Human-Wildlife conflict; *Eurasian beaver*; Eurasian otter; social acceptance; wildlife tolerance

check for updates

Academic Editors: Thomas H. White, Jr. and Donald J. Brightsmith

Received: 20 June 2025
Revised: 28 July 2025
Accepted: 6 August 2025
Published: 7 August 2025

Citation: Gridan, A.; Pașca, C.; Ionescu, G.; Sîrbu, G.; Spătaru, C.; Ionescu, O.; Hardalau, D. Spatial Forecasting and Social Acceptance of Human-Wildlife Conflicts Involving Semi-Aquatic Species in Romania. *Diversity* **2025**, *17*, 559. https://doi.org/10.3390/d17080559

1. Introduction

Europe contains over 1.75 million water bodies, about 1.32 million natural and 430,000 artificial, which together cover approximately 2.83% of the continent's total area [1]. These water bodies host diverse wildlife, including fish, amphibians, reptiles, birds, and various types of mammals [2,3], among which semi-aquatic animals are of particular interest for this study. A semi-aquatic mammal is a species that, through evolutionary adaptation, relies on both aquatic and terrestrial habitats for part of its life history, with aquatic dependency extending beyond basic water consumption and varying in degree, distinguishing them from fully terrestrial or aquatic mammals [4,5]. In Europe, key semi-aquatic mammals include the Eurasian otter (*Lutra lutra* L.) [6], *Eurasian beaver* (*Castor fiber* L.) [5], water vole (*Arvicola amphibius* L.) [7], and the introduced muskrat (*Ondatra zibethicus* L.) [8] or nutria (*Myocastor coypus* Molina) [9], all of which depend on both land and water environments for activities such as feeding, breeding, and shelter [10]. Of interest to this study are the Eurasian otter and the *Eurasian beaver*, both listed under Annex II and Annex IV of the EU Habitats Directive [11], which necessitates a careful approach to their management.

The *Eurasian beaver* is a species that was on the brink of extinction at the beginning of the 20th century, with only 1200 specimens remaining across eight core populations in Eurasia due to various causes (overhunting, fur trade, castoreum, and others) [12–15]. Conservation efforts across Europe after World War II have led to significant population recovery [16,17]. In countries such as the Netherlands [18], Wales [19], Scotland [20,21], and Romania, beavers were reintroduced successfully. At the end of the 1990s, 182 specimens of beavers were reintroduced in Romania, and since then, the species has thrived [22,23]. The *Eurasian beaver* provides significant ecological benefits [24,25], but the species' resurgence has also led to renewed HWC [26,27]. As a result, coexistence between humans and beavers remains challenging [28], and the acceptance of this species is questionable. While the beaver has a strictly herbivorous diet [29], the Eurasian otter is a carnivore with an ichthyophagous diet, feeding predominantly on fish [30,31]. The Eurasian otter has one of the widest distributions of semi-aquatic mammals, from Portugal to Japan and from Northern Europe and Asia to the Mediterranean [32,33]. This species plays a key role as a predator in freshwater ecosystems, helping to regulate fish populations and serving as a bioindicator of ecological health [34,35]. Over the past century, the otter has suffered a significant decline in Europe, mainly due to water pollution [36]. Although classified as Near Threatened by the IUCN [37], the species did not disappear from most European countries and maintained populations in the thousands [36,38], with reintroduction efforts carried out only in countries such as The Netherlands [39] and parts of Spain [40]. Nonetheless, HWC may arise, particularly in areas where otters prey on fish from commercial farms [41–43].

Despite their protected status, public tolerance of both beavers and otters remains mixed: surveys in Germany [44], Scotland [45], and Italy [46] show that many residents welcome beaver-driven habitat restoration, yet farmers and land managers often voice opposition when dams flood fields or disrupt drainage [47]. Likewise, fish farm and fishery stakeholders across Central and Southwestern Europe frequently perceive otters as economic competitors, and attitudes tend to improve only when effective compensation or prevention measures are in place [41–43,48,49]. Building broader acceptance therefore hinges on early community engagement, conflict-mitigation tools (e.g., flow devices, electric fencing, insurance schemes) [50,51], and communication of the wider ecosystem services that these semi-aquatic mammals provide [52].

Effective mitigation depends on accurately locating where HWC occurs, yet institutional damage reports are often archived in disparate formats and at coarse administrative scales, limiting their usefulness for local-scale planning [53]. Integrating these official records with georeferenced field observations within a GIS framework enables the harmonization of reporting standards, spatial aggregation of recurrent incidents, and analysis of landscape attributes, such as floodplain extent, crop type, or density of fish farming sites, that predispose areas to damage, and most importantly can ease the allocation of compensation [28,54,55]. While different wildlife species such as beavers and otters cause distinct types of conflict, beavers through dam-building and tree-felling, otters primarily through predation on fish stocks, it is still methodologically reasonable to assess social acceptance and identify risk areas using the same statistical tools and overall questionnaire framework, provided that species-specific elements are included. This spatially explicit background is essential for prioritizing preventive measures and directing limited conservation resources toward locations where ecological benefits can be maximized while social and economic costs are minimized [42].

Across Europe, and in Romania in particular, Human-Wildlife damage is currently driven largely by HWC with ungulates [56,57], mesocarnivores [58,59], and large carnivores [60–64], while rising impacts from semi-aquatic species risk further diminishing public acceptance of living alongside wildlife [65–67]. Understanding public perception of these protected species is essential for ensuring coexistence, and the institutions directly involved in wildlife management must have access to information about potential HWC zones. For this purpose, this study aims to assess the public acceptance of the *Eurasian beaver* and Eurasian otter within the study area using structured questionnaire surveys but also to understand the complex processes behind the coexistence with the studied species. Additionally, it seeks to collect and integrate institutional damage reports with georeferenced field observations in order to develop GIS-based forecasting maps that identify current and potential future HWC areas, supporting targeted management and mitigation strategies.

2. Materials and Methods

2.1. Study Area

This research was conducted in the Olt River basin in central and southeastern Romania, a region that encompasses an area of approximately 24,050 km^2. The Olt River (Figure 1) originates in the Eastern Carpathians, in Harghita County, at an elevation of 1440 m above sea level. It flows for 615 km through the counties of Harghita, Covasna, Brașov, Sibiu, Vâlcea, and Olt before discharging into the Danube River. The river basin includes all landform types found in Romania—mountains, hills, and plains—and the area features high morphological diversity, including secondary rivers, floodplains, and artificial reservoirs. These environmental gradients make the region suitable for semi-aquatic species, which are the focus of this study: the *Eurasian beaver* and the Eurasian otter. Along the river’s course, a series of hydrotechnical works have been constructed for flood protection, aiming to safeguard cities and municipalities such as Miercurea Ciuc, Sfântu Gheorghe, Brașov, Făgăraș, Sibiu, Drăgășani, and others. Given the region’s history of flooding, the presence of beavers, in particular, poses a potential threat to the effectiveness of these structures.

2.2. Data Collection

A multidisciplinary approach was employed to collect data in two main stages during 2024. This included structured surveys targeting stakeholder groups, standardized institutional reporting (Supplementary Material Table S1), and field verification of Human-Wildlife conflict (HWC) locations.

A structured questionnaire (Supplementary Material Text S1), developed using Google Forms, was distributed among 15 stakeholder groups, including local authorities, environmental professionals, hunters, aquaculture operators, farmers, and local students. All participants were from the study area and from municipalities identified as having a risk of conflict, most of which are predominantly rural. Students were not excluded from the study as in these areas, many teenagers and adults from rural communities are employed in agriculture and related works, making them directly aware of coexistence issues. This contrasts with students living in urban areas, who tend to have a completely different perception of coexistence [68]. The survey consisted of four main sections: demographic information (age, occupation, and educational background), awareness of the species' legal protection status and conflict involvement, attitudes toward species presence (5-point scale evaluation) and community-level acceptance, and type and extent of damage attributed to the species. Additionally, over 1050 institutions in the study area were asked to fill in a standardized review form. The institutions included municipal councils, environmental protection agencies (APM), water management authorities (SGA), forestry departments (both private and state-owned), and railway operators (CFR). The form requested data on damage location, species involved, type and magnitude of impact, and estimated financial losses.

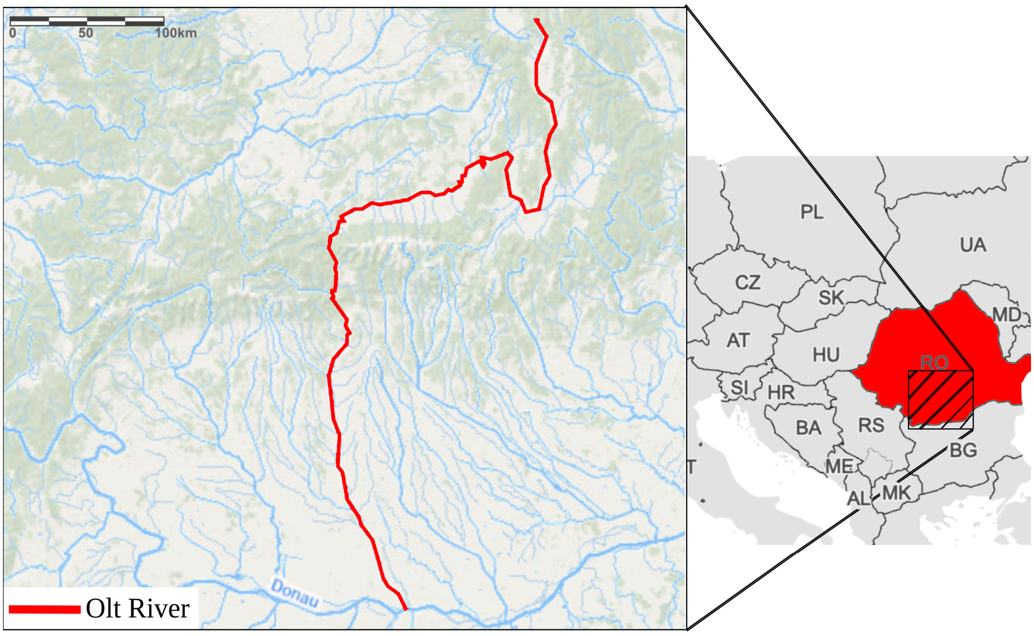

Figure 1. Course of the Olt River from its source in the Carpathian Mountains to its confluence with the Danube River, developed using data from the European Commission's EMODnet (European Marine Observation and Data Network) and Eurostat.

In the second stage, satellite imagery (Google Earth 7.3) was analyzed in order to identify any sign of the beavers, partially alongside the results of the standardized forms, to detect signs of habitat alteration, dam-building activity, and flooding patterns. The identified areas were subsequently validated through field investigations conducted by a team of experts, during which GPS coordinates, habitat characteristics, vegetation types, and species-specific indicators such as active dams, lodges, feeding marks, and scats were recorded.

2.3. Forecasting of HWC Areas and Statistical Analysis

Based on data collected through standardized damage reporting forms and field surveys, conflict hotspots involving the *Eurasian beaver* and Eurasian otter were georeferenced and integrated into digital maps using QGIS 3.32. Spatial analyses were conducted by integrating standardized raster layers representing variables such as infrastructure proximity, land use, species presence, and hydrological and ecological features. Each variable was weighted based on expert input, and cumulative risk scores were classified into low, medium, and high categories using quantile breaks, with them integrated into the development of the map. Conflict zone forecast maps were developed specifically for the counties of Harghita, Covasna, Brașov, and Sibiu, with the Olt River basin identified as a high-risk area for beaver-related impacts. Vâlcea and Olt counties were not used in the development of the HWC maps as they host only isolated or transient beaver populations due to urbanization, steep terrains, or artificial river modifications.

To examine whether demographic and experiential factors jointly predicted respondents' tolerance toward the *Eurasian beaver* and Eurasian otter, a multivariate general linear model (MGLM or MANOVA) was fitted in IBM Statistics 30.0.0.0. Beaver- and otter-tolerance scores (1 = high; 5 = low) were computed and entered as dependent variables, while stakeholder group (8 levels), conflict experience (4 levels), education level (3 levels: university/post-secondary school, high school, and gymnasium or lower), and compensation claim status (1 = submitted/0 = no claim) were fixed factors. The age group variable was treated as a covariate. All two- and three-way interactions among the categorical predictors were requested, and Type III sums of square with Pillai's Trace were used, as Box's test indicated only marginal heterogeneity of the covariance matrices (M = 14.4, $p = 0.050$). Prior to modeling, the data were checked for collinearity and outliers.

3. Results

3.1. Stakeholder Group Survey

A total of 203 individuals from 15 selected stakeholder groups (Figure 2), all from the potential conflict area, completed the survey. In the demographic section, the largest group of respondents was students at various educational levels (29.1%), followed by forest specialists (12.8%), municipal administrative workers (11.8%), local residents (11.3%), and farmers (4.9%). The remaining 30.1% comprised wildlife managers, researchers, fishery workers, and others. In terms of age distribution, the majority of participants (37.7%) were aged 36–50, followed by 31.3% under 25, 20.5% aged 51–65, 9% aged 25–35, and 1.5% over 65.

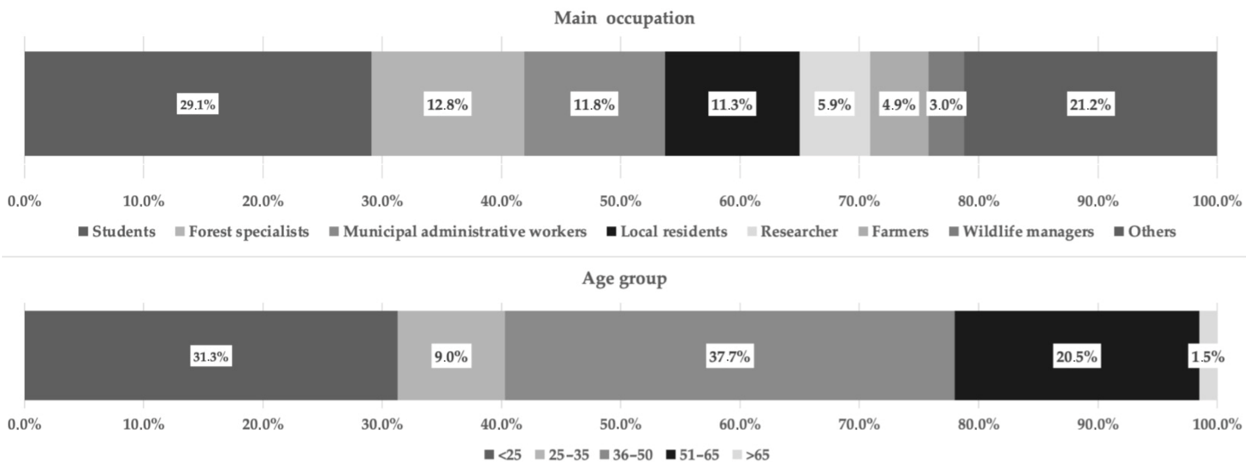

Figure 2. Demographic distribution of survey respondents by main occupation (**top**) and age group (**bottom**).

In the second section of the survey, which addressed conflicts with the studied species, 80.8% of respondents were aware that both the *Eurasian beaver* (*Castor fiber* L.) and the Eurasian otter (*Lutra lutra* L.) are strictly protected species. While 76.35% reported no direct conflict with either species, 15.76% reported conflicts with beavers, 3.45% with otters, and 4.44% with both species. However, only 46.9% of these conflicts were formally reported to authorities. Among conflicts involving otters, just 33% of respondents submitted financial compensation claims, whereas no such claims were filed for beaver-related incidents.

Regarding the nature of the damage (Figure 3), 23.9% of respondents reported land flooding, 18.3% agricultural field damage, 15.7% damage to infrastructure, 14.7% damage to fisheries (not through fish predation), 14.7% to forests, and 12.8% to orchards. Financial losses were estimated by 34 respondents, with 25% reporting damage between EUR 100 and 200, 41% between EUR 200 and 600, 9% between EUR 600 and 1000, and 25% over EUR 1000. The final section of the survey explored species acceptance. The majority (77.8%) did not perceive beaver coexistence as problematic, 15.6% expressed moderate acceptance, and 6.6% expressed no acceptance. For otters, 89.2% reported no issues with coexistence, 5.9% moderate acceptance, and 4.9% no acceptance.

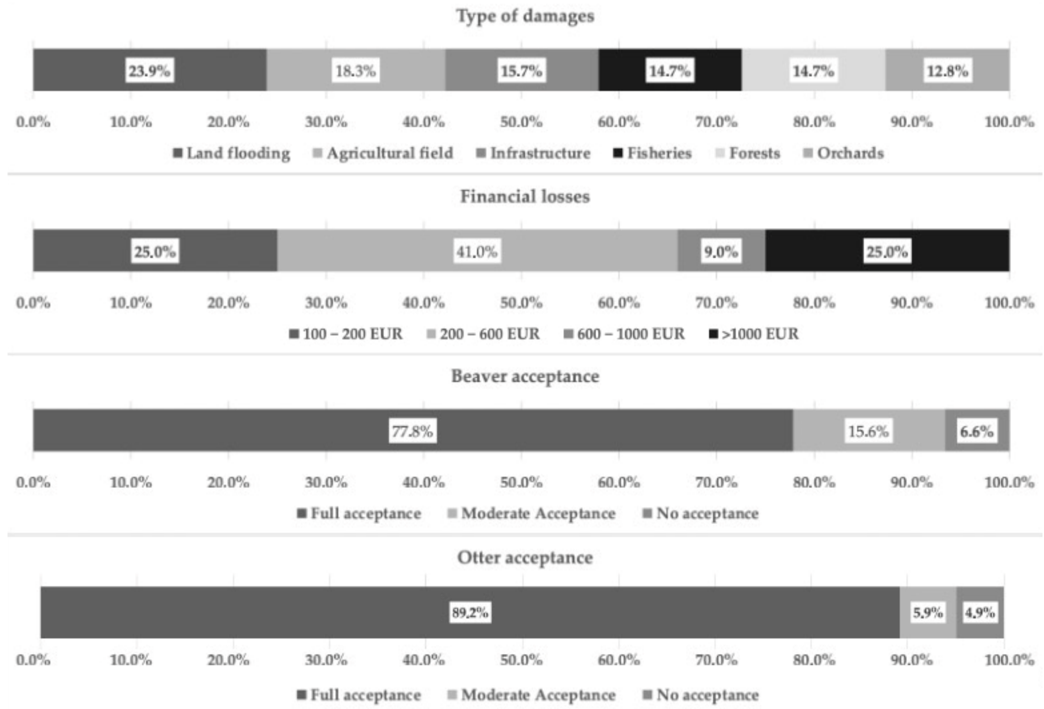

Figure 3. Impacts and attitudes reported by respondents. From **top** to **bottom**: type of damage attributed to semi-aquatic mammals; estimated financial loss per event; acceptance of the *Eurasian beaver*; and acceptance of the Eurasian otter.

When asked about personal attitudes toward (Figure 4) the *Eurasian beaver*, 53.2% expressed liking the species, 34.5% were indifferent, 6.9% found the species disturbing but tolerable, 2.0% preferred elimination, and 3.4% favored relocation over elimination. Regarding the Eurasian otter, 53.7% liked the species, 39.9% were indifferent, 2.0% were disturbed but tolerant, 1.0% preferred elimination, and 3.4% preferred relocation. At the community level, 48.8% of respondents perceived general attitudes toward these species as indifferent, 28.6% reported positive acceptance, 15.7% reported very high acceptance, 5.4% reported low acceptance, and 1.5% reported a complete lack of acceptance.

The MANOVA revealed a strong multivariate effect of stakeholder group (Wilks $\Lambda = 0.064$, F = 80.35, 14, 380, $p < 0.001$), conflict experience ($\Lambda = 0.462$, F = 44.78, 4, 380, $p < 0.001$), and education level ($\Lambda = 0.743$, $F(4, 374) = 16.92$, $p < 0.001$) on the tolerance scores, while age showed no effect ($\Lambda = 0.994$, F = 0.55, 2, 190, $p = 0.58$). The results showed that researchers, environmental agency staff, and municipal employees expressed the highest tolerance, whereas farmers and fish farm owners were the least tolerant. Respondents who had no conflict experience were more accepting than those reporting damage from both species. Participants with university or post-secondary education were significantly more tolerant than those with only high-school or gymnasium education. Univariate tests confirmed that the three factors significantly increased the beaver acceptance scores and otter acceptance scores (all $p < 0.001$). The model accounted for 95% of the variance in beaver acceptance scores ($\eta^2 = 0.95$) and 97% in otter acceptance scores ($\eta^2 = 0.97$).

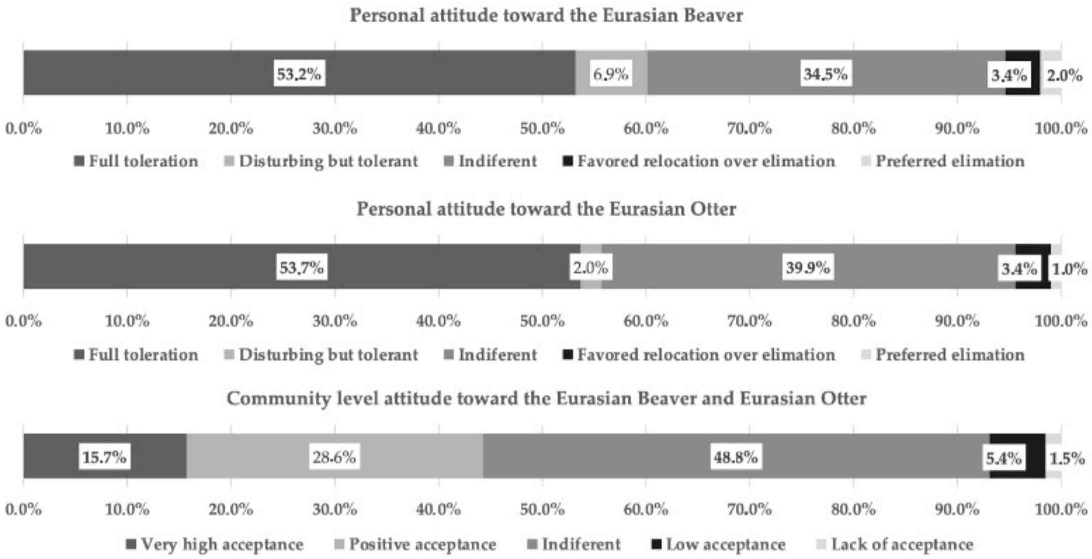

Figure 4. Attitudes toward the two semi-aquatic mammals. Percentage distribution of (**top**) personal attitudes toward the *Eurasian beaver*, (**middle**) personal attitudes toward the Eurasian otter, and (**bottom**) the perceived community-level attitude toward both species combined.

3.2. Institutional Reporting and Forecasted HWC Hotspots

Although an impressive effort was made to distribute the form as widely as possible, being sent to over 1050 town halls, county branches of the Environmental Protection Agencies (APM), branches of the National Agency for Land Reclamation (ANIF), subunits of Romanian Waters Management (SGA), Forestry Administrations, as well as branches of Romanian Railway Company (CFR) and National Road Infrastructure Management Company (CNAIR), only 81 responses were received from city halls (7.7% of the total requests), 4 from SGA, 4 from ANIF, and 27 from APM (66%). Only 19 HWC sites were documented from the respondents in 2024, primarily across localities in Harghita County, with most cases concentrated along tributaries of the Olt River, while the other sites were analyzed through direct field surveys. These incidents represent only beaver-related damage reported during 2024. The recorded impacts included the construction of approximately 241 beaver dams, which contributed to the inundation of adjacent pastures and meadows. The cumulative length of affected watercourses was estimated at around 28.9 km, while the total flooded area reached approximately 213 hectares. Field experts conducted 113 site inspections to verify possible conflict hotspots for beavers, confirming 109 of them, while access was not possible for four locations due to land ownership constraints.

Harghita County shows a concentrated distribution of conflict hotspots (Figure 5), particularly along the upper part of Olt River and its tributaries. The model reveals high-risk zones in areas of low-gradient rivers and intensive agricultural use around Tușnad municipality, where *Eurasian beaver* activity is frequent. Field validations confirmed dam construction and evidence of pasture flooding in multiple locations. The forecasted clusters suggest continued risk in the near Mădăraș, Dănești, and Miercurea Ciuc municipalities.

In Covasna County, the forecast indicates fewer but concentrated conflict clusters (Figure 6), primarily along the Râul Negru River and its tributaries. These areas feature suitable riparian vegetation and are in proximity to farmland, creating favorable conditions for beaver colonization and damming. The conflict risk is particularly elevated in the southern part of the county bordering with Brașov, where Râul Negru meets with Olt, where floodplains and historical wetlands provide ideal habitat. The map shows potential expansion corridors toward the southeast, highlighting areas that may experience increasing pressure.

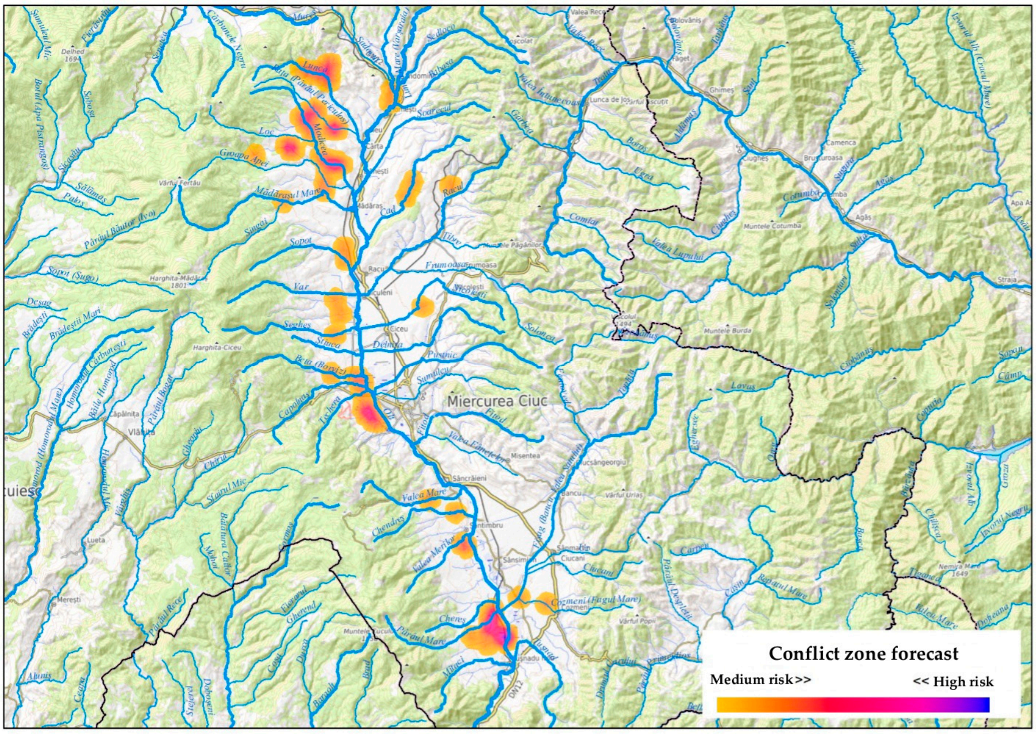

Figure 5. Human–beaver potential conflict zones in Harghita County.

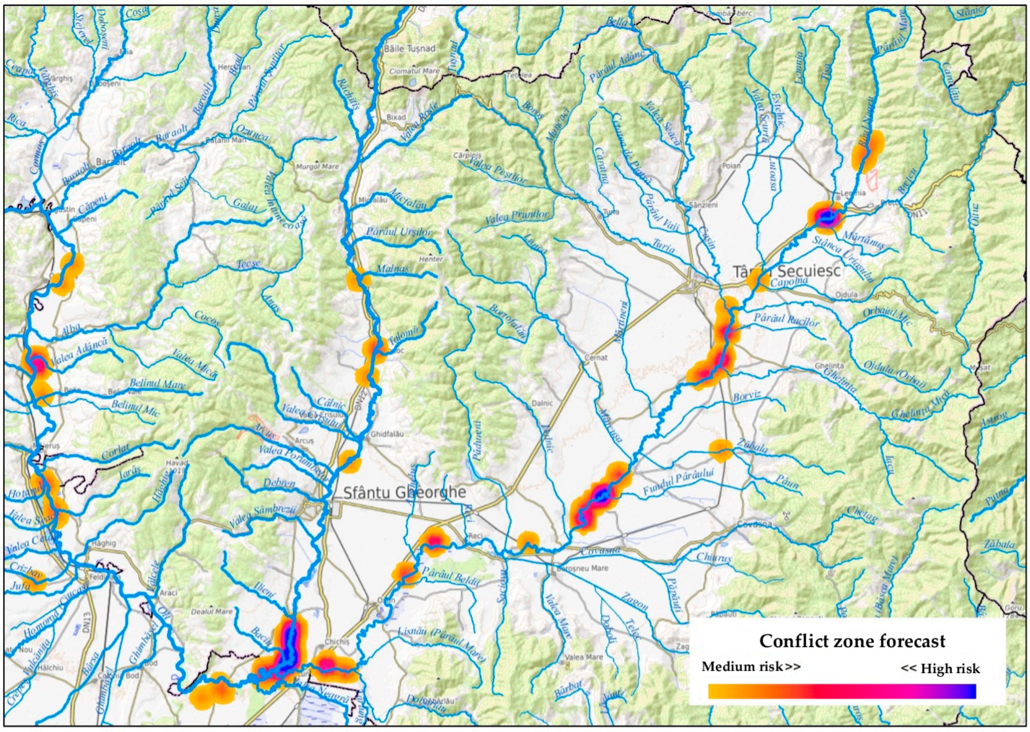

Figure 6. Human–beaver potential conflict zones in Covasna County.

Brașov County presents a broad network of potential conflict areas (Figure 7), particularly around the Olt River's middle basin and its adjacent streams. High-density clusters appear near the cities of Făgăraș and Feldioara, where infrastructure crosses dynamic river corridors. The forecast suggests that expanding beaver populations already reached suburban and peri-urban zones, especially where humans built houses in the vicinity of agricultural landscapes. The presence of canals, levees, and agricultural systems raises the likelihood of economic damage.

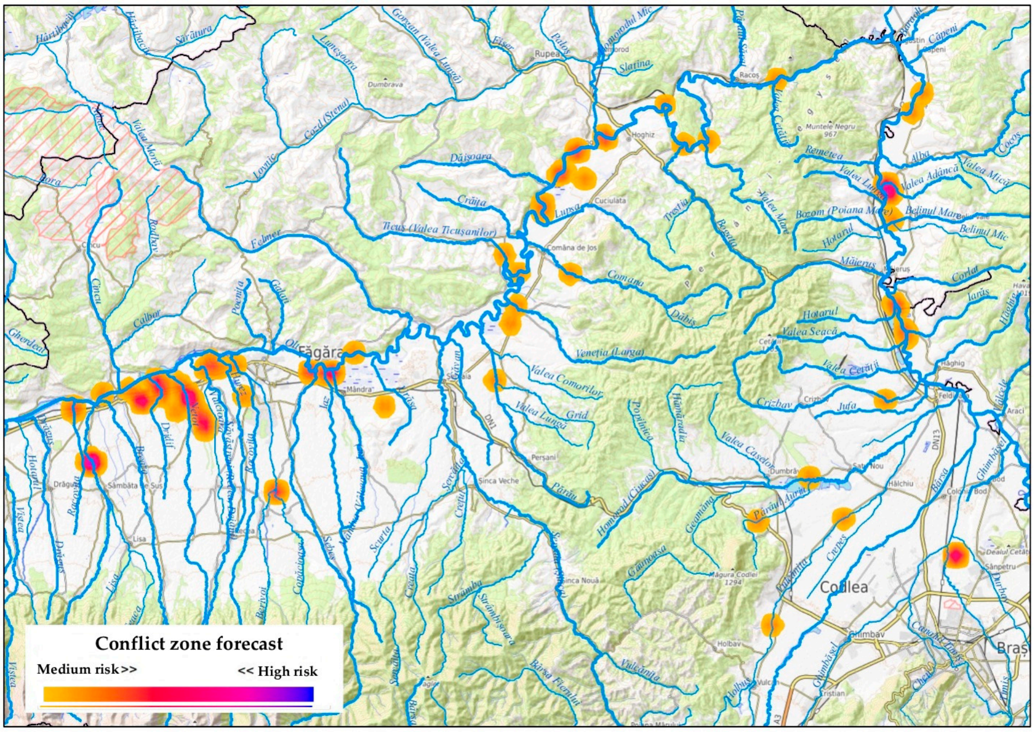

Figure 7. Human–beaver potential conflict zones in Brașov County.

In Sibiu County, conflict forecasts identify medium-to-high-risk zones along the Olt River (Figure 8), especially in the northern half of the county. The clustering of forecast points is linked to gently sloping riverbanks and abundant riparian vegetation. Conflict potential is highest near Avrig and Tălmaciu, where agricultural fields, orchards, and road infrastructure border beaver-accessible waterways. Though fewer in number than in Brașov or Harghita, these sites pose significant risks due to their proximity to important transport routes and economic assets.

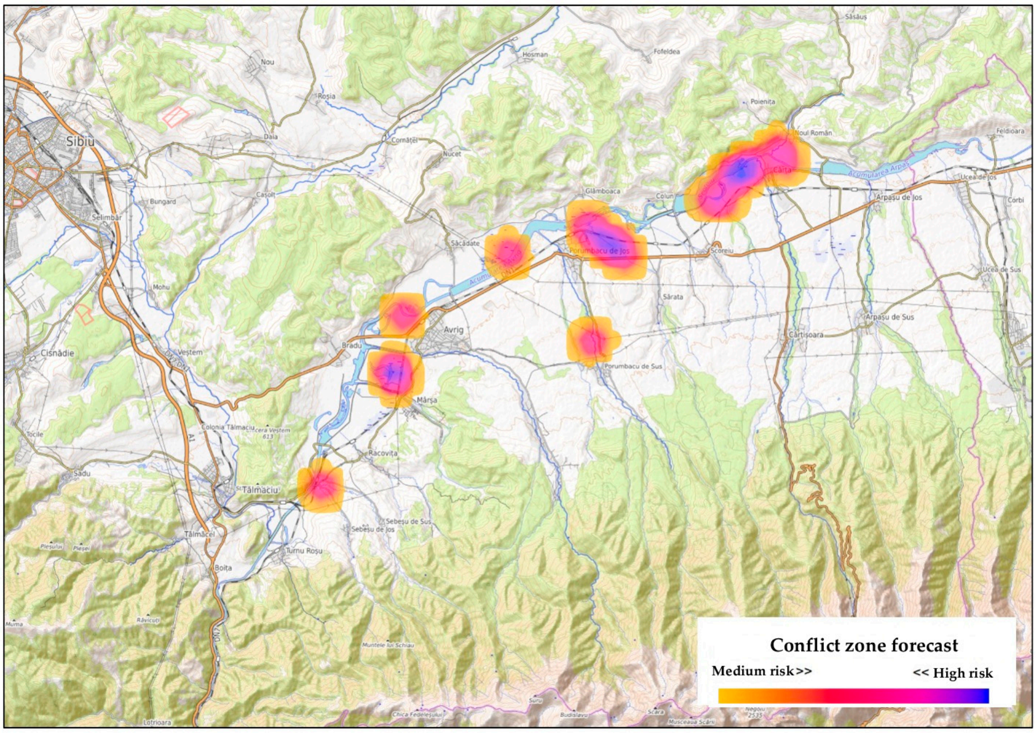

Figure 8. Human–beaver potential conflict zones in Sibiu County.

4. Discussion

The respondent pool was dominated by local students (29.1%) and forestry professionals (12.8%), which might bias the results as the respondents are not evenly distributed. The prevalence of younger and highly educated individuals is noteworthy, as previous studies have shown that these groups consistently express more favorable attitudes toward reintroduced ecosystem engineers such as the beaver, similar to a situation in Greece [69], in contrast to primary production stakeholders like farmers [45,70]. In Southeast England, a similar study found that environmentalists and the general public strongly supported beaver presence, whereas farmers voiced reservations about crop loss and flooding risk [70]. Age also played a significant role: respondents aged <25 and 36–50 together represented almost 70% of the total respondents. Surveys suggest that middle-aged cohorts often hold more utilitarian views of wildlife [71], balancing economic and ecological considerations [60], whereas younger participants tend to prioritize and support biodiversity values [72,73]. The substantial share of 36–50 year olds in the dataset provides a nuanced perspective that partially tempers youthful enthusiasm yet still contrasts with the more conservative age structures reported in rural Poland [53], where the average respondent age exceeded 50 years and tolerance for beaver impacts was markedly lower.

An important percentage of 80.8% of interviewees recognized the strict legal protection of both species, which shows a high knowledge of the species status. Despite this, fewer than one-quarter (23.65%) of participants had experienced direct HWC, which might be an indication that the majority of the respondents did not have any interaction with the species. Even in the case of direct conflict, only 46.9% of the incidents were formally reported, which can be an indicator that the compensation procedure in Romania is not efficient, as is it currently in some parts of the world [74]. The underreporting of HWC events is a widespread issue [66,75], underscoring the necessity of implementing an effective reporting system.

The respondents attributed 23.9% of beaver impacts to land flooding, 18.3% to crop damage, and 15.7% to infrastructure interference. These proportions do not align with compensation files from Warmia–Mazury (Poland), where flooding accounted for 47.7–66.4% of claims between 2009 and 2016 [53]. Crop damage from grazing and direct plant consumption represents a significant type of impact in this study, also observed in the Czech Republic [76] and Norway [77]. Infrastructure damage represented a considerable impact, as beaver activity frequently disrupts roads and hydrotechnical installations, similarly [78]. Otter conflicts were rarer (3.45% of respondents), echoing the species' lower visibility and the prevalence of small-scale aquaculture farmers in the study area. Yet the proportion of compensation requests filed (33%) is higher than that reported for Portuguese marine fish farms, where bureaucratic hurdles and regulations leave most losses uncompensated [41]. In Greece, all stakeholders except commercial fishers preferred compensation over interventions in the case of damage caused by otters [79].

In the conservation process of wildlife, it has been found that tolerance plays a critical role in ameliorating HWC [80]. Positive attitudes toward both mammals dominated (≥77% acceptance). This might be explained also by the species traits, as they do not directly threaten human life, and their traits might be "charismatic" and thus gain more support [81] compared to low acceptance levels toward carnivores [82,83].

The tolerance of humans toward wildlife species can be defined as "the ability and willingness of an individual to absorb the extra potential or actual costs of living with wildlife" [84], and this aspect remains an important element in the context of Human-Wildlife coexistence. The fuzzy cognitive map (FCM) [85] reframes coexistence with the protected semi-aquatic species as the product of interacting and interlinked processes (Figure 9). When beaver populations settle in an area, they begin building dams [86], which in turn impound water and floods adjacent lands and infrastructures. This flooding can create problems in terms of land use activities such as agriculture and forestry, generating direct economic costs that are experienced as monetary losses by local stakeholders, from farmers to forestry managers. These losses escalate social confrontation between wildlife managers and land owners, thereby intensifying HWC and degrading the tolerance toward coexistence [87]. A counter-acting structure originates from the animals' positive ecological functions toward the ecosystem services. Beaver dam-building simultaneously creates wetland habitat, elevates groundwater, and diversifies and enriches aquatic microhabitats and biodiversity [25,86,88], while otter presence signals improved trophic integrity and water purification [89,90]. Collectively, these ecosystem service flows enhance biodiversity and nutrient cycling and provide landscape resilience, benefits that once recognized raise the overall social acceptance and tolerance of both species. Increased acceptance then feeds back to the conflict intensity, forming a balancing loop that can stabilize coexistence with the involvement of stakeholders.

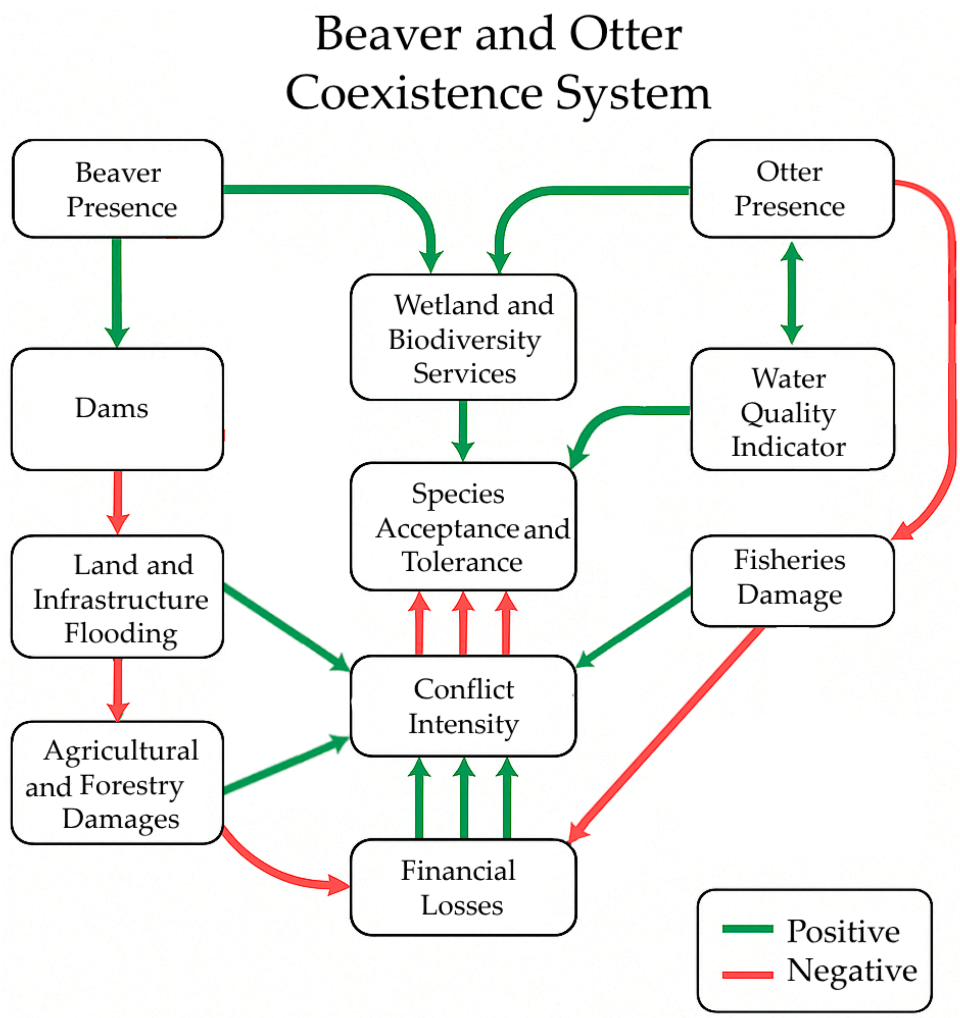

Figure 9. Fuzzy cognitive map illustrating the socio-ecological drivers of conflict and coexistence between beavers and otters.

Positioning economic loss generation and ecosystem services as competing forces of HWC [91] reveals three main avenues for interventions. The first approach is to showcase and reward the hidden benefits of healthy wetlands and richer wildlife communities. Programs such as payments for ecosystem services [24] and biodiversity credits [92] can help make this advantage visible and valuable to society. The second approach targets the physical impacts that drive costs. Installing flow control devices [93,94] on troublesome beavers' dams and installing gears in fisheries that prevent otters help reduce economic losses [41,95]. The third approach offers direct financial incentives through streamlined compensation schemes. Prompt payments that are easy to obtain and require minimal bureaucratic paperwork encourage landowners to tolerate and even support the presence [74] of beavers and otters. When preventive measures and clear, well-communicated control procedures are paired with compensation schemes, dampening the negative feedback loop that fuels conflict and amplifying the positive loop that builds public support, giving beavers, otters, and local communities a better chance to coexist.

Spatially explicit Human-Wildlife conflict (HWC) forecast maps were produced for Harghita, Covasna, Brașov, and Sibiu, counties along the Olt River, showing the area's most at risk so action can be taken in advance. By modeling conflict hotspots [96], authorities and local communities can shift from reactive responses to proactive strategies [97,98], allocating occasional check-ups of the highlighted areas, installing preventive mitigation devices, and planning outreach before incidents occur. When embedded in regional planning and conservation frameworks, these maps enable a prime step into the development of integrated early-warning systems [99] and can also guide land use and infrastructure decisions to not deter with the studied species, which are listed under Annex II and Annex IV of the EU Habitats Directive [11]. Because the focal species in this study are protected under European legislation, every action with the potential to affect them or their habitats must be carefully evaluated [100]; thus, conflict and distribution maps become essential and necessary for decision tools that align development with conservation goals and also develop a long-term culture of coexistence [101]. Coupled with species distribution models, the maps also reveal probable expansion corridors by merging municipal damage reports with expert-validated field data [102,103], similar to the ones developed for the Negru River [28]. The resulting GIS layers highlight peri-urban watercourses where preventive installations, such as flow pipes or pond levelers [93,94], could reduce future damage at minimal ecological cost. While this approach is well advanced for beavers, comparable conflict forecasting for otters remains underdeveloped, underscoring the need to extend the same spatially explicit methodology to additional protected species and commercial fisheries.

This study has several limitations that should be considered when interpreting the findings. The use of online surveys likely introduced sampling bias by favoring younger, more technologically literate individuals, potentially leading to an overrepresentation of positive wildlife attitudes [104] and the drawing in of additional residents whose views on wildlife were not entirely objective. To improve representativeness, future research should include in-person interviews, particularly targeting subsistence farmers, aquaculture operators, and rural communities from the conflict zone. The temporal scope of the data collection, limited to a single year (2024), constrains the ability to observe seasonal variation in conflict intensity or changes in public perception over time, especially to cover years with high precipitation levels. Longitudinal studies would provide a clearer understanding of these dynamics as beaver populations expand. Additionally, institutional participation was limited, with only 7.7% of the contacted municipalities submitting the standardized reporting form, which reduced the statistical power for validating conflict prediction models.

Future studies should span several years and use detailed environmental data such as LiDAR-based terrain models and hydrological measurements to refine conflict forecasts and capture seasonal patterns, and the same spatial modeling approach should be extended to otters and other protected species while adding assessments of ecosystem services to provide more balanced, evidence-based decisions at Human-Wildlife boundaries.

5. Conclusions

By integrating stakeholder surveys, institutional damage reports, and expert-validated field checks, this study identified current and emerging Human-Wildlife conflict (HWC) hotspots involving the *Eurasian beaver* and Eurasian otter within Romania's Olt River basin. The attitudes of local communities, institutions, and other stakeholders are essential for fostering coexistence with protected species. While HWCs may arise, maintaining accessible and constructive coexistence remains crucial. Conflict forecast maps can serve as the foundation for an integrated early warning system, to not only prevent and manage damage but also inform the development of effective management strategies and regulations for both fauna and flora. Ultimately, combining social perception data with fine-scale GIS-based forecasts provides a replicable approach to support future conservation goals and promote sustainable coexistence between humans and wildlife.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/d17080559/s1, Table S1—Standardised form; Text S1—Sample questionnaire.

Author Contributions: Conceptualization: A.G., G.I. and O.I.; data curation: A.G. and C.P.; funding acquisition: G.I. and O.I.; investigation: A.G., C.P. and O.I.; methodology: A.G., C.P. and C.S.; resources: A.G., C.P. and G.I.; software: G.S. and D.H.; supervision: G.I. and O.I.; validation: A.G. and C.P.; visualization: C.P. and C.S.; writing—original draft: A.G., G.I., O.I. and D.H.; writing—review and editing: A.G., C.P., G.I., G.S., C.S., O.I. and D.H. All authors have read and agreed to the published version of the manuscript.

Funding: This research acknowledges the support received from the Romanian Ministry of Research and the Innovation and Digitalization funds PN23090304 (12N/1 January 2023), and the APC was funded through the National Institute for Research and Development in Forestry "Marin Drăcea".

Institutional Review Board Statement: Not applicable.

Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available due to project requirements.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. Izmailova, A.V.; Korneenkova, N.Y. Water Resources of Natural and Artificial Water Bodies in Europe. *Water Resour.* **2022**, *49*, 1–9. [CrossRef]
2. Irfan, S.; Alatawi, A.M.M.; Irfan, S.; Alatawi, A.M.M. Aquatic Ecosystem and Biodiversity: A Review. *Open J. Ecol.* **2019**, *9*, 1–13. [CrossRef]
3. Sánchez-Montoya, M.M.; Moleón, M.; Sánchez-Zapata, J.A.; Escoriza, D. The Biota of Intermittent and Ephemeral Rivers: Amphibians, Reptiles, Birds, and Mammals. In *Intermittent Rivers and Ephemeral Streams: Ecology and Management*; Academic Press: Cambridge, MA, USA, 2017; pp. 299–322.
4. Glynnis, H. *Semi-Aquatic Mammals: Ecology and Biology*; Johns Hopkins University Press: Baltimore, MD, USA, 2020.
5. Mortensen, R.M.; Reinhardt, S.; Hjønnevåg, M.E.; Wilson, R.P.; Rosell, F. Aquatic habitat use in a semi-aquatic mammal: The *Eurasian beaver*. *Anim. Biotelemetry* **2021**, *9*, 35. [CrossRef]
6. Macdonald, S.M.; Mason, C.F. Some factors influencing the distribution of otters (*Lutra lutra*). *Mamm. Rev.* **1983**, *13*, 1–10. [CrossRef]
7. Lister, A.M. Speciation and evolutionary trends in Quaternary vertebrates. In *Reference Module in Earth Systems and Environmental Sciences*; Elsevier: Amsterdam, The Netherlands, 2023.
8. Uehlinger, U.; Arndt, H.; Wantzen, K.M.; Leuven, R.S.E.W. The Rhine River Basin. In *Rivers of Europe*; Elsevier: Amsterdam, The Netherlands, 2009; pp. 199–245.
9. Gethöffer, F.; Siebert, U. Current knowledge of the Neozoa, Nutria and Muskrat in Europe and their environmental impacts. *J. Wildl. Biodivers.* **2020**, *4*, 1–12.
10. Irving, L. Aquatic Mammals. In *Comparative Physiology of Thermoregulation*; Whittow, G.C., Ed.; Academic Press: Cambridge, MA, USA, 1973; pp. 47–96.

11. Council of the European Communities. Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora. *Off. J. Eur. Community* **1992**, *206*, 7–50.
12. Nolet, B.A.; Rosell, F. Comeback of the beaver Castor fiber: An overview of old and new conservation problems. *Biol. Conserv.* **1998**, *83*, 165–173. [CrossRef]
13. Burdock, G.A. Safety assessment of castoreum extract as a food ingredient. *Int. J. Toxicol.* **2007**, *26*, 51–55. [CrossRef]
14. Treves, A.; Comino, E. A bibliometric literature review in beaver management: When does the beaver become a resource? *Mamm. Rev.* **2024**, *54*, 213–228. [CrossRef]
15. Paderewski, J.; Sienkiewicz-Paderewska, D. Long-term dynamics, distribution, and protection of the *Eurasian beaver* Castor fiber in Poland. *J. Water Land Dev.* **2025**, 155–162. [CrossRef]
16. Nolet, B. *Management of the Beaver (Castor Fiber): Towards Restoration of Its Former Distribution and Ecological Function in Europe*; Council of Europe: Strasbourg, France, 1997.
17. Campbell-Palmer, R.; Gow, D.; Campbell, R.; Dickinson, H.; Girling, S.; Gurnell, J.; Halley, D.; Jones, S.; Lisle, S.; Parker, H.; et al. *The Eurasian Beaver Handbook*; Pelagic Publishing: London, UK, 2016.
18. Dijkstra, V.A.A. Reintroduction of the Beaver, Castor Fiber, in The Netherlands. In *Beaver Protection, Management, and Utilization in Europe and North America*; Springer: New York, NY, USA, 1999; pp. 15–16.
19. Halley, D.J.; Jones, A.L.; Chesworth, S.; Hall, C.; Gow, D.; Jones-Parry, R.; Walsh, J. *The Reintroduction of the Eurasian Beaver Castor Fiber to Wales: An Ecological Feasibility Study*; NINA Report 457; Norsk Institutt for Naturforskning: Trondheim, Norway, 2015; 66p.
20. Gaywood, M.J. Reintroducing the *Eurasian beaver* Castor fiber to Scotland. *Mamm. Rev.* **2018**, *48*, 48–61. [CrossRef]
21. Kitchener, A.C.; Conroy, J.W.H. The history of the Eurasian Beaver Castor fiber in Scotland. *Mamm. Rev.* **1997**, *27*, 95–108. [CrossRef]
22. Ionescu, G.; Ionescu, O.; Pasca, C.; Visan, D. *Castorul in Romania*; Editura Silvica: Bucharest, Romania, 2010.
23. Ionescu, G.; Troidl, C. Beaver project Romania—A reintroduction with special focus on antropic factors. In Proceedings of the European Beaver Symposium, Bratislava, Slovakia, 15–19 September 1997.
24. Thompson, S.; Vehkaoja, M.; Pellikka, J.; Nummi, P. Ecosystem services provided by beavers *Castor* spp. *Mamm. Rev.* **2021**, *51*, 25–39.
25. Law, A.; Mclean, F.; Willby, N.J. Habitat engineering by beaver benefits aquatic biodiversity and ecosystem processes in agricultural streams. *Freshw. Biol.* **2016**, *61*, 486–499. [CrossRef]
26. Lorimer, J. Worlding and weirding with beaver: A more-than-human political ecology of ecosystem engineering. *Trans. Inst. Br. Geogr.* **2025**, *50*, e12698. [CrossRef]
27. Auster, R.E.; Barr, S.W.; Brazier, R.E. Beavers and flood alleviation: Human perspectives from downstream communities. *J. Flood Risk Manag.* **2022**, *15*, e12789. [CrossRef]
28. Gridan, A.; Ionescu, O.; Ionescu, G.; Fedorca, A.; Ciocirlan, E.; Pașca, C.; Hardalau, D. The Ecological Impacts and Modeling of the Beaver Dam Distribution: A Study on Habitat Characteristics and Environmental Factors in Romania. *Ecologies* **2025**, *6*, 34. [CrossRef]
29. Parker, J.D.; Caudill, C.C.; Hay, M.E. Beaver herbivory on aquatic plants. *Oecologia* **2007**, *151*, 616–625. [CrossRef] [PubMed]
30. García-Silva, O.; Gallo-Reynoso, J.P.; Bucio-Pacheco, M.; Medrano-López, J.M.; Meza-Inostroza, P.M.; Grave-Partida, R.A.; García-Silva, O.; Gallo-Reynoso, J.P.; Bucio-Pacheco, M.; Medrano-López, J.M.; et al. Neotropical otter diet variation between a lentic and a lotic systems. *Therya* **2021**, *12*, 93–103. [CrossRef]
31. Almeida, D.; Copp, G.H.; Masson, L.; Miranda, R.; Murai, M.; Sayer, C.D. Changes in the diet of a recovering Eurasian otter population between the 1970s and 2010. *Aquat. Conserv.* **2012**, *22*, 26–35. [CrossRef]
32. Conroy, J.W.H.; Yoxon, P.; Gutleb, A.C. The status of the Eurasian otter (*Lutra lutra*) in Europe—A review. In Proceedings of the First Otter Toxicology Conference No 1, Skye, Scotland, 21–25 September 2000.
33. Rehbein, M. From Historical Archives to Algorithms: Reconstructing Biodiversity Patterns in 19th Century Bavaria. *Diversity* **2025**, *17*, 315. [CrossRef]
34. Manzoor, M.; Bhat, K.A.; Khurshid, N.; Yatoo, A.M.; Zaheen, Z.; Ali, S.; Ali, M.N.; Amin, I.; Mir, M.U.R.; Rashid, S.M.; et al. Bio-Indicator Species and Their Role in Monitoring Water Pollution. In *Freshwater Pollution and Aquatic Ecosystems*; Apple Academic Press: New York, NY, USA, 2021; pp. 321–347.
35. Lee, C.; Luan, X. A Review on Eurasian Otters in Urban Areas: Principles for the Enhancement of Biodiversity. *Diversity* **2025**, *17*, 356. [CrossRef]
36. Yoxon, P.; Yoxon, B. Eurasian otter (*Lutra lutra*): A Review of the current world status. *J. Int. Otter Surviv. Fund* **2019**, *5*, 53–73.
37. Roos, A.; Loy, A.; de Silva, P.; Hajkova, P.; Zemanova, B. *Lutra lutra*. The IUCN Red List of Threatened Species. June 2015. Available online: https://www.iucnredlist.org/species/12419/21935287 (accessed on 5 June 2019).
38. Bifolchi, A.; Lodé, T. Efficiency of conservation shortcuts: An investigation with otters as umbrella species. *Biol. Conserv.* **2005**, *126*, 523–527. [CrossRef]

39. Koelewijn, H.P.; Pérez-Haro, M.; Jansman, H.A.H.; Boerwinkel, M.C.; Bovenschen, J.; Lammertsma, D.R.; Niewold, F.J.J.; Kuiters, A.T. The reintroduction of the Eurasian otter (*Lutra lutra*) into the Netherlands: Hidden life revealed by noninvasive genetic monitoring. *Conserv. Genet.* **2010**, *11*, 601–614. [CrossRef]
40. Saavedra Bendito, D. Reintroduction of the Eurasian otter (*Lutra lutra*) in Muga and Fluvià basins (north-eastern Spain): Viability, development, monitoring and trends of the new population. Ph.D. Thesis, University of Girona, Girona, Spain, June 2003; p. 218.
41. Santos-Reis, M.; Santos, R.; Antunes, P.; Sales-Luís, T.; Gomes, J.; Freitas, D.; Madruga, L. Reconciliation of the Conflict Between Otters and Fish Farmers. In *Environmental Science and Engineering*; Springer: Berlin/Heidelberg, Germany, 2013; pp. 49–79.
42. Vaclavikova, M.; Vaclavik, T.; Kostkan, V. Otters vs. fishermen: Stakeholders' perceptions of otter predation and damage compensation in the Czech Republic. *J. Nat. Conserv.* **2011**, *19*, 95–102. [CrossRef]
43. Kloskowski, J. Otter *Lutra lutra* damage at farmed fisheries in southeastern Poland, I: An interview survey. *Wildl. Biol.* **2005**, *11*, 201–206. [CrossRef]
44. Hohm, M.; Moesch, S.S.; Bahm, J.; Haase, D.; Jeschke, J.M.; Balkenhol, N. Reintroduced, but not accepted: Stakeholder perceptions of beavers in Germany. *People Nat.* **2024**, *6*, 1681–1695. [CrossRef]
45. Auster, R.E.; Barr, S.W.; Brazier, R.E. Improving engagement in managing reintroduction conflicts: Learning from beaver reintroduction. *J. Environ. Plan. Manag.* **2020**, *64*, 1713–1734. [CrossRef]
46. Viviano, A.; Auster, R.E.; Mazza, G.; Lagrotteria, A.; Pucci, C.; Senserini, D.; Campbell-Palmer, R.; Needham, R.; Curci, D.; Mori, E. *Eurasian beavers* in Central Italy: Perceptions in the local community. *Naturwissenschaften* **2023**, *110*, 30. [CrossRef] [PubMed]
47. Holmes, G.; Rowland, G.; Fox, K. Eager about beavers? Understanding opposition to species reintroduction, and its implications for conservation. *People Nat.* **2024**, *6*, 1524–1537. [CrossRef]
48. Freitas, D.; Gomes, J.; Luis, T.S.; Madruga, L.; Marques, C.; Baptista, G.; Rosalino, L.M.; Antunes, P.; Santos, R.; Santos-Reis, M. Otters and fish farms in the Sado estuary: Ecological and socio-economic basis of a conflict. *Hydrobiologia* **2007**, *587*, 51–62. [CrossRef]
49. Špur, N.; Gomboc, K.Ž.; Šorgo, A. Public acceptability of measures to prevent from predation on commercial fish by the endangered Eurasian otter (*Lutra lutra*) in Natura 2000. *J. Nat. Conserv.* **2018**, *44*, 21–32. [CrossRef]
50. Morzillo, A.T.; Needham, M.D. Landowner Incentives and Normative Tolerances for Managing Beaver Impacts. *Hum. Dimens. Wildl.* **2015**, *20*, 514–530. [CrossRef]
51. Taylor, J.D.; Singleton, R.D. The evolution of flow devices used to reduce flooding by beavers: A review. *Wildl. Soc. Bull.* **2014**, *38*, 127–133. [CrossRef]
52. Ulicsni, V.; Babai, D.; Juhász, E.; Molnár, Z.; Biró, M. Local knowledge about a newly reintroduced, rapidly spreading species (*Eurasian beaver*) and perception of its impact on ecosystem services. *PLoS ONE* **2020**, *15*, e0233506. [CrossRef]
53. Janiszewski, P.; Hermanowska, Z. Damage Caused by the European Beaver (*Castor Fiber* L.) in Agricul-tural and Forest Farms in View of Selected Atmospheric Factors and Animal Behavior. *Appl. Ecol. Environ. Res.* **2019**, *17*, 15633–15642. [CrossRef]
54. Graham, H.A.; Puttock, A.; Macfarlane, W.W.; Wheaton, J.M.; Gilbert, J.T.; Campbell-Palmer, R.; Elliott, M.; Gaywood, M.J.; Anderson, K.; Brazier, R.E. Modelling *Eurasian beaver* foraging habitat and dam suitability, for predicting the location and number of dams throughout catchments in Great Britain. *Eur. J. Wildl. Res.* **2020**, *66*, 42. [CrossRef]
55. Maringer, A.; Slotta-Bachmayr, L. A GIS-based habitat-suitability model as a tool for the management of beavers Castor fiber. *Acta Theriol.* **2006**, *51*, 373–382. [CrossRef]
56. Hardalau, D.; Codrean, C.; Iordache, D.; Fedorca, M.; Ionescu, O. The Expanding Thread of Ungulate Browsing—A Review of Forest Ecosystem Effects and Management Approaches in Europe. *Forests* **2024**, *15*, 1311. [CrossRef]
57. Hardalau, D.; Fedorca, M.; Popovici, D.-C.; Ionescu, G.; Fedorca, A.; Mirea, I.; Daniel, I.; Ionescu, O. Insights in Managing Ungulates Population and Forest Sustainability in Romania. *Diversity* **2025**, *17*, 194. [CrossRef]
58. Anthony, B.; Moldovan, D. Poised for engagement? Local communities and Măcin Mountains National Park, Romania. *Int. J. Biodivers. Sci. Manag.* **2008**, *4*, 230241. [CrossRef]
59. Popovici, D.C.; Ionescu, O.; Ionescu, G.; Hardalau, D. Two Decades of Expansion: Population Dynamics and Spatial Distribution of the Golden Jackal in Romania between 2004–2025. *Bull. Transilv. Univ. Brasov. Ser. II For. Wood Ind. Agric. Food Eng.* **2025**, *18*, 41–54. [CrossRef]
60. Stăncioiu, P.T.; Dutcă, I.; Bălăcescu, M.C.; Ungurean, Ş.V. Coexistence with Bears in Romania: A Local Community Perspective. *Sustainability* **2019**, *11*, 7167. [CrossRef]
61. Cimpoca, A.; Voiculescu, M. Patterns of Human–Brown Bear Conflict in the Urban Area of Brașov, Romania. *Sustainability* **2022**, *14*, 7833. [CrossRef]
62. Salvatori, V.; Mertends, A. Damage prevention methods in Europe: Experiences from LIFE nature projects. *Assoc. Teriologica Ital.* **2012**, *23*, 73–79.
63. Geacu, S. Damage incurred by the big carnivorous mammals on Romania territory over 1940–1950. *Revista de Silvicultură și Cinegetică* **2017**, *22*, 98–102.

64. Anthony, B.P.; Szabo, A. Protected Areas: Conservation Cornerstones or Paradoxes? Insights from Human-Wildlife Conflicts in Africa and Southeastern Europe. In *The Importance of Biological Interactions in the Study of Biodiversity*; IntechOpen: London, UK, 2011.
65. Treves, A.; Wallace, R.B.; Naughton-Treves, L.; Morales, A. Co-Managing Human-Wildlife Conflicts: A Review. *Hum. Dimens. Wildl.* **2006**, *11*, 383–396. [CrossRef]
66. Nyhus, P.J. Human-Wildlife Conflict and Coexistence. *Annu. Rev. Environ. Resour.* **2016**, *41*, 143–171. [CrossRef]
67. König, H.J.; Kiffner, C.; Kramer-Schadt, S.; Fürst, C.; Keuling, O.; Ford, A.T. Human-Wildlife coexistence in a changing world. *Conserv. Biol.* **2020**, *34*, 786–794. [CrossRef]
68. Patterson, M.E.; Montag, J.M.; Williams, D.R. The urbanization of wildlife management: Social science, conflict, and decision making. *Urban For. Urban Green.* **2003**, *1*, 171–183. [CrossRef]
69. Liordos, V.; Kontsiotis, V.J.; Georgari, M.; Baltzi, K.; Baltzi, I. Public acceptance of management methods under different Human-Wildlife conflict scenarios. *Sci. Total Environ.* **2017**, *579*, 685–693. [CrossRef]
70. Oliveira, S.; Buckley, P.; Consorte-McCrea, A. A glimpse of the long view: Human attitudes to an established population of *Eurasian beaver* (castor fiber) in the lowlands of south-east England. *Front. Conserv. Sci.* **2022**, *3*, 925594. [CrossRef]
71. Li, M.; Jiang, W.; Li, B.; Butt, N. Social and cultural aspects of Human-Wildlife conflicts: Understanding people's attitudes to crop-raiding animals and other wildlife in agricultural systems of the Tibetan Plateau. *Integr. Conserv.* **2023**, *2*, 214–225. [CrossRef]
72. Seddon, P.J.; van Heezik, Y. Reintroductions to 'Ratchet Up' Public Perceptions of Biodiversity. In *Ignoring Nature No More*; University of Chicago Press: Chicago, IL, USA, 2015; pp. 137–152.
73. Hermann, N.; Menzel, S. Threat Perception and Attitudes of Adolescents Towards Re-Introduced Wild Animals: A qualitative study of young learners from affected regions in Germany. *Int. J. Sci. Educ.* **2013**, *35*, 3062–3094. [CrossRef]
74. Ravenelle, J.; Nyhus, P.J. Global patterns and trends in Human-Wildlife conflict compensation. *Conserv. Biol.* **2017**, *31*, 1247–1256. [CrossRef]
75. Dickman, A.J.; Macdonald, E.A.; Macdonald, D.W. A review of financial instruments to pay for predator conservation and encourage human-carnivore coexistence. *Proc. Natl. Acad. Sci. USA* **2011**, *108*, 13937–13944. [CrossRef] [PubMed]
76. Mikulka, O.; Homolka, M.; Drimaj, J.; Kamler, J. European beaver (Castor fiber) in open agricultural landscapes: Crop grazing and the potential for economic damage. *Eur. J. Wildl. Res.* **2020**, *66*, 101. [CrossRef]
77. Lodberg-Holm, H.K.; Garvik, E.S.; Fountain, M.S.; Reinhardt, S.; Rosell, F. Crop circles revealed spatio-temporal patterns of beaver foraging on cereal fields. *Agric. Ecosyst. Environ.* **2022**, *337*, 108066. [CrossRef]
78. Hood, G.A.; Manaloor, V.; Dzioba, B. Mitigating infrastructure loss from beaver flooding: A cost–benefit analysis. *Hum. Dimens. Wildl.* **2018**, *23*, 146–159. [CrossRef]
79. Liordos, V.; Kontsiotis, V.J.; Nevolianis, C.; Nikolopoulou, C.E. Stakeholder preferences and consensus associated with managing an endangered aquatic predator: The Eurasian otter (*Lutra lutra*). *Hum. Dimens. Wildl.* **2019**, *24*, 446–462. [CrossRef]
80. Digun-Aweto, O.; Van Der Merwe, P.; Saayman, M. Tolerance factors in human-wildlife conflicts in protected areas: The case of Cross River National Park, Cross River State Nigeria. *GeoJournal* **2022**, *87*, 349–361. [CrossRef]
81. Liordos, V.; Kontsiotis, V.J.; Anastasiadou, M.; Karavasias, E. Effects of attitudes and demography on public support for endangered species conservation. *Sci. Total Environ.* **2017**, *595*, 25–34. [CrossRef] [PubMed]
82. Newsom, A.; Lozano, J.; Martín-López, B. Social perceptions of carnivores across the globe—A literature review. *Hum. Dimens. Wildl.* **2025**. [CrossRef]
83. Kleiven, J.; Bjerke, T.; Kaltenborn, B.P. Factors influencing the social acceptability of large carnivore behaviours. *Biodivers. Conserv.* **2004**, *13*, 1647–1658. [CrossRef]
84. Kansky, R.; Kidd, M.; Knight, A.T. A wildlife tolerance model and case study for understanding human wildlife conflicts. *Biol. Conserv.* **2016**, *201*, 137–145. [CrossRef]
85. Kosko, B. Fuzzy cognitive maps. *Int. J. Man. Mach. Stud.* **1986**, *24*, 65–75. [CrossRef]
86. Larsen, A.; Larsen, J.R.; Lane, S.N. Dam builders and their works: Beaver influences on the structure and function of river corridor hydrology, geomorphology, biogeochemistry and ecosystems. *Earth. Sci. Rev.* **2021**, *218*, 103623. [CrossRef]
87. Serenari, C. Beyond Tolerance: Mitigating Human-Wildlife Conflict with Hospitality. *Animals* **2024**, *14*, 1185. [CrossRef]
88. Zhu, D.; Yu, S. Building Ecosystems: The Transformative Role of Beavers. *Biol. Evid.* **2024**, *14*, 172–183. [CrossRef]
89. Narváez, M.; Cabezas, S.; Blanco-Garrido, F.; Baos, R.; Clavero, M.; Delibes, M. Eurasian otter (*Lutra lutra*) diet as an early indicator of recovery in defaunated river communities. *Ecol. Indic.* **2020**, *117*, 106547. [CrossRef]
90. Bedford, S.J. The effects of riparian habitat quality and biological water quality on the European Otter (*Lutra lutra*) in Devon. *Biosci. Horiz. Int. J. Stud. Res.* **2009**, *2*, 125–133. [CrossRef]
91. Fletcher, R.; Massarella, K.; Ferraz, K.M.P.M.B.; Kiwango, W.A.; Komi, S.; Mabele, M.B.; Marchini, S.; Nygren, A.; Sandroni, L.T.; Alagona, P.S.; et al. The production-protection nexus: How political-economic processes influence prospects for transformative change in human-wildlife interactions. *Glob. Environ. Change* **2023**, *82*, 102723. [CrossRef]

92. Bruggeman, D.J.; Jones, M.L.; Lupi, F.; Scribner, K.T. Landscape Equivalency Analysis: Methodology for estimating spatially explicit biodiversity credits. *Environ. Manag.* **2005**, *36*, 518–534. [CrossRef]
93. Laramie, H.A. A Device for Control of Problem Beavers. *J. Wildl. Manag.* **1963**, *27*, 471. [CrossRef]
94. Simon, L.J.; Org, E. Solving Beaver Flooding Problems through the Use of Water Flow Control Devices. *Proc. Vertebr. Pest Conf.* **2006**, *22*, 22. [CrossRef]
95. Sales-Luís, T.; Freitas, D.; Santos-Reis, M. Key landscape factors for Eurasian otter *Lutra lutra* visiting rates and fish loss in estuarine fish farms. *Eur. J. Wildl. Res.* **2009**, *55*, 345–355. [CrossRef]
96. Miller, J.R.B. Mapping attack hotspots to mitigate human–carnivore conflict: Approaches and applications of spatial predation risk modeling. *Biodivers. Conserv.* **2015**, *24*, 2887–2911. [CrossRef]
97. Spencer, R.D.; Beausoleil, R.A.; Martorello, D.A. How Agencies Respond to Human–black Bear Conflicts: A Survey of Wildlife Agencies in North America. *Ursus* **2007**, *18*, 217–229. [CrossRef]
98. Madden, F.; McQuinn, B. Conservation's blind spot: The case for conflict transformation in wildlife conservation. *Biol. Conserv.* **2014**, *178*, 97–106. [CrossRef]
99. Quansah, J.E.; Engel, B.; Rochon, G.L. Early Warning Systems: A Review. *J. Terr. Obs.* **2010**, *2*, 2.
100. Trouwborst, A. Conserving European Biodiversity in a Changing Climate: The Bern Convention, the European Union Birds and Habitats Directives and the Adaptation of Nature to Climate Change. *Rev. Eur. Community Int. Environ. Law* **2011**, *20*, 62–77. [CrossRef]
101. Pasca, C.; Ionescu, G.; Fedorca, A.; Jurj, R.; Sirbu, G.; Popa, M.; Gridan, A.; Ionescu, O. Beaver management in Romania between challenges and perspectives. The National Action Plan for the Conservation of the *Eurasian beaver* population (*Castor fiber* L.)—Synthesis. *Rev. Silv. Cinegetică* **2022**, *50*, 109–118.
102. Hofmann, D.D.; Behr, D.M.; McNutt, J.W.; Ozgul, A.; Cozzi, G. Bound within boundaries: Do protected areas cover movement corridors of their most mobile, protected species? *J. Appl. Ecol.* **2021**, *58*, 1133–1144. [CrossRef]
103. Wikar, Z.; Ciechanowski, M. Beaver Dams and Fallen Trees as Ecological Corridors Allowing Movements of Mammals across Water Barriers—A Case Study with the Application of Novel Substrate for Tracking Tunnels. *Animals* **2023**, *13*, 1302. [CrossRef]
104. Vaske, J.J.; Carlos, A.W.D.; Manfredo, M.J.; Teel, T.L. Evaluating alternative survey methodologies in human dimensions of wildlife research. *Hum. Dimens. Wildl.* **2023**, *28*, 320–334. [CrossRef]