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Mapping biodiversity and cultural values complemented with understanding of social dynamics provides effective means for addressing opportunities for nature conservation in a cultural landscape

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The ecosystem services framework can usefully complement biodiversity assessments in developing socially robust nature conservation strategies in protected areas and beyond. However, there is still little research, especially in Eastern Europe, which links biodiversity assessment and nature related values to the deeper social-economic dynamics and aspirations existing in the local communities. Here we address this knowledge gap with a study case from Romania. We used data from a thorough biodiversity survey to map the protected species and habitats in a Natura 2000 area. Then we used participatory mapping with key local community representatives to understand the type of values linking the local community with the protected area, distinguishing between the past (1960's-1989 period) and present. We identified that socio-economic and cultural values were strong and synergistically manifested in the past but not in the present. A dramatic abandonment of land use practices was reported. The current distribution of protected species and habitats does not overlap with the farmed areas in the past and present. Interviewees report that the local community went through dramatic changes from the past to present: increased individualism weakened or lost local rules, diversifying individual aspirations, low level of collective actions and weak alignment between knowledge and aspirations and the protected area. New socio-cultural values are represented by educational activities, however, with a lack of genuine local community engagement. Key directions identified by participants for the future of the site were nature friendly activities such as tourism, biking trails, forestry, and the renewal of viticulture.

KEYWORDS

protected area, participatory mapping, socio-cultural values, human-nature reconciliation, socio-ecological system

1 Introduction

In the European Union (EU) biodiversity conservation strongly relies on the Natura, 2000 network of protected areas (Schirpke et al., 2014; Pellegrino et al., 2017). The Natura 2000 protected area system is based on two Directives, one promoting the protection of birds, and the other the protection of species (other than birds) and habitats. Human-nature reconciliation in the Natura 2000 areas remains an important challenge as well as an opportunity for nature conservation.

The social-ecological systems framework helps in understanding people and nature as tightly coupled and interdependent systems (e.g., Fischer et al., 2012). The social-ecological systems can be decomposed into different layers of system depth such as the ecosystems and biodiversity, the values connecting people and nature, and the characteristics and dynamics of the social systems (Riechers et al., 2021; Hartel et al., 2023). While typically the Natura 2000 protected areas in the EU evolved as tightly coupled social-ecological systems (*sensu* Fischer et al., 2012), the dominant scientific literature still focuses on the nature component (Popescu et al., 2014) while the diversity of human-nature connections and the nature's contributions to people only recently starts to gain scientific attention (Chan et al., 2016; Ives et al., 2017; Diaz et al., 2018; Fischer et al., 2021). While understanding the distribution and state of nature and key natural elements as well as the human nature connections is important for biodiversity management, studies that additionally addresses the perceived social dynamics related features are still relatively scarce globally (e.g., Riechers et al., 2021) and are scarce in Eastern Europe (Hanspach et al., 2014; Molnar and Babai, 2021). Understanding the deeper social dynamics and how these influences human-nature connections, land ownership and stewardship represents a key leverage for nature conservation in human shaped landscapes (Riechers et al., 2021). As noted by Abson et al., 2017, these deeper social dynamics provide important insights into less obvious but more powerful system levels which could foster nature conservation and yet these aspects are less understood. Hartel et al. (2023) highlighted the potential for a “conundrum” character of the traditional cultural landscapes, i.e., a misalignment between the rich local knowledge and memories as well as the nature friendly farming practices and the economic aspirations of the local communities which are oriented towards western economic ideals. If such misalignment exist, the effective nature conservation in farming landscapes entails genuine effort to rebuild the diverse human-nature connections (Ives et al., 2017) and stewardship forms (Chan et al., 2016) which could act as social and cultural insurances for nature.

This short research piece aims to present the challenges for protecting a Natura 2000 site which evolved as a social-ecological system in Romania by implementing a research simultaneously at four levels: biodiversity assessment and mapping (by using experts and field assessments), identifying and mapping socio-cultural values related to nature (by using interviews and participatory mapping with key local community members), identifying the changes in the local community with relevance to the human-nature connections (by using interviews and participatory mapping with key local community members), and identifying the key directions for the future (by using

interviews and participatory mapping with key local community members).

2 Materials and methods

2.1 Study area

The study was conducted in the “Coasta Lunii” Natura 2000 site of ca 700 ha, which also includes a small butterfly reserve (20.64 ha) (Figure 1). The site is located in central part of Romania on the territory of two counties (Cluj and Mureş) and has three territorial administrative units (Viişoara, Luna and Cheţani). The land cover is composed by tree plantations and forest vegetation (ca 42.46%), grasslands (31.31%), shrubs and anti-erosion curtains (21.59%), arable and abandoned arable land (1.82%), orchards (2.12%) and communal roads (1.09%). Plantations with largely non-native species such as *Pinus nigra*, *Fraxinus ornus*, *Elaeagnus angustifolia*, *Hippophae rhamnoides*, *Robinia pseudacacia*, *Gleditsia triacanthos*, *Larix decidua* and *Fraxinus excelsior* (native) were realized in the 90's, as part of a regional forestation campaign which affected several dry grasslands with exceptional natural values. At its core, the site was designated for the conservation of Sub-Pannonic steppic grasslands habitat (formal code: 6240*, the asterisk indicates a priority habitat, i.e., habitat types in danger of disappearance and whose natural range is dramatically reducing within the EU) and species such as *Bombina variegata*, *Cucullia mixta*, *Gortyna borelii lunata*, *Catopta thrips* *Pseudophilotes bavius hungarica* and *Crambe tataria*. The site is protected as Natura 2000 site since 2007.

2.2 Data collection

The ecological and biodiversity data were collected in 2019 within a project aiming to develop the management plan of the site (Ministry of Environment, Waters and Forests, EnviroTeam Association, 2022).

To identify socio-cultural values, we used a combination between individual person interviews and group discussions. Various studies report the selection of interviewees based on the trust developed between the participant and the facilitator (Horcea-Milcu et al., 2016), randomly (Hartel et al., 2017), or based on other people's recommendations on knowledgeable persons (snowball method) regarding a specific area and topic (Erős et al., 2020). Here, we targeted people with genuine direct experience with the protected area (people who have lived or worked in the area for a long time, or were directly involved in its administration, so that they also have memories of the communist, or even the pre-communist period). In total, 10 interviews were carried out: six one-person exercises, three with two persons, and one with three persons (in total 15 persons, nine men, and six women). The formal expertise of the selected persons was diverse, from city hall officials (2 persons), zootechnician implementing management in the site (1 person), foresters (2 persons, which were custodians of the site), teachers (4 persons), school principals and landowners (6 persons). The age of the persons varied between 39 and 73 years.

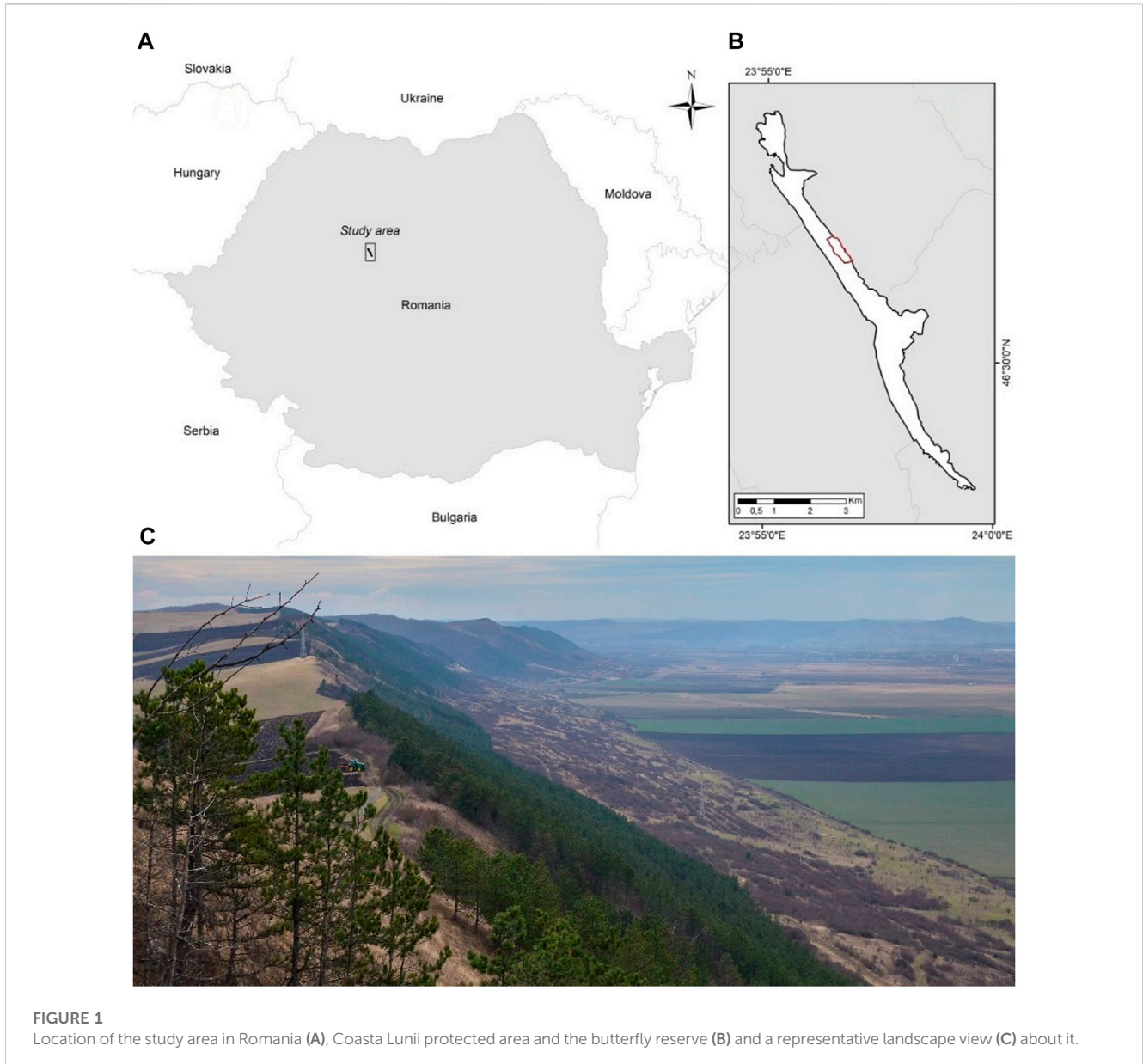


FIGURE 1 Location of the study area in Romania (A), Coasta Lunii protected area and the butterfly reserve (B) and a representative landscape view (C) about it.

TABLE 1 The main topics addressed by this study and the questions used to address these topics.

Topic	Question
1. Identifying and mapping the main values and establishing their importance (see Table 2)	Please read the values presented on the cards as inspiration and then mark on the printed map the places where such values were relevant for the local community were present Please if possible, distinguish the past (i.e., from your experience)* and present (i.e., up to 5–7 years ago) when mapping these values
2. The main changes undergone which are relevant from the perspective of the social and natural system	What changes have happened which are relevant to Coasta Lunii site over time? Please focus on changes in the local communities (social), as well as on economic and environmental changes
3. The relationship between changes (identified in topic 2) and the values (identified in topic 1)	Were there any influences of the above mentioned changes on the values you identified and draw on the map?
4. Future perspective	How would you like to see the future of the site?

*Interview participants were able to share personal experiences since the 1960's.

Each interview was structured into four main topics (Table 1). At the beginning, the interviewer provided a short description of the study. A Google Earth Satellite image (A1 size)

with the study area and a ca 3 km buffer of its surroundings was shown to the participants and the discussions were carried out while this map was visible and interventions (e.g., drawings) were

TABLE 2 Selected socio-cultural values and their definitions as understood in this study.

Socio-cultural values	Definitions	Literature
Material values	Activities of gathering fruits, mushrooms, wood for fire or other culturally established utilities	Plieninger et al. (2013); Stolton et al. (2015); Sherrouse et al. (2011)
Cultural values	Places or structures relevant to local culture and history, for example, building elements, old trees or geological formations	Plieninger et al. (2013); Stolton et al. (2015); Sherrouse et al. (2011)
Educational/cognitive values	Places recognized by the community for species of flora and fauna or activities through which people develop their cognitive capacities	Plieninger et al. (2013); Schirpke et al. (2014); Stolton et al. (2015); Sherrouse et al. (2011)
Aesthetic values	Places perceived to be particularly beautiful	Plieninger et al. (2013); Schirpke et al. (2014); Allendorf, (2007); Sherrouse et al. (2011)
Recreational values	Places used for recreational activities (e.g., hiking, cycling)	Schirpke et al. (2014); Allendorf, (2007); Sherrouse et al. (2011); Plieninger et al. (2013)
Social values	Places where the local community gathers to socialize	Plieninger et al. (2013); Stolton et al. (2015); Roux et al. (2020))
Attachment/identity values	Places to which the community has feelings of attachment, places important to local identity	Plieninger et al. (2013); Schirpke et al. (2014); Roux et al. (2020)
Therapeutic values	Places where people retreat for reflection, quiet	Bryce et al. (2016); Sherrouse et al. (2011)

possible on it. The first topic (Table 1) referred to the main socio-cultural values of the protected area. In order to provide standardized assistance in this respect, we printed the values enumerated in Table 2 on cards, and these were put in the same order near the map and presented to participants. After an initial deliberative discussion about the values presented on cards, participants were asked to mark the values on the map, with colored markers, either by polygons or by points. We also asked them to distinguish mapped values in two broad temporal scales: the “past” (the participants were able to cover the period of 1960’s–1989) and the “present” (up to ca 5–7 years ago). Our previous research implemented in Romanian rural systems based on interviews (e.g., Hartel et al., 2014; Hartel et al., 2017) shows that memories can provide reliable and acceptable information to understand key changes in the recent history of the social-ecological systems. After addressing the topics (Table 1) we asked the participants to describe their future perspective of the protected area.

2.3 Data analysis

The natural values were visualized on maps, the polygons being available from the management plan (Ministry of Environment, Waters and Forests, EnviroTeam Association, 2022).

The interviews were recorded and transcribed. Transcripts were then analyzed using an open coding technique: each narrative was decomposed into codes (items), that summarized the main terms discussed during exercises (Bryman, 2012; Hartel et al., 2017). Representative quotes will be provided in the text for illustration.

For spatial analyses and mapping the values and the overlaps, we used ArcGIS 10.5. For mapping the socio-cultural values, we digitalized the socio-cultural values that the stakeholders identified, and to explore the overlaps between the values, the “intersect” function was used, and subsequently, the overlap percentage was calculated.

3 Results

3.1 Mapping protected species and habitats

Three protected habitats and seven protected species were identified and mapped (Figure 2). The habitats were: Subcontinental peri-Pannonic scrub (40A0*), Sub-Pannonic steppic grasslands (6,240*) and Euro-Siberian steppic woods with *Quercus spp.* (9110*). The protected species were *C. tataria*, *C. thrips*, *G. borelii lunata*, *Lucaus cervus*, *Bombina variegata*, *Bombina bombina* and *P. bavius hungarica*.

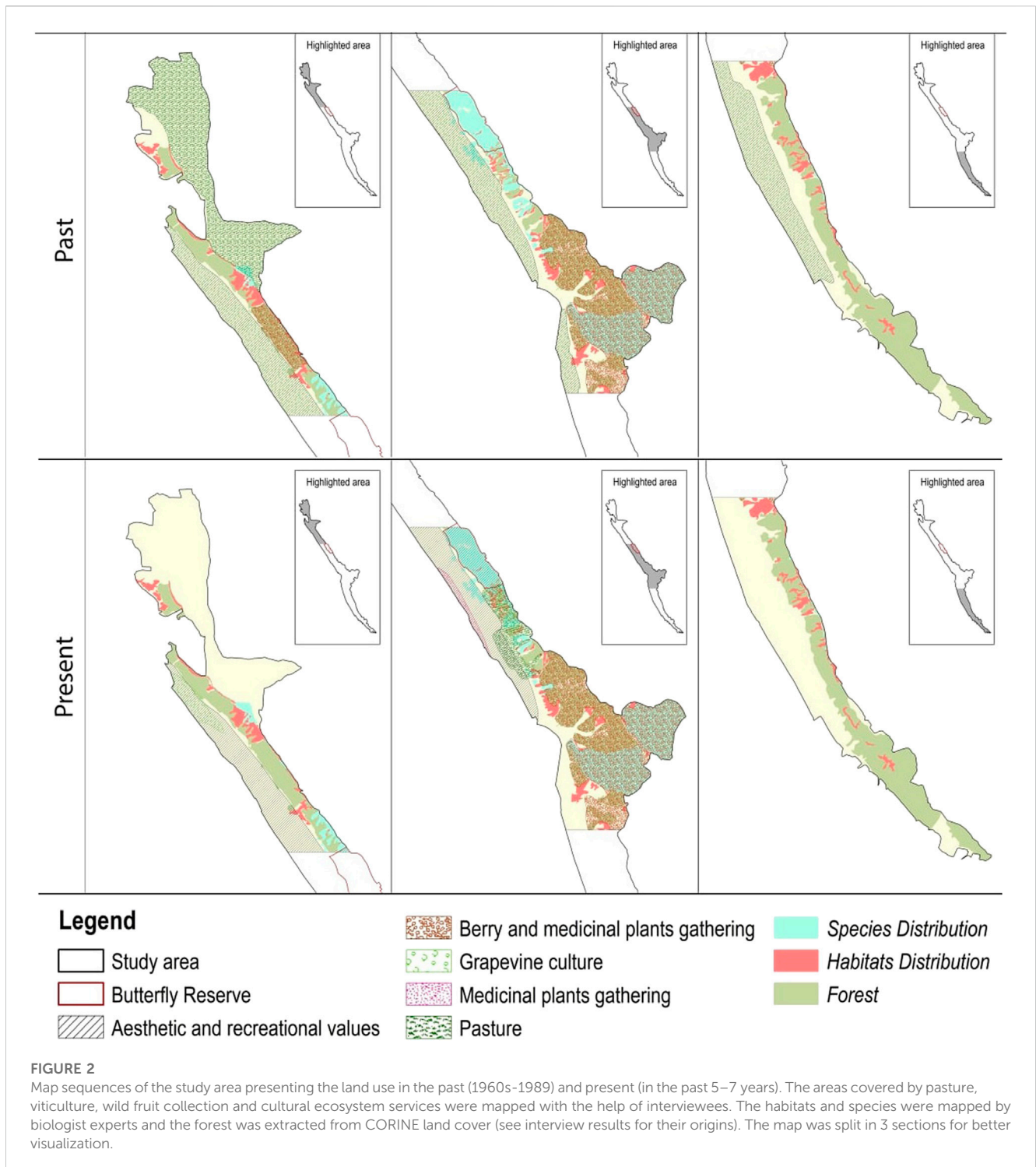
3.2 Identifying and mapping the main socio-cultural values

According to the locals, in the past (i.e. 1960’s–1989) ca 26% of the area was used for traditional viticulture, ca 38% was used for livestock grazing, and ca 23% was used for berry and plants collection. Nowadays, however, ca 1% of the area is used for viticulture, 23% for berry and medicinal plants picking, and only 4% is managed for livestock grazing (Figure 2).

Participants talked vividly about the wine grapes which played a major importance in the life of the local communities. Grape and wine production and the rich socio-cultural values were strongly interconnected in the past.

“We used to like it, especially in autumn, when the grape it was harvested. Every person was with the barrels of grapes, it was a celebration, recreation and it was splendid. To stay there on the hill, with food, with steaks and in good spirits, the community even brought musicians. Around 1980, we went there with musicians and partied. We used to go from May 1st to August 23rd to spend time there, under the grapes. It was beautiful. Now, all those terraces are destroyed, only shrubs and bushes” (farmer, age: 68 years, male).

“There were vine crops and the people obtained production, the people used the grapes for wine, for food. Now they disappeared. If



you abandon the wine crop for two years it will disappear ... Excursions were organized with the children periodically to the forest, around the area where the vines were, from May 1 there was great excitement and people there. It was a very beautiful and popular recreation area” (retired teacher, age: 67 years, female).

The forestry engineer and the zootechnician emphasized the afforestation and forestry (massively implemented in 1960–1965) activities as key environmental benefits for the area, to improve the

lands with “*inferior economic value*” (i.e., steppic grasslands). The forester also emphasized the need for reconciliation of the visions of nature conservationists and forestry:

Now according to us, as forestry principles, the idea is to return to the natural, fundamental type of forest, whenever this is possible. The fact that there is pine, black locust and ash, is the thing that stabilized the land, so if that vegetation would be removed from there, the land would come down, with all the steppe vegetation and

all the butterflies and everything. Probably in time, a combination between foresters and biologists must be found to reach a compromise. It was requested by biologists that we no longer plant pine, well, then we no longer plant pine, we no longer plant black locust, fine, but further, the fact that land must be stabilized by tree plantation and some grass patches remains between them I think it is normal. If we manage to stabilize the land with downy oak or sessile oak or pear it would be an extraordinary target, now it also depends on the monitoring that will be done. In the management plan the biologists write about restoring the oak forest, it seems interesting. If the objectives are related to herbaceous vegetation, insects, butterflies, etc. They are very important, we understand this, it is no problem, we understand if they are extraordinary objectives to protect. So, in principle, we want there to be a balance between our opinions and the objectives in the management plan (forester, former custodian of the site, 51 years, male).

In the past the site was regularly visited for wild fruit collection and educational purposes while nowadays the educational activities are only occasionally implemented in the butterfly reserve (Figure 2), which is also a place for sightseeing, being also a hiking destination. Wild fruits are also occasionally collected.

3.3 Exploring the overlaps between natural and socio-cultural-economic values

The current distribution of the assessed species and habitats did not show substantial overlap with the viticultural and pastoral lands (past and present), nor with the forest plantations. There was a small overlap between the past aesthetic and recreational values and the present habitats and species assessed in this study. The present aesthetic and recreational values genuinely overlap with the habitat 6240* (see methods for the meaning of the code, 21.61%), habitat 40A0* (12.01%), the species *C. thrips* (58.77%), *C. tataria* (30.88%), *P. bavius hungarica* (77.98%) and the butterfly reserve.

3.4 Social changes with relevance to the natural protected area

The interviewees associate the changes in the political regime with the changes in landownership, sense of place, and stewardship. When the lands were abusively owned by the communist-dictatorial system the farmers were obligated to go and implement farming practices, being paid with products (the so-called 'collective'). Several culturally and socially vivid events (see above) were remembered from this period. With the collapse of the communism the land went back to individual ownership, this being followed by abandonment. The emerging economic and socio-cultural opportunities at the regional scale and beyond resulted in the emigration of youngsters and the abandonment of traditional vineyards and pastures (see Figure 2), this being highlighted as a dramatic change for the study site. Interviewees report increased individualism, weakened or lost local rules, diversifying individual aspirations, low level of collective actions, weak alignment between knowledge and aspirations. These dramatic changes are illustrated

with a quote from a mayor who serves at this function since over a decade:

'Now you do not see a person on the fields. Before [i.e., in the past] people went to work in the field and socialized, communicated, but now there is a lack of communication and we want to try to make them socialize again. Before, people went to work, to church on foot and told stories, now that does not happen anymore. The human relationship changed very much. By the fact that we want to develop the Nature reserve and we want to make it a point of orientation and a tourist route, we want to bring people together, to make them talk, to communicate. In the past, games were organized in villages, where there were choirs and dancing, young people, old people and children went there. It was a human relationship within the collective, now the community lives singularly through each individual, it no longer communicates, there are no more relationships between people' (mayor for three mandates, age: 69 years, male).

Interviewees see the future of the Natura 2000 site in tourism, especially ecotourism, agrotourism, the biking route, and local products (i.e., from reviving wine yards and livestock products). Also, a local traditional museum was envisioned by one interviewee. Participants suggest developing tourist routes in a minimalistic and nature-friendly way, inspiring and developing the civic spirit of locals and tourists and banning grazing in areas of special natural value. These all will depend on people with initiatives and financial support through projects and the "highway 137" planned near the protected area was perceived as an impediment for these initiatives.

4 Discussion

In this research, we used biodiversity inventory, nature-related value mapping and social system understanding to highlight the challenges and opportunities for nature conservation in a Natura 2000 site which evolved as a cultural landscape. Participatory mapping of social values along with natural elements were successfully implemented in other protected areas of Europe including Italy (Battisti et al., 2022), Poland (Maczka et al., 2019), Greece (Vlami et al., 2020), Spain (Garcia-Nieto et al., 2015) and other countries (e.g., Strzelecka et al., 2017). Our research also shows that past land use, even if abandoned for decades, can have a strong legacy effect on the current protected species and habitats distribution. The protected species and habitats were unable to re-establish in the previously managed, now abandoned lands even after decades of abandonment. Ruprecht et al. (2010) found that litter accumulation due to abandonment of the traditional grassland management practices can prohibit several rare plant species in steppe habitats and the removal of plant biomass can trigger seed germination of these species even after 40 years. We believe that such mechanism may be valid in the case of grazing abandonment considering that protected habitats such as the habitat 6240* and 40A0* (see methods) are dependent on extensive agricultural practices (Rákossy and Kovács, 2001). Outside the protected area where extensive grazing with cattle is still maintained we identified valuable steppe grasslands of which maintenance depends on the persistence of extensive cattle grazing (authors, personal observation). The abandonment of this type of pastoral activity or its replacement with industrial sheep grazing

(which is already established in the surroundings) will be detrimental to this vegetation. The habitats 6240* and 40A0* identified in our study site persisted probably because of accidental grazing by few sheep (our own observation) happening occasionally which may mimic extensive farming practices. A formally assumed and responsible biodiversity management should take over the maintenance of these habitats instead of the accidental (and illegal) grazing activities.

We found that the cultural values of the past were strongly related to traditional practices, especially in the case of viticulture. Traditional farming practices which involved community activities (such as the clearing of shrubs from pastures and managing vineyards) were always important from socio-cultural and local identity perspectives as well (Chan et al., 2016). Nowadays, however, the aesthetic and cultural values are restricted to educational activities and youngsters, targeting protected species and at a restricted spatial scale and with no real local community engagement. Balázsi et al. (2019) found similar results in two rural systems of Transylvania: for the traditional rural communities it is difficult to separate the diverse types of human nature connectedness (Ives et al., 2017) because these are strongly interlinked. Socio-economic changes had dramatic influence on all types of human-nature connections (Balázsi et al., 2019).

Increased diversification of social, cultural and economic aspirations sometimes coupled with ethnic change and immigration of non-locals enlarged the spectra of local opportunities (e.g., Câmpeanu and Fazey, 2014) but also the challenges (i.e., through local tensions and conflicts) in the rural communities after the collapse of the communism in various rural regions of Romania (Hartel et al., 2014). This shows how vulnerable was the perceived community stability from the communist period. Nevertheless, local community representatives perceive a high potential for ecotourism and the revival of viticulture, building on the emergent values at the level of the urban communities as well as the proximity of a major town to the protected area. In conclusion, here we showed that the natural capital in the studied protected area bears the strong legacy of the past and present land use and human-nature relationships. Likewise, the farming and viticultural practices are still part of the local memory and can be accessed through interviewing elderly persons.

Conclusion

We show that the reconciliation of humans and nature in protected areas also requires understanding of the sense of agency and land stewardship forms. These cannot be captured by

the tools of conventional species and habitats mapping. We concur with Riechers et al. (2021) that leveraging nature conservation in cultural landscapes involves the consideration of deep leverage realms such as the sense of agency and sense of place.

Data availability statement

The raw data supporting the conclusion of this article will be made available by the authors, without undue reservation.

Author contributions

S-DM, VM, and TH contributed to the conception and design of the study. S-DM, TH, and VM performed the fieldwork. VM organized the database. CVM performed the statistical analysis and performed the GIS mapping. S-DM wrote the first draft of the manuscript. VM, TH, and CVM, wrote sections of the manuscript. All authors contributed to the manuscript revision, read, and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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