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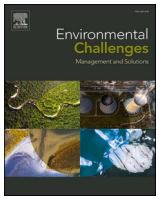

Human ecological analysis of conflict toward using natural resources: Evidence from Iran

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ABSTRACT

The use of nature by humans has always been a source of conflict. This study aimed to conduct a human ecological analysis of conflict in the exploitation of Iran's natural resources. The research is qualitative, applied, and descriptive, using the fuzzy WASPAS method. Twenty-six experts were selected via purposeful snowball sampling. Thirty-seven criteria were identified and categorized into three main criteria: human ecology, attitudes of government and beneficiaries, and conflict reduction solutions. Results indicated that lack of managerial knowledge, inappropriate attitudes toward law enforcement, and mistrust between stakeholders are key conflict drivers. For conflict management, structural coherence, participatory management, and qualified personnel are essential. The findings suggest that selecting capable managers, promoting education, and adopting participatory approaches can reduce conflicts. Policymakers can use these results to mitigate human-nature and inter-stakeholder conflicts.

1. Introduction

1.1. Importance of natural resource conflicts globally

The sustainable development concept is intertwined with the protection of natural resources and the destruction of these critical resources challenges the attainment of this goal (Wassie, 2020; Savari et al., 2025). On the other hand, human exploitation of nature has been always an important cause of contradiction (Valizadeh et al., 2021). The competition to obtain these common and rare resources in nature has been one of the main reasons for conflict and contradiction between different groups, mainly in rural and agricultural areas (Luo et al., 2024). Considering the adverse effect of increasing conflict and dispute in the exploitation of natural resources on the economy and human life, it is required to identify the effective factors (Sini and Sulaiman, 2021; Aysan et al., 2023). For example, we can refer to the view of the users in the management of natural resources, which is based on two groups: one is the supportive view of natural resource managers (mainly in government areas and act as decision-makers and executives) and the other is the livelihood opinion of users (those whose lives and jobs depend on natural resources) (Kolahi, 2021).

1.2. Iran's context

Iran provides a critical context for examining such conflicts. While renewable natural resources cover 78.5 % of Iran's land area (Agricultural Statistics of Iran, 2021), the country faces significant environmental challenges, ranking 105th among 180 countries on the Environmental Performance Index (Brick et al., 2017). This indicates an unsustainable exploitation trend. Iran faces accelerating degradation of its forests and rangelands (Hallaj et al., 2024); for instance, annual forest loss is estimated at 63,000 hectares, with a staggering one million hectares lost every five years, contributing significantly to erosion and reduced productivity (National Committee for Sustainable Development, 2015; Islamic Parliament Research Center of Iran, 2016). A substantial portion of this destruction is rooted in conflicts among stakeholders vying for access and control over these dwindling resources, creating a fertile ground for conflict between state agencies and local users.

1.3. Human ecology as a lens

Understanding the relationships between conflicting parties is essential for analyzing natural resource conflicts, which can be

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approached from various scientific angles. One pertinent lens is human ecology within environmental sociology, which examines human actions, reactions, and relationships from the perspective of individual and social behavior towards the environment (Derdowski et al., 2020). Among the models developed to study human-environment relations, the POET human ecology model (Duncan, 1964) offers a powerful framework. The POET model, comprising four interrelated components – Population, Organization, Environment, and Technology (Fig. 1)– provides a holistic view for analyzing complex socio-ecological systems (Green, 2002; Lawrence, 2003; Nguyen, 2009). This model has proven effective for analyzing power relations and conflict processes, helping to determine how key variables influence the likelihood of disputes over natural resource use (Namboodiri, 1988; Bijani et al., 2020). For example, population growth and technological changes interact with social organizations, often leading to environmental degradation through activities like deforestation and mining. These changes can trigger conflicts not only among human groups but also between humans and the broader ecosystem, while simultaneously driving the formation of new social institutions aimed at resolving these disputes (Green, 2002; Tabara and Pahal-Wostl, 2007; Bijani et al., 2022).

1.4. Research gap and novelty

While previous research has examined natural resource conflicts in Iran from technical, legal, or sectoral perspectives, few studies have adopted an integrated human ecological approach to analyze the interplay of social, institutional, and technological drivers of conflict. The present study aims to conduct a human ecological analysis of conflict in the exploitation of Iran's natural resources using the components of the POET model. This approach allows for a holistic understanding of how population pressures, organizational weaknesses, environmental degradation, and technological choices collectively shape conflict dynamics in a resource-dependent developing context. The novelty of this research lies in its specific focus on conflicts through a human ecology framework and its application of the fuzzy WASPAS (Weighted Aggregated Sum Product Assessment) method to systematically prioritize conflict criteria and management solutions based on expert judgments. This mixed-method approach addresses a significant gap in the existing literature, which often prioritizes technical or legal analyses while overlooking the socio-political and managerial dimensions of resource governance. Furthermore, this study seeks to present integrated solutions that incorporate both the users' perspectives and the government's protectionist stance regarding natural resources. By doing so, it contributes to the international literature on environmental conflict and governance by offering a nuanced case study from Iran that underscores the importance of trust-building, participatory management, and institutional coherence—factors that are critical yet often neglected in top-down policy frameworks. The findings offer transferable insights for other resource-dependent regions in the Global South facing similar socio-ecological challenges.

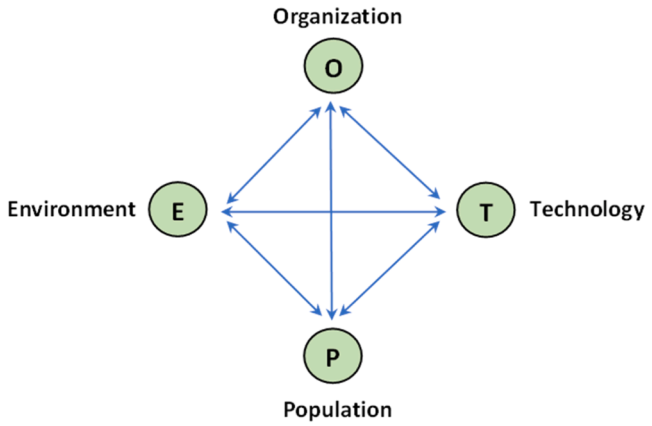

Fig. 1. POET human ecological model (Duncan, 1964; Tabara and Pahal-Wostl, 2007).

2. Materials and methods

This research is qualitative in terms of research paradigm, applied in terms of purpose, and descriptive based on the type of research. The data collection and analysis were conducted using the fuzzy WASPAS (Weighted Aggregated Sum Product Assessment) method. Fuzzy WASPAS is a multi-criteria decision-making (MCDM) technique that integrates the Weighted Sum Model (WSM) and the Weighted Product Model (WPM) within a fuzzy environment to enhance decision accuracy under uncertainty (Zavadskas et al., 2012). It was deemed appropriate for this study as it allows for the systematic prioritization of the identified conflict criteria based on expert judgments, effectively handling the ambiguity inherent in qualitative assessments. In this application, expert opinions on the importance of various criteria were collected using linguistic terms, converted into fuzzy numbers (Table 1), and processed through the fuzzy WASPAS algorithm to determine final scores and rankings (see Appendix 1 for key formulas).

The participating experts included 26 specialists in Iran's natural resources field, selected through purposeful snowball sampling to ensure access to knowledgeable informants. It is important to acknowledge that due to the sampling strategy, which relied on expert networks, the results may reflect a bias toward academic and governmental perspectives, potentially underrepresenting grassroots stakeholders.

To ensure the validity and reliability of the qualitative data, several measures were implemented. For credibility, the initial research questions and identified items were verified by a panel of five experts in the field. Dependability was achieved by audio-recording and verbatim transcription of the interviews. For transferability, the preliminary findings were discussed with five other experts who had not participated in the study. Confirmability was strengthened through triangulation using multiple data sources, including document analysis, interviews, and cross-verification of the extracted items with the participating experts.

The research process consisted of two main stages:

- An initial open-ended questionnaire was administered to identify conflict criteria based on the POET model dimensions. From the responses, 37 frequent items were extracted.
- These 37 items were then presented to the same experts in a structured questionnaire using a five-point Likert scale (1= least effect, 5= highest effect) to score their perceived importance.

3. Results

3.1. Descriptive statistics of the respondents

The descriptive characteristics of the respondents participating in this study are provided in Table 2.

Table 1
Verbal expressions and corresponding fuzzy numbers.

Code	Priorities	Fuzzy equivalent of priorities		
		Lower limit (L)	Middle limit (M)	Upper limit (U)
1	Very weak	1	1	3
2	Weak	1	3	5
3	Medium	3	5	7
4	Good	5	7	9
5	Very good	7	9	11

Source: Patil & Kant (2014).

Table 2
Personal and professional descriptive characteristics of the respondents.

Variable		Frequency	Percent	Mean	SD	Min	Max
Gender	Female	1	3.80				
	Male	25	96.20				
Level of education	Bachelor and Master	9	34.60				
	Doctorate (PhD)	17	65,040				
Age (year)				55.54	7.70	41	76
Work experience (year)				28.12	6.84	16	44
Workplace	Government sector	18	69.20				
	Research and academic sector	8	30.80				

SD: Standard Deviation, **Min**: Minimum, **Max**: Maximum.

3.2. Introduction of research factors

Based on the literature review and research background, human ecology factors of conflict in the exploitation of Iran's natural resources were identified and extracted in the form of three main criteria and 37 items (Table 3).

3.3. The results of fuzzy analysis of human ecology subjects

The fuzzy WASPAS analysis revealed clear priorities among the factors driving conflicts over natural resources in Iran. Population pressures emerged as the strongest drivers, particularly population growth leading to water scarcity, food shortages, and land loss (B2, B1, B3 ranked 1st–3rd). This indicates that demographic change is not only straining natural ecosystems but also accelerating competition over limited resources (Fig. 2).

Within the domain of social organization, weak institutional structures and lack of stakeholder organization (B8, B7, B6) were consistently ranked highest. These findings highlight the mismatch between rural/local institutions and formal state conservation policies, undermining collaborative management.

Environmental degradation factors also played a significant role. Non-unified decision-making among environmental organizations (B12) and weak public concern for environmental issues (B10, B13) were repeatedly identified as critical. This illustrates that fragmented governance and low environmental awareness among communities reinforce ecological decline.

Technological aspects further deepened conflicts. Destructive or poorly adapted technologies (B18, B16, B17) were emphasized as major contributors, reflecting how rapid technological development without ecological considerations exacerbates tensions.

When analyzing stakeholders' and government attitudes, low managerial knowledge and awareness (N4), inappropriate law enforcement approaches (N5), and mistrust between stakeholders and officials (N8) ranked highest. This shows that governance failures and lack of trust are as influential as ecological pressures in generating conflicts.

Finally, conflict management solutions were prioritized. Creating organizational and structural coherence (P5), promoting participatory management (P6), and employing qualified/meritocratic managers (P4) received the top rankings. These solutions point to the urgent need for governance reform, transparency, and inclusion of stakeholders in decision-making processes (Fig. 3).

At the aggregated level, conflict management solutions were ranked first among the three main domains, followed by stakeholder/government attitudes, and then human ecology. This suggests that while demographic and ecological pressures trigger conflict, the decisive leverage lies in institutional reform and participatory governance (see Appendix 2).

3.3.1. The results of fuzzy WASPAS of the main criteria

Fuzzy WASPAS implementation was also conducted for three main components. Accordingly, the scores given to the items of each component were averaged to obtain the main component score. Thus, fuzzy WASPAS calculations were performed (Table 4). So, the first rank was given to conflict management solutions in natural resources. The attitude of the stakeholders and the government towards the conflict was ranked second and human ecology was ranked third.

3.3.2. Present a conceptual model of human ecology of conflicts in natural resources

Fig. 4 presents a conceptual model showing the three main domains - human ecology, stakeholder/government attitudes, and management solutions - with arrows indicating their interactions. Population dynamics drive ecological pressures, which interact with weak institutions and governance failures, while conflict management strategies can mitigate these tensions.

4. Discussion

The findings of this study demonstrate that demographic pressure, weak governance structures, and misaligned stakeholder attitudes are central drivers of conflict over natural resources in Iran. Rather than merely restating that "population growth leads to shortages of water resources," it is important to interpret this outcome within the broader socio-ecological context. Population expansion increases demand for scarce resources, but its conflict-inducing potential is magnified when governance is fragmented and institutions lack legitimacy. This finding resonates with comparative studies; for instance, research in India and Ethiopia has similarly shown that demographic stress exacerbates resource disputes in contexts of institutional weakness (Wassie, 2020; Rai et al., 2021). Likewise, studies in Central Asia highlight that water competition becomes particularly acute in the absence of cross-border trust and participatory mechanisms, mirroring the mistrust identified between stakeholders and officials in Iran.

Another key contribution of this study is to highlight the role of mistrust between stakeholders and officials. The results indicate that low managerial knowledge and inappropriate enforcement of laws erode legitimacy and reduce public participation. This aligns strongly with the literature on environmental governance, which emphasizes that when stakeholders perceive decision-making as unjust or top-down, they disengage, thereby fueling conflict escalation (Helvetas, 2013; Ostrom, 1990). Our results suggest that building trust through participatory governance models and by recognizing indigenous knowledge, as recommended in solutions P6 and P8, can mitigate such risks, a principle supported by the work of Bebbington (1999) on capabilities and institutional legitimacy.

Importantly, the fuzzy WASPAS rankings should not be interpreted as providing definitive solutions. Instead, they reflect perceived priorities among a specific group of experts. As such, the rankings are indicative rather than predictive, and they must be considered alongside contextual political, cultural, and ecological dynamics. For instance, the high ranking of "organizational and structural coherence" (P5) and "participatory management" (P6) should be seen as broad guiding principles for reform, not as technocratic prescriptions. This cautious interpretation acknowledges a key methodological limitation of fuzzy

Table 3
Factors affecting conflict in the exploitation of Iran's natural resources.

Components	Factors	Items	Code
Human ecology	Population dynamics	Population increases the basis of food shortage and destruction of natural resources	B1
		Population increases, which leads to the reduction of water resources and the destruction of natural resources	B2
		Population increases the basis of pollution of water systems and destruction of the land	B3
		Lack of Land use planning in the demographic field	B4
		The increase in population is the basis for the reduction of arable land and invasion of natural resources	B5
	Social organization	The inconsistency of village social institutions with natural resource protection policies	B6
		Non-priority of natural resources for rural and local institutions	B7
		Lack of proper organization of stakeholders in order to preserve natural resources	B8
		The lack of dynamics of non-governmental and local urban and rural institutions in the field of natural resources	B9
	Environmental degradation	Not giving priority to the environment for the masses of people	B10
		Lack of attention to the environment and natural resources in the general culture of the people	B11
		Non-unification of decisions in environmental and natural resources organizations	B12
		Weakness of environmental concerns in people	B13
	Technology	Lack of appropriate technology for the development of natural resources	B14
		The development of incompatible technologies with the development of natural resources	B15
		Weak governance in the balanced development of technology	B16
		Lack of technologies that reduce people's dependence on natural resources	B17
		The development of technologies that accelerate the destruction of natural resources	B18
The attitude of the stakeholders and the government towards the conflict		The lack of meritocracy in the selection of managers is the basis for the exalted view of the appointed manager	N1
		Lack of public awareness is the basis for changing the attitude of stakeholders and officials	N2
		The one-dimensional economic views of officials, creating the environment for the reduction of environmental and cooperative incentives	N3
		Low management knowledge, awareness and view of managers towards natural resources	N4
		Inappropriate view and attitude of officials based on the form of law enforcement	N5
		Economic view of subsistence and provision of benefits to the user	N6
		Changing the attitude of the stakeholders due to lack of proper training and low level of environmental literacy without changing the stakeholders' attitude	N7
		The mistrust of the stakeholders towards the officials, the reason for removing the item of participation in human-centered development	N8
		The difference in the world view of the government and the stakeholders is one of the factors of conflict.	N9
Conflict management solutions in natural resources		Strengthening the country's natural resources governance system by separating the country's natural resources organization and forming a separate ministry	P1
		Supporting the management of natural resources in the governance structure of the country against conflicting government agencies	P2
		Avoiding the implementation of outdated and similar natural resource management policies, programs and projects	P3
		Employing qualified and meritocratic people in natural resource management	P4
		Creating organizational and structural coherence in organizations in charge of natural resources management	P5
		Public participation and participatory management in natural resource management	P6
		Reducing the government's ownership of natural resources	P7
		Using indigenous knowledge of stakeholders in natural resource management	P8
		Clear information, promotion and education; In promoting general and professional knowledge of the natural resources sector	P9
		The lack of meritocracy in the selection of managers is the basis for the exalted view of the appointed manager	P10

multi-criteria models: while excellent for systematizing expert judgment under uncertainty, they are sensitive to the composition of the expert panel and the selected criteria. Our study's strength lies in applying this systematic approach within a human ecological framework, but its limitation is the potential bias towards academic and governmental perspectives due to the sampling strategy, potentially underrepresenting grassroots voices. Future research should aim to incorporate a more diverse range of stakeholders, including local communities, and could triangulate these findings with other MCDM methods or quantitative surveys to enhance validity.

From a comparative perspective, the Iranian case underscores patterns that are visible across the Global South. In India, centralized forestry policies that ignored local livelihoods produced conflict until participatory forest management was institutionalized (Rai et al., 2021). In Ethiopia, population growth and land scarcity have similarly strained customary resource management systems, highlighting the need for hybrid institutional arrangements that blend local and formal governance (Wassie, 2020). These parallels suggest that Iran's experience, while context-specific, offers lessons of wider relevance: demographic stress coupled with governance deficits tends to escalate conflict, but inclusive, trust-based management can provide pathways for mitigation.

Regarding implications for sustainability, the findings have significant academic and pragmatic value. Academically, they reinforce the

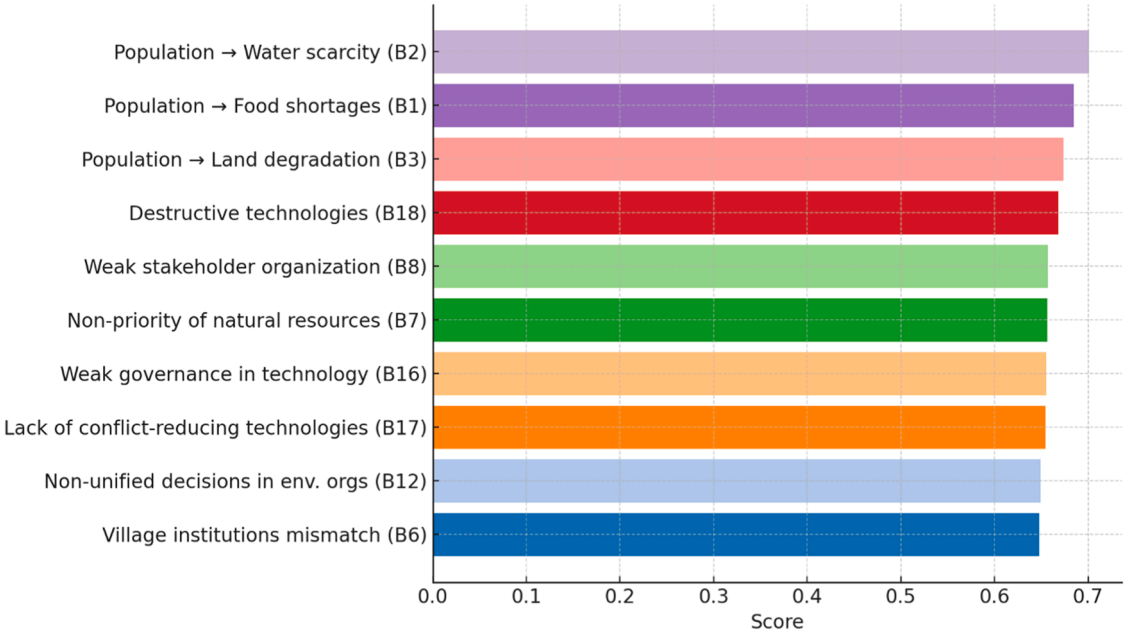

Fig. 2. Top-ranked drivers of conflict in natural resources.

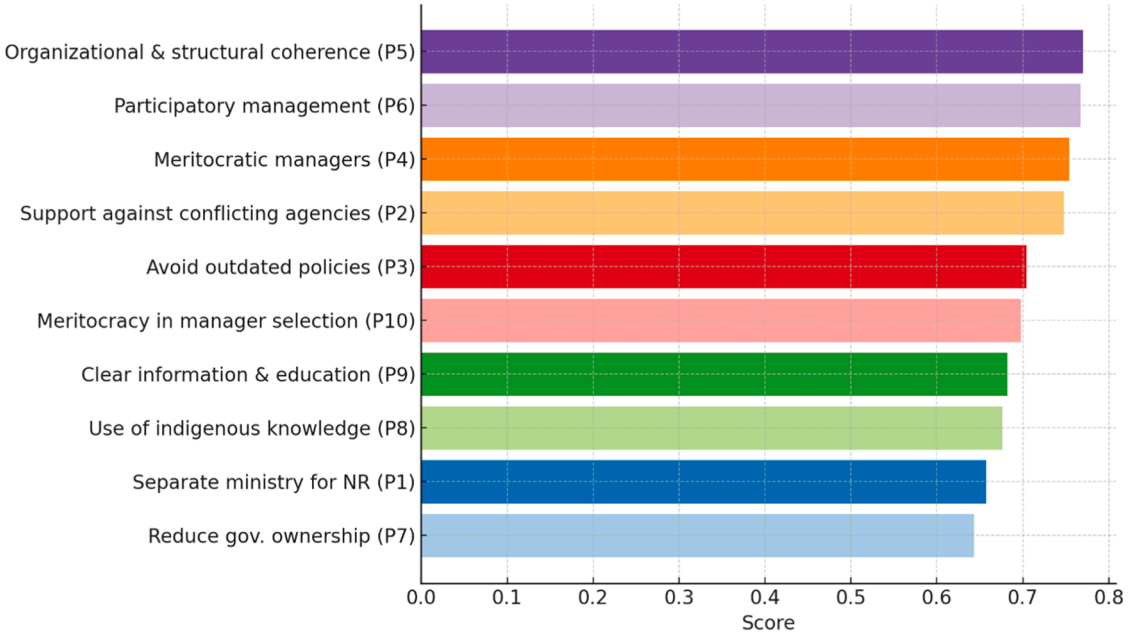

Fig. 3. Top-ranked conflict management solutions.

Table 4
The score and rank of the main components.

Code	Components	Score	Normal score	Rank
P	Conflict management solutions in natural resources	0.7658	0.2116	1
N	Attitude of the stakeholders and the government towards the conflict	0.7307	0.2019	2
B	Human ecology	0.7043	0.1947	3

necessity of integrated, transdisciplinary approaches like human ecology for understanding socio-ecological conflicts, moving beyond purely technical or economic analyses. Pragmatically, for sustainability goals to

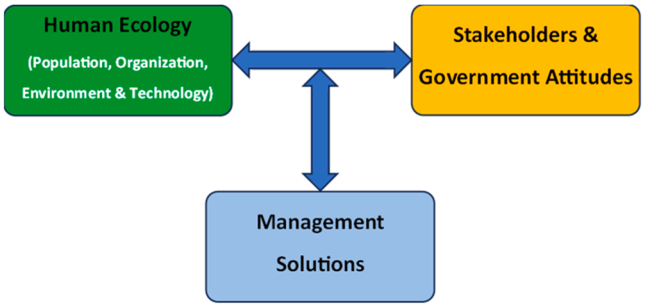

Fig. 4. Conceptual model of human-ecological conflict interactions.

be achieved in Iran, policymakers must focus on the highest-ranked solutions: institutional reform (P5), participatory governance (P6), and meritocracy (P4). Sustainable resource use is unlikely without resolving the underlying conflicts driven by mistrust and poor governance. Therefore, the implications point directly towards the need for a fundamental shift from top-down, control-based resource management to collaborative, adaptive, and legitimate governance systems that can reconcile conservation with local livelihood needs.

Overall, this study emphasizes the need to integrate demographic trends, governance quality, and participatory frameworks in analyzing resource conflicts. Rather than focusing solely on ecological or technical factors, a human ecological lens highlights how social trust, institutional design, and stakeholder attitudes shape conflict trajectories. Future research should expand the comparative lens to other regions, incorporate quantitative tests of the relationships between the prioritized factors, and conduct longitudinal studies to examine how participatory reforms unfold in practice and impact both conflict resolution and ecological sustainability over time.

5. Conclusion

This study set out to analyze conflicts over the use of natural resources in Iran through a human ecological lens, applying the POET model and the fuzzy WASPAS method. By engaging 26 experts, the research identified and prioritized multiple drivers of conflict and potential solutions. This approach highlighted the interaction between ecological pressures, governance weaknesses, and social attitudes in shaping disputes.

The findings revealed that population growth, weak institutional organization, and destructive technologies exacerbate ecological pressures, while limited managerial knowledge, inappropriate law enforcement, and mistrust between stakeholders emerged as the most critical attitudinal drivers. Conversely, the top-ranked solutions were creating organizational and structural coherence, adopting participatory management, and appointing qualified managers. These results underscore that institutional reform and trust-building are more decisive than demographic or ecological trends alone.

For Iranian policymakers, the study emphasizes the urgency of moving beyond top-down management and fostering participatory governance structures. Practical steps include decentralizing decision-making, integrating indigenous knowledge, and prioritizing transparency and meritocracy in managerial appointments. Such measures can strengthen legitimacy, reduce conflicts, and support sustainable use of natural resources in line with national development goals.

Like all research, this study has limitations. It relied on a relatively small expert sample, without direct input from local communities, and applied only one MCDM method (fuzzy WASPAS). Future research should include a broader range of stakeholders, triangulate expert assessments with field-based data, and compare results across different ecosystems. Such extensions would enrich the understanding of conflict dynamics and enhance the applicability of proposed solutions.

Ethical standards

Please pay attention to the following.

- This article does not contain any studies with animals performed by any of the authors.
- All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.
- Informed consent: Informed consent was obtained from all individual participants included in the study.
- “Data sharing not applicable to this article as no datasets were generated or analyzed during the current study”.

CRediT authorship contribution statement

Amir Saghaleini: Writing – original draft, Software, Resources, Methodology, Investigation, Formal analysis, Data curation. **Heshmatollah Saadi:** Writing – review & editing, Visualization, Validation, Supervision, Project administration, Methodology, Conceptualization. **Masoud Bijani:** Writing – review & editing, Validation, Resources, Methodology, Conceptualization.

Declaration of competing interest

The authors also do not have any financial interest or any other conflict of interests.

All three of the aforementioned authors are involved in all stages of the study, including theoretical studies, data collection, analysis and data processing, and the presentation of the report. The ordering of their names based on their contribution to the process.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.envc.2025.101340.

Data availability

Data will be made available on request.

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