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Review article

Eight strategies for human–wolf coexistence and their application to Swiss governance gaps

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ABSTRACT

Increasing conservation efforts have led to increases in wolf populations in Europe. However, the resulting conservation conflicts erode conservation support when farmers and rural citizens fear for their livelihoods. Fostering human–wolf coexistence can be achieved through a variety of strategies. By using the Institutional Analysis and Development (IAD) framework, I provide a general policy perspective on strategies for human–wolf coexistence. These can be synthesised into eight strategies and include: (1) wolf habitat and population management, (2) scientific research and exchange, (3) education and awareness, (4) farm-level livestock protection (including new technologies), (5) resolution and mediation of conservation conflicts, (6) community-based conservation and (7) financial instruments. These strategies need to be embedded into (8) legal protection frameworks and policies. I then identify missing strategies and emerging opportunities for wolf conservation in Switzerland specifically, which is a relevant case study due to mounting opposition among rural citizens. I suggest that two strategies in Switzerland's approach to human–wolf coexistence are missing, which can create sustained co-benefits for both humans, especially farmers, and wolves: financial instruments (including benefit sharing and conservation performance payments) and community-based conservation. These findings aim at stimulating scientific debate as well as exploring their applicability in Switzerland through policy for a holistic approach to human–wolf coexistence.

1. Introduction

Biodiversity loss is a pressing issue, fostered by overexploitation of natural resources and agricultural activities (Maxwell et al., 2016; Rigal et al., 2023). This loss motivates increasing conservation efforts, which have led to increases in carnivores, including wolves, in Europe (Chapron et al., 2014). However, conservation conflicts emerge from livestock predation by wolves and human fear of the latter. Besides direct interactions between humans and wolves (human–wolf impacts), these more often result in conflicts between humans regarding wolves (human–human conflicts, such as conservationists and farmers) (Redpath et al., 2013). Both impacts and conflicts can erode conservation support when the livelihoods of rural communities, including farmers, are threatened (Dressel et al., 2015). Subsequently, this lack of conservation support has led to poaching and the illegal killing of wolves (Sunde et al., 2021) as well as recent changes in legislations that allow for substantial removal of wolf populations in, for example, countries of the European Union as well as Switzerland via the Bern Convention (KORA, 2024; Council of Europe, 2025).

These developments suggest a substantial lack of human-wolf coexistence. Coexistence, as defined by Carter and Linnell (2016), is a

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dynamic but sustainable state in which humans and wolves co-adapt to living in shared areas. Their interactions are governed by effective institutions that ensure long-term wolf population persistence, their social legitimacy, and tolerable levels of risk to humans. Therefore, coexistence strategies require the mitigation of conservation conflicts and a balance between conservation outcomes and livelihoods of local communities. However, rural communities commonly perceive costs from conservation conflicts as high, sometimes leading to misperceptions on the potential costs and benefits (Meyer and Börner, 2022; Meyer, 2024). Therefore, achieving sustainable coexistence necessitates developing strategies that generate tangible, shared benefits from wildlife presence to support rural communities while addressing these misperceptions (Carter and Linnell, 2023).

Mitigating conflict and fostering the coexistence of humans and wolves can be achieved through a variety of strategies. This policy perspective uses the Institutional Analysis and Development (IAD) framework (Section 2) and an overview of the literature to derive eight coexistence strategies (Ostrom, 2011). These eight strategies can constitute a holistic approach to human–wolf coexistence (Section 3).

In Switzerland, wolves have increasingly recolonised their former habitats, but conservation support among rural citizens is increasingly lacking, even though the country exhibits multiple governance strategies to foster human–wolf coexistence. Thus, current wolf conservation efforts in Switzerland constitute an ideal case for pinpointing missing coexistence strategies that constitute governance "blind spots". To provide an overview of these blind spots in Switzerland's approach to human–wolf coexistence, I map coexistence strategies currently in place in Switzerland and highlight corresponding coexistence strategies as identified by the IAD (Section 4). This leads me to suggest a holistic approach to human–wolf coexistence that could fill these blind sports (Section 5). The two emerging governance opportunities that could enhance resilient coexistence include financial incentives and community-based conservation. I then justify these suggestions by integrating them into the concept of archetypal human–wildlife outcomes (Carter and Linnell, 2023). This concept offers an evaluative lens of the proposed coexistence strategies, by categorizing the types and qualities of coexistence outcomes and assessing their level of coexistence resilience. With this perspective, I seek to stimulate scientific debate and encourage exploration of novel governance models for coexistence, given the current urgency and political shift in wolf conservation in Switzerland (Section 6).

2. Deriving a perspective on coexistence strategies through the institutional analysis and development framework

The IAD framework is a multi-tier conceptual map (Ostrom, 2011) that enables deriving a perspective of coexistence strategies in the context of common-pool resources such as wildlife—and in this case wolves. It can be argued whether wolves constitute a common-pool resource or a public good. Both categories differ regarding whether a good or resource is subtractable. In the context of this perspective, however, wolf population management options such as public and private hunting are relevant. These management options remove wolves from the ecosystem, and thus, they cannot be watched or hunted by other humans, making them a common-pool resource. However, this approach reduces wolves to their extrinsic value and therefore to the benefits wolves provide to humans or ecosystems for direct or indirect use. In Section 6, I engage in a discussion on the intrinsic and relational values of wolves that go beyond a utilitarian approach.

Grossman (2019) showed that the IAD framework helps in (understanding) policymaking in times of crisis, which threatens society economically or physically and calls for public policy response. Livestock predation by wolves (and the resulting aftermath) can be understood as such a crisis (Zscheischler and Friedrich, 2022; Gabehart, 2025). In Switzerland, this has become visible in increasing societal tensions. These culminated in the revisions of the hunting law in 2023, which allows the culling of 70 % of the wolf population

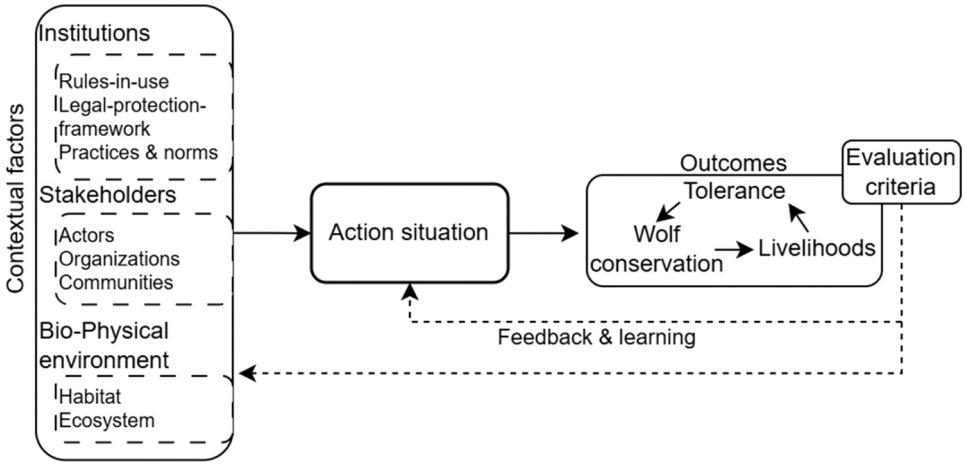

Fig. 1. Institutional Analysis and Development (IAD) framework in the context of human–wolf coexistence. Both contextual factors and the evaluation of outcomes influence the action situation. The action situation has, in turn, an effect on outcomes, which includes wolf conservation, rural livelihoods and tolerance towards wolves. These are evaluated and fed back to the contextual factors and the action situation through feedback and adaptive learning processes. Adapted from Ostrom (2011) *and* McGinnis (2011).

and resulted in shooting of over 80 wolves in 2024 with further regulations underway. This crises and tensions therefore render the IAD framework a suitable tool. Key components of the IAD framework include contextual factors, action situations, outcomes, evaluation criteria, and feedback (or adaptive learning processes) (McGinnis, 2011). Fig. 1 draws on an adapted IAD framework in the context of human–wolf coexistence.

As defined by Ostrom (2011, p. 11): "Action situations are the social spaces where individuals interact […]". Fostering the coexistence of humans and wolves (as interacting individuals) is the point of departure in this policy perspective and therefore identified as the action situation, which is the key component of the IAD framework and at the centre of Fig. 1. The action situation influences the outcomes. In the context of human–wolf coexistence, these outcomes are tolerance for wolves by (rural) citizens, wolf conservation status, and local livelihood outcomes. These outcomes are in a consecutive circle, as wolf conservation influences livelihoods, which influences tolerance. These outcomes need to be evaluated against some evaluation criteria, that is, indicators such as wolf and pack numbers or farmers' incomes. Contextual factors influence the action situation and include institutions (such as formal rules-in-use and legal protection frameworks as well as practices and norms), stakeholders (including actors, organisations, and communities), and the physical environment (such as wolf habitats and the respective ecosystem). Actors are humans and their communities, as well as government agencies but also wolves. Feedback or adaptive learning processes pertain to insights into whether and how coexistence works through, for example, scientific research.

3. Eight strategies for human–wolf coexistence

Using the IAD framework, I argue that governance approaches fostering human–wolf coexistence can be summarised into eight non-exclusive strategies.

3.1. Wolf habitat and population management

The management of wolf habitats and populations should be embedded in regular monitoring activities, including wolf demographics and predation incidences. These ensure informed decision making, such as translocation or removal, and constitute feedback to the action situation and contextual factors. Beyond these, wolf management includes three options.

First, preserving and restoring carnivores' natural habitats ensures that they have ample space and resources, as their habitat is determined by land cover and topography, prey richness, as well as anthropogenic factors (see Falcucci et al. 2013 and Behr et al. 2017 for an extensive list of factors determining wolf habitats). Preserving and restoring wolf habitats may therefore reduce the likelihood of conflicts arising from competition for resources such as prey (Di Minin et al., 2016).

Second, translocating carnivores to more suitable areas could theoretically prevent overpopulation and reduce conservation conflicts. However, Linnell et al. (1997) demonstrated the poor performance of translocation as a single mitigation measure.

Third, lethal population management includes eradication, public hunting, culling, and selective removal (Treves and Naughton-Trevers, 2005). DeCesare et al. (2018) indicated that the targeted removal of wolves in Montana, USA, can significantly reduce livestock depredations, which is in line with findings of Eklund et al. (2017), who suggest that selective removal of adult or breeding carnivores decreases the risk of livestock depredation. Bradley et al. (2015) show that partial and full pack removal in three states of the US can reduce the occurrence of livestock depredations by up to 79 %. Kutal et al. (2023) demonstrated that there is no relationship between the number of wolves killed through public wolf hunting and livestock losses in Slovakia. Similarly Ostermann-Miyashita et al. (2025) suggest that there is little evidence on the effectiveness of lethal control in Europe. While reducing wolf numbers might lower livestock predation, it can also have no impact or even worsen attacks by disrupting pack structures or opening territories. In total, this suggests that case-specific evaluation of population management is essential and that substantial geographic heterogeneity needs further research.

Lastly, wolves can contribute to coexistence with humans through their behaviour, avoiding humans. These, however, require interconnected wilderness areas to maintain landscapes that support this coexistence (Lamb et al., 2020). Recent research by Anderson et al. (2023) highlighted how the "socioecology of fear" (adapted from the ecological term "ecology of fear") can result in human–wolf coexistence—that is, wolves need to be adequately afraid.

3.2. Scientific research and exchange

Knowledge of wolf behaviour, movement patterns, and population dynamics is crucial for the implementation of targeted management strategies, such as the establishment of protected corridors and habitats, to prevent wolves from roaming into human settlements and farms. Conducting ongoing research on wolf behaviour, population dynamics, and ecological roles informs management decisions and enhances our understanding of their interactions with humans. As Doney et al. (2023) emphasised, national and international collaborations and research networks can share successful strategies and experiences, promoting effective coexistence practices across borders.

Further, scientific research needs to be embedded in explicit research designs to generate the causal effects of interventions and monitoring, as highlighted by Barrett (2021), to single out effective interventions and guarantee their cost-effectiveness. This research on intervention effectiveness remains however comparatively scarce, as pointed out by Artelle et al. (2024). This is also illustrated by the conflicting empirical evidence on the effectiveness of lethal control of wolves in the US and Europe (see Section 3.1 before and Ostermann-Miyashita et al. 2025 and (Treves et al., 2019)). Artelle et al. (2024) therefore propose a shift in focus toward more solutions-oriented research to foster coexistence. Ideally, scientific research and exchange are also connected to monitoring activities

and integrated into long-term government programmes (also see previous section). Developing these programmes is however costly and laborious (Caughlan and Oakley, 2001), as some governments in, for example, developing countries may lack the resources for such efforts, jeopardising the development of successful management strategies.

Besides natural science, social science is important to understand the needs and perspectives of different stakeholders in wolf conservation (Ostermann-Miyashita et al., 2025). In this context, measuring the wider public perception of wolf conservation is important to evaluate the social capacity and acceptance of wolves and their management, as shown by Arbieu et al. (2019) and Capitain et al. (2025).

3.3. Education and awareness

Raising awareness among rural residents helps them understand the ecological benefits of wolves and can foster tolerance and support for their presence. Similarly, urban residents, who are often more accepting of wolves (Behr et al., 2017) must be aware of the potential costs of conservation conflicts with wolves. Stakeholders should, therefore, be informed through education and awareness. In this regard, it is imperative to approach stakeholders, especially local communities on eye-level, such that local context is recognized (Fariss et al., 2023). Although awareness raising by itself may not suffice in promoting human–wildlife coexistence (Qian et al., 2022), it can support communities in adopting proactive measures. Importantly, challenges such as the social costs of conflict should be acknowledged and taken seriously to ensure that local communities feel heard, supported, and empowered to actively participate in coexistence efforts while safeguarding their livelihoods. A more specific aspect of raising awareness pertains to proper waste disposal, which reduces the interaction space between humans and wolves (Mohammadi et al., 2022).

3.4. Farm-level livestock protection, including new technologies

Commonly used livestock protection measures involve four main aspects: fences, shepherds and guarding animals such as livestock guarding dogs, nighttime confinement, and deterrence, such as fladry, audio, and human presence (Treves et al., 2009). Vogt et al. (2022) showed the effectiveness of livestock protection measures in Switzerland, especially the combination of livestock guarding dogs with electric fences and shepherds. However, there is a general need for more evidence-based interventions to mitigate conservation conflicts with wolves, highlighting the scarcity of comparative studies and the call for a standardised evaluation approach in the future (van Eeden et al., 2018; Artelle et al., 2024).

These conventional livestock protection measures can be accompanied by new technological innovations, including virtual fences, unmanned arial vehicles (such as drones), and apps that allow for rapid information exchange, such as wolf predation incidence tracking. Virtual fencing systems can offer real-time data on animal behaviour (Umstätter et al., 2020) and provide early warnings of predation incidences. Here, during predation by wolves, animals are not confined by a physical fence and can flee without hindrance. Apps can utilise GPS tracking and camera traps to alert farmers and communities to the presence of wolves, enabling timely preventive actions. In France, the *MapLoup* app helps local herders inform each other, as predation incidences by wolves are tracked and spatially mapped in real time (see https://maploup.fr/ for more information). Drones can cover vast areas in little time, providing aerial surveillance and swift inspection of fences.

3.5. Resolution and mediation of conservation conflicts over and with wolves

When human-wolf impacts and human-human-conflicts occur, an active dialogue between stakeholders, such as farmers and wildlife professionals, can help foster human–wolf coexistence. This needs to be embedded in a joint factfinding process, as highlighted by Hansen et al. (2022) in the “Wolf Dialogue Project”. This can empower stakeholders to take on a shared responsibility for wolves as a common good. As another key tool, Redpath et al. (2013) developed a roadmap for managing conservation conflicts that involves an initial mapping of conflict as well as active conflict management, which often engages third parties. These parties include mediators, government representatives, internal peacemakers, and scientists (Redpath et al., 2013). Therefore, training these parties, also including wildlife professionals, in conflict resolution techniques can facilitate peaceful coexistence by addressing conflicts in a constructive manner and finding shared solutions—especially in human–human conflicts.

3.6. Community-based conservation

Community-based conservation[1] (CBC) is a popular strategy for the conservation of fauna, including carnivores. CBC is characterised by decentralised governance and devolution of land-use rights to a designated community of local residents in wildlife conservation landscapes (Agrawal and Gibson, 1999). This form of collective management of natural resources has the twin goal of natural resource conservation, especially wildlife, and improving community livelihood and security (Treves et al., 2006). A global comparison by Zhang et al. (2023) indicates a tendency for community-based and co-managed governance arrangements to produce beneficial outcomes for people and nature. Fariss et al. (2023) highlight that CBC are successful in working for both people and nature when they occur in national contexts supportive of local governance, i.e. that local communities and their needs are recognized.

[1] Also referred to as community-based natural resource management (CBNRM)

Successful examples of wolf conservation efforts involving communities can be found globally. These include the "Blackfoot Challenge" in Montana, USA (Wilson et al., 2017; Richardson, 2022), where community members were included in meetings, workshops, field tours, and regular group meetings, as well as opportunities to participate in monitoring, fencing, and livestock carcass removal. In the upper Humla and upper Dolpa regions of the Nepalese Himalayas, people living in the community-owned Kanchenjunga Conservation Area (a form of CBC) showed more positive attitudes towards the Himalayan wolf (*Canis lupus chanco*), compared to non-CBC respondents (Kusi et al., 2020). In central Brazil, communities neighbouring the Serra da Canastra National Park participated in discussing conflicts with maned wolves (*Chrysocyon brachyurus*) (Bizerril et al., 2013). Through an environmental education programme, participation resulted in producing a book about the region, developing a travelling environmental cinema touring local towns and farms, and training the community on communication tools. Further examples include the conservation of the Ethiopian wolf (*Canis simensis*) surrounding Mount Abune Yosef, Ethiopia (Ashenafi et al., 2005; Eshete et al., 2015) and CBC for grey wolves (*Canis lupus*) by the local *Chushul* community in the Ladakh region of the Indian Himalaya (Sonam et al., 2022). In France, the early warning system app *MapLoup* (described above) is a product of collaboration between communities, environmental organisations, and wildlife experts. It can be considered a hybrid form of citizen science and co-management. Finally, a global comparison by Zhang et al. (2023) indicates a tendency for community-based and co-managed governance arrangements to produce beneficial outcomes for people and nature.

Why and how does CBC work? Involving local residents in areas of wolf presence in the decision-making processes and conservation efforts empowers them to contribute to solutions (Treves et al., 2009). This collaborative strategy considers local knowledge and creates agency in wolf conservation by local stakeholders (Doney et al., 2023). As Saarikoski et al. (2024) argued, co-management through joint fact-finding is a constructive way to facilitate coexistence. In southern Africa, CBC is also often associated with tourism, with local communities receiving cash and in-kind benefits from non-consumptive and consumptive tourism, such as trophy hunting and photo safaris (Meyer et al., 2021; Meyer and Börner, 2022).

However, CBC is also contested. Brooks et al. (2012) indicated that the success of CBC is dependent on the project design, including the capacity building in local communities, as well as the tenure regimes and supportive cultural beliefs and institutions.

3.7. Financial instruments

Dickman et al. (2011) highlighted three important financial instruments that could alleviate economic burdens on farmers to encourage human–carnivore coexistence.

Compensation and insurance measures aim to compensate individuals for losses incurred due to wildlife depredation, reducing animosity, and retaliatory killing of animals. Although these measures have been shown to reduce hostility towards wolves in, for example, Yellowstone National Park, these measures come with their own challenges (Redpath et al., 2013). Farmers need timely and adequate payments that cover opportunity costs, arising from lost future offspring of killed livestock, (Bautista et al., 2019; Kimaro and Hughes, 2023). However, slow and unreliable damage verification can discourage compensation claims (Nyhus et al., 2005). Additionally, compensation schemes may attract migration to funded areas and often depend on uncertain external funding (Dickman et al., 2011). Relying solely on compensation to build tolerance for wolves is likely insufficient (Bautista et al., 2019).

Benefit sharing redirects revenues from wildlife-related activities, such as ecotourism and trophy hunting, back to local communities to help offset unaddressed costs. Therefore, CBC can also represent the concept of financial benefit sharing, with the above-mentioned success in both wildlife conservation and poverty alleviation (Meyer et al., 2021); however, challenges such as distributional inequalities, "elite capture", and the lack of conditionality on conservation measures persist (Kamoto et al., 2013). Additionally, protecting land for conservation can impose significant opportunity costs on local communities, potentially reinforcing poverty traps and leading to negative impacts on wildlife. However, this has become an integral part of regional conservation efforts, especially in South Africa (Meyer and Börner, 2022).

Lastly, *conservation performance payments* are payments per conservation outcome. In the context of carnivores, payments per-animal offspring are made (quid-pro-quo) to e.g. farmers and livestock herders, in which any actions that lead to an increase in offspring are irrelevant. These payments are therefore directly linked to the production of desired environmental outcomes and provide greater flexibility for service providers, lower transaction costs for livestock keepers, and reduced opportunity costs for local communities (Zabel and Holm-Müller, 2008). The payments also do not result in the problem of moral hazard, as *compensation and insurance* measures do, which can lead to sub-optimal levels of livestock protection. *Conservation performance payments* have resulted in remarkable effects on Sweden's carnivore conservation (Zabel and Holm-Müller, 2008). However, there are production risks for service providers (e.g. farmers who conserve carnivores), the possibility of elite capture of benefits, and the need for well-defined land tenure and property rights (Zabel and Holm-Müller, 2008).

In the context archetypal outcomes of human–wildlife interactions by Carter and Linnell (2023), these financial measures can create sustained co-benefits—that is, farmers and communities derive monetary benefits, which can help in legitimising the conservation status of wolves. However, Igoe and Brockington (2007) highlighted that the 'neoliberalisation of nature' can lead to reregulation from commodification and new types of territorialisation, where the partitioning of resources, such as wildlife and landscapes, can control or even exclude local people. Redpath et al. (2013) highlighted further pitfalls of financial instruments, such as when profit is not a primary aim, particularly among wealthy stakeholders, or when incentives are politically unacceptable. Therefore, careful considerations should be made before applying such a neoliberal strategy to coexistence.

3.8. Legal protection frameworks

Finally, all strategies, particularly wolf and habitat management plans, should be clearly defined and integrated into legal protection frameworks—laws and policies that operate at different scopes and jurisdictions, including international, national, regional, and transboundary levels.[2] These should regulate, for example, carnivore hunting, trapping, and persecution, (Trouwborst, 2010) or institutionalise compensation programmes. Legal frameworks make management transparent and hold all stakeholders accountable. Embedding these strategies in laws and policies also provides stability for long-term wolf conservation, as their populations often require sustained management to recover from historical declines (Mech and Boitani, 2010).

3.9. Eight governance strategies for human–wolf coexistence

Together, I summarise these eight strategies in Fig. 2, where seven of them need to be integrated into *legal protection frameworks and policies.*

4. Humans and wolves in Switzerland

Wolves in Switzerland have recolonised their former habitats since the end of the 1990s, but conservation support among rural citizens is increasingly lacking, even though the country exhibits multiple governance strategies to foster human–wolf coexistence. Thus, current wolf conservation efforts in Switzerland constitute an ideal case for pinpointing missing strategies that constitute governance blind spots. To do this, I first provide an outline of challenges to human-wolf coexistence. Then I map coexistence strategies currently in place in Switzerland and highlight the corresponding coexistence strategies derived from the IAD.

4.1. Challenges for coexistence

Wolves have been recolonizing Switzerland since 1996. As of 2023, 37 wolf packs, of which 20 only reside in Switzerland, have been verified and an estimated 320 individual wolves claim their territory from the Jura mountains in the west to the Engadin region in the east (KORA, 2024). This development has also led to widespread livestock predation by wolves. From 2003–2020 livestock killed by wolves increased from 38 to 815 per year. On the one hand, this predation contributed to farm structural change such, as increasing shepherding and decreasing permanent, non-guarded pastures among sheep farms (Mink et al., 2023). On the other, farms and farmland was also abandoned (Mink and Mann, 2022). In total, the number of seasonal mountain farms declined by 11 % between 2003 and 2021 (Meyer et al., 2024). This has led to public upheaval since the first incidences of wolf predation and people protesting for increased regulation of the Swiss wolf population (see an example in Fig. 3).

Protests suggest widespread low-level acceptance of wolves, especially in the western Alps and most of the central Alps of Switzerland (Behr et al., 2017). On November 1st, 2023, these low acceptance levels resulted in the Federal Council of Switzerland to approve an amendment to the hunting ordinance, which allows the culling of 70 % of the wolf population (2023 base year). With this decision, the council temporarily enforces the implementation of regulations for a portion of the amended hunting law passed by Parliament in 2022. With this, 12 of Switzerland's 26 wolf packs may be shot. As of January 31st, 2024 this led to the shooting of 81 wolves — a loss of 26 % of the entire Swiss wolf population (KORA, 2024). A second wave of regulation activities has been underway since September 2024, aiming at the complete removal of six packs, plus the partial removal of wolf cubs born in 2024. The include the complete removal of the *Vorab*, *Mont Tendre*, *Augstboard, Nanz, Les Toules*, and *Hérens-Mandelon, Fuorn, Risoud* packs, plus the partial removal of wolf cubs born in 2024. As of March 2025, three of these packs have been completely removed.[3] Other regulations are currently being evaluated by the Federal Office for the Environment. This shows that the demand for regulation of wolf populations by non-governmental organisations and other stakeholders, such as the farmers' union, has led to changes in the law due to the low tolerance of rural populations. If thoroughly implemented, this will lead to substantial conservation setbacks and undermine hard-won conservation successes. In the context of the IAD, this constitutes the action situation and requires public policy response to foster coexistence, which I outline in the next section.

4.2. Blind spots of human–wolf coexistence strategies

To provide an overview of missing coexistence strategies—the blind spots—in Switzerland's approach to human–wolf coexistence, I map the strategies currently in place in Switzerland in Table 1 and apply the IAD framework to highlight their corresponding coexistence strategies, as identified in Section 3. In the context of the IAD framework, these blind spots also call for policy action, which I subsequently address in section 4.3.

The monitoring of the wolf population in Switzerland is carried out by KORA, an in-state foundation. The organisation provides

[2] Supranational frameworks include the EU Habitats Directive or the Bern Convention. National frameworks and policies include, for example, the Endangered Species Act (ESA) of the US, the Species at Risk Act (SARA) of Great Britain, and the Federal Nature Conservation Act (Bundesnaturschutzgesetz) of Germany. Transboundary cooperation of countries' conservation efforts is governed by, for example, the European Habitats Directive (Council Directive 92/43/EEC) or the Convention on Biological Diversity (CBD).

[3] News on current hunting activities and an extensive list of wolf losses can be found at https://www.kora.ch/en/news?page=2&language=en

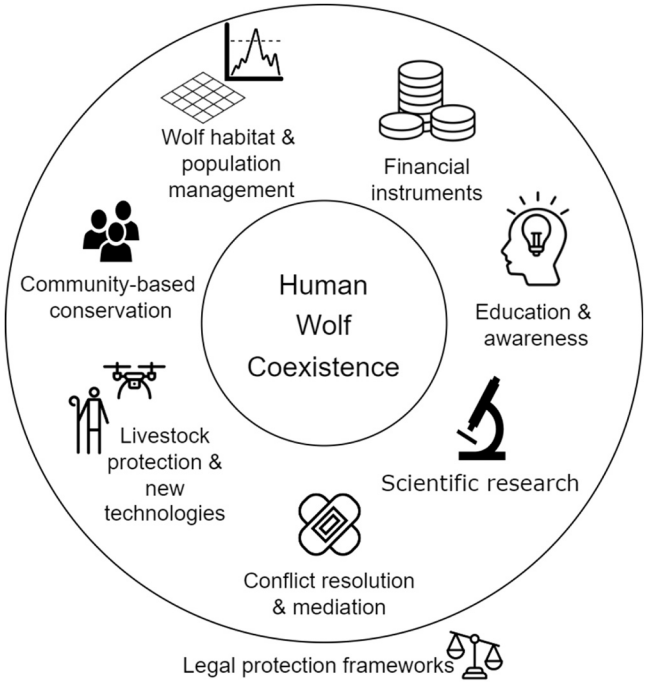

Fig. 2. Eight governance strategies for human–wolf coexistence. Human–wolf coexistence is at the centre and can be achieved by using all seven strategies, which should be embedded in legal protection frameworks and policies.

Fig. 3. "No place for large carnivores". Popular initiatives against wolves in Valais, Switzerland, indicate low tolerance for wolves among rural citizens and demanding of wolf population regulation. May 3, 2016.

information on **wolf habitat and population management** to the Federal Office for the Environment, including lethal population management, which is carried out by the cantons and their gamekeepers (Table 1, row 1). KORA also collaborates with universities, technical colleges, government institutions, and non-profit organisations within and outside of Switzerland, therefore fostering **scientific research and exchange** (Table 1, row 2). **Public awareness programmes** about wolves in Switzerland are based on initiatives by non-profit and non-governmental organisations such as WWF, ProNatura, and Gruppe Wolf Schweiz (Table 1, row 3). The Swiss government provides a federal **livestock protection programme**, for which the Swiss Association for the Development of Agriculture and Rural Areas (AGRIDEA) operates two specialist departments for technical livestock protection and livestock protection dogs, grouped together under "Herdenschutz Schweiz" (herd protection Switzerland). Through cantonal authorities, the government

Table 1
Comparing identified coexistence strategies and corresponding strategies implemented in Switzerland.

	Coexistence strategies	*Corresponds to*	Coexistence strategies in Switzerland
1	Wolf habitat and population management		Wolf monitoring by KORA and regulation of wolves that have significant impact by cantonal authorities
2	Scientific research and exchange		Research and exchange carried out by public entities such as KORA, national universities, NGOs
3	Education and awareness		Public awareness programmes by NGOs
4	Livestock protection measures		Livestock protection programmes (Link)
5	Conflict resolution and mediation		Regional mediation platforms such as "Infoplattform Grossraubtiere" (Link)
6	Community-based conservation		*No corresponding strategy*
7	Financial instruments:		- Farmer's compensation schemes
	- Compensation & insurance		- *No corresponding strategy*
	- Benefit sharing		- *No corresponding strategy*
	- Compensation performance payments		
8	Legal protection frameworks and policies		Cantonal management strategies, national laws (such as the federal law on nature and heritage conservation and hunting law), Bern Convention

also provides farmers with new technologies such as drones for rapid farm surveillance to mitigate livestock predation by wolves (Table 1, row 4). Regional **mediation platforms** such as the "Dialogplattform Grossraubtiere" (dialog platform large carnivores) as well as the "Infoplattform Grossraubtiere" (information platform large carnivores),[4] initiated by different farmers interest groups, provide best practices and conflict resolution and mediation (Table 1, row 5). Regarding **financial instruments**, farmer's **compensation schemes** exist and livestock owners must prove that wolves were responsible (Agridea 2016). The damage is assessed by wildlife wardens and compensated by the cantonal hunting administration. In cases of missing animals proven to have disappeared due to wolf attacks, compensation is at the discretion of the cantonal hunting administration. Compensation amounts are based on guidelines from Swiss breeding associations, but there is currently no compensation practice for cattle. Further, there are no corresponding strategies to benefit-sharing arrangements or conservation performance payments (Table 1, row 7).

Finally, the interaction of humans and wolves in Switzerland is governed by a combination of **different legal protection frameworks and policies** (Table 1, row 8). These include cantonal management plans, national laws, international agreements, and the "Concept Wolf Switzerland". Twelve out of 26 cantons provide designated regional management plans.[5] For example, the canton of Bern provides a catalogue of measures that includes monitoring, communication, and management recommendations for farmers (Economic Directorate of the Canton of Bern, 2010). National laws include the Federal Law on Nature and Heritage Conservation, which regulates wolf protection, and the national hunting law (The Federal Assembly of the Swiss Confederation, 2025). The latter regulates circumstances under which wolves can be legally hunted, for example, when they pose a threat to livestock or public safety. Switzerland is also a signatory to the Bern Convention on the Conservation of European Wildlife and Natural Habitats, an international agreement listing the wolf as a protected species. Among these legal protection frameworks and policies, "Concept Wolf Switzerland" is an important governance document. The organisational structure involves Federal Office for the Environment's oversight, inter-cantonal commissions for regional management, and the involvement of national working groups and local authorities. Therefore, the concept interlinks stakeholders throughout the governance system and provides implementation aid. "Concept Wolf Switzerland" aims at connecting and strengthening all the aforementioned strategies and includes (1) ensuring public awareness of wolf behaviour, (2) minimising conflicts with various sectors, (3) formulating principles for damage prevention and compensation, (4) preventing undue restrictions on livestock farming, and (5) establishing criteria for shooting wolves causing harm or regulating expanding wolf populations that have significant impacts. Despite the substantial list of strategies for human–wolf coexistence in Switzerland, Table 1 highlights the lack of strategies corresponding to benefit sharing, compensation performance payments and CBC (Table 1, rows 6 and 7).

5. Towards a holistic approach to human–wolf coexistence

Switzerland's approach to human–wolf coexistence emphasises the regulation of wolves, drawing major public attention (Micallef, 2023; O'Sullivan, 2024). However, this assigns no inherent value to wolves for rural citizens, including farmers, and leads to substantial conservation reliance for wolf populations to thrive. Although this can constitute a form of coexistence, the work of Carter and Linell (2023) shows it may not be as resilient because it requires strong conservation policies for species to persist alongside high human densities. Co-benefits are, however, the archetype closest to coexistence. I adopt Carter and Linell's (2023) concept and adapt it to the Swiss situation of human–wolf interactions, as shown in Fig. 4.

Fig. 4 conceptualises the consequence of perturbations from conservation conflicts in Switzerland (a shift in the system on the y-axis in Fig. 4), initiated by mounting opposition due to conservation conflicts resulting in wolf regulation activities. It shifts the human–wolf system from the current wolf conservation reliance to three potential outcomes and shows how adding financial instruments and

[4] Further information, also on other working groups that work on informing the general public and providing mediation forums can be found here: https://infoplattform-grossraubtiere.ch/wp-content/uploads/2023/06/Tourismus-und-landwirtschaft.pdf

[5] An overview and each regional management plan can be found here: https://www.kora.ch/en/general/library/concepts

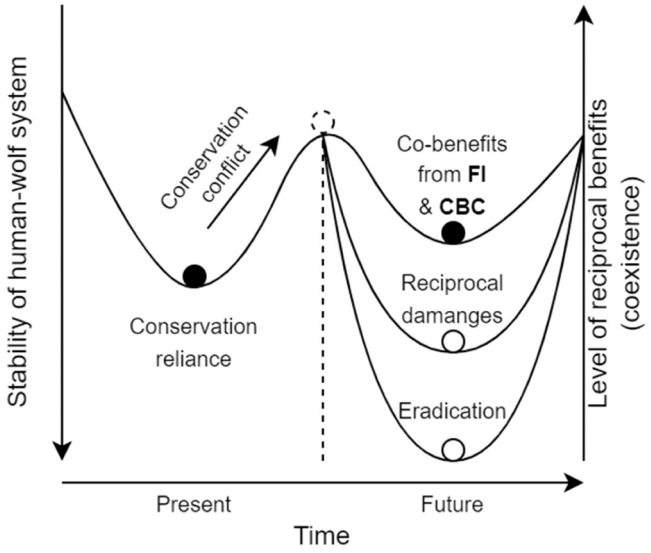

Fig. 4. Consequence of perturbations from conservation conflict to the stability of the human–wolf system (left y-axis) and the level of reciprocal benefits (as a measure of coexistence – right y-axis) in Switzerland across time (x-axis). Black and white dots indicate outcomes consistent and inconsistent with coexistence, respectively. Adapted from Carter and Linnell (2023). *Note: There is a direct trade-off between system stability and levels of reciprocal benefits (a measure of coexistence). A stable system is associated with the eradication of wolves, as no conservation conflicts arise, but this is an obvious conservation setback. At the other end of the spectrum, high levels of reciprocal benefits require high levels of coordination and governance, which come with lower levels of system stability. This is an addition and slight change to* Carter and Linnell's (2023) *concept.*

CBC can lead to co-benefits, consistent with coexistence. Co-benefits arise when, first, wolves' "benefit" through improved conservation outcomes, enabling their populations to thrive. Second, humans can also benefit through financial incentives (benefit sharing and conservation performance payments), which assign monetary value to wolf populations. This is consistent with the findings of Redpath et al. (2013), who used a game-theoretical approach to highlight how conservation conflicts of parties[6] can be managed to an acceptable level (although not always resolved) by moving from a zero-sum game, where one's gain is the other's loss, towards non-zero-sum outcomes. This implies that improvements in wolf conservation outcomes need to be associated with improvements in, for example, farmers' livelihoods. By their very definition, co-benefits can do so when they arise from financial incentives. This has also been highlighted by Carter and Linnell (2023) in the case of CBC in Namibia (Meyer et al., 2021).

Applying conservation performance payments (as a financial incentive) to Switzerland's wolf population, that is, paying for wolf offspring, may seem controversial, given the negative sentiment towards wolves in rural areas (Behr et al., 2017). However, conservation performance payments would give wolf offspring's a monetary value and therefore a benefit to humans. They may also constitute a solution to the prevailing moral hazard problem, leading to suboptimal levels of livestock protection (Zabel and Holm-Müller, 2008). Shepherds and farmers could find optimal solutions to their livestock protection situation by themselves, as the actions that led to the conservation outcome are not relevant, giving farmers agency in both conservation work and livestock protection measures. As transaction costs are zero (as these are indirectly paid through conservation performance payments), this also lifts the shepherd's burden of finding killed (and often mutilated) livestock for claiming compensation payments.

Switzerland has well-defined land tenure and property rights. Municipalities, defined as communities in this setting, are the smallest political units in Switzerland and have direct democratic rights and substantial fiscal authority (Auer, 2016). This helps because the clear municipal boundaries enable an unambiguous allocation of wolf pack territories and offspring numbers to specific municipalities. Conservation performance payments could be implemented though both contracts and funds via a two-tier approach. First, contracts between the government and municipalities define the payments per offspring and the minimum number of conserved wolf offsprings. Second, payments are then allocated to a municipality fund, which can be used to finance farmers needs such as salaries for shepherds, farm infrastructure, or any other needs of the farmers. How this may be designed and implemented is up for debate and needs substantial co-creation among relevant stakeholders.

Benefit sharing and CBC are commonly linked through tourism to generate income (Naidoo et al., 2016). Tourism is an important economic factor in many rural areas of Switzerland (Leimgruber, 2021; Meyer et al., 2025). Although a form of wolf-related tourism already exists in parts of the Swiss Canton of Valais, where so-called "wolf safaris" supply tourists with photo opportunities, these are not provided by local communities but by a travel agency from other parts of Switzerland. Therefore, there is no benefit-sharing for local communities, as the benefits from revenues do not stay with the local economy, which leads to low support for these initiatives

[6] In the light of our definition of conservation conflicts, conflict parties are human–human, such as farmers and conservationists and human–wildlife, such as farmers and wolves.

(SRF, 2021), among other reasons. Generating tourism experiences by local stakeholders through, for example, photo safaris from local guides may however be a way to create benefits for the local economy. This has also been highlighted by Cartier and Schmid (2021) who suggest a high willingness to pay of tourists for exclusive and guided tours by wolf experts. This would tab into the substantial expenditures by tourists for recreation and other cultural services, which amount to over 1 billion CHF in 2017 (Federal Statistical Office, 2022). On the demand side for tourism, tourists need to be made aware of the potential for wolf photo safaris. However, there is no indication of guided wolf safaris when checking e.g. Switzerland's official tourism portal (www.myswitzerland.com). Finally, wolf tourism may not be without its drawbacks. The presence of livestock guarding dogs for livestock protection can create conflict with hikers and mountain bikers (Riesen and Rupf, 2017). Further, social acceptance of wolf tourism needs to be considered, which I highlighted as low in some regions of Switzerland due to the lack of benefit sharing. This calls for participatory planning of these measures, i.e. involving local stakeholders in the design and pricing of wolf tourism as well as benefit-sharing from CBC to secure the stakeholder's buy-in.

Fostering tourism activities through CBC also gives agency to rural residents in wolf governance through a participatory process. As Christensen et al. (2021) showed that citizen monitoring of natural resources as part of a CBC process, creates inclusive governance, contributing to better-informed rural residents who participate more in the enforcement of rules around resource use. This aspect of CBC may be a promising path towards human–wolf coexistence due to the inclusivity of wolf governance. Like conservation performance payments, the design and implementation of this form of benefit sharing and CBC through tourism needs to be discussed and co-created among the relevant stakeholders.

6. Outlook

In summarising eight strategies for achieving human–wolf coexistence, I provide a general policy perspective for researchers, policymakers and practitioners to help explore potential solutions to conservation conflicts. Further, by highlighting governance gaps and the outlined approach to human–wolf coexistence for Switzerland specifically, I hope to stimulate scientific debate and the exploration of potential applications, as it may spark conversations on strategies to human wolf coexistence in Switzerland that are *outside the box*. The overview can also be applied to other countries that offer different contexts and settings and may assist researchers in pinpointing governance gaps in human–wolf governance. More broadly, this overview may also help to govern the coexistence of humans with other wildlife, but its appropriateness needs to be assessed, given the particularities of conservation conflicts with different wildlife species.

We may have already passed a tipping point of the human–wolf system in Switzerland, heading towards a state that is less consistent with coexistence. Switzerland has started substantially regulating its wolf population, diminishing its number by 26 % as of the end of 2024, with further widespread regulations underway and planned. In a broader geographical context, the EU has implemented a reduction of the conservation status of wolves[7] as of March 7th, 2025, with substantial conservation implications. It is therefore urgent to explore the highlighted strategies for human–wolf coexistence.

This perspective uses a utilitarian approach to the value of wolves, which focuses on the benefits and costs of wolves to humans and ecosystems. However, wolves also exhibit intrinsic and relational values, i.e. worth of wolves in itself and the worth of the relationship between wolves and humans, respectively (Chan et al., 2018). Considering these values can add moral and cultural dimensions and subsequently highlights future research avenues on how these dimensions may influence human-wolf coexistence strategies.

These may also be influenced by the concept of the shifting baseline syndrome (Pauly, 1995). In the case of wolves, this suggests that each generation feels that the wolf population they grew up with is normal but may forget how abundant or scarce wolf populations used to be. In Switzerland, where wolves have been eradicated for over 100 years, the baseline for most farmers is no wolves. Due to increasing delays of farm succession, the Swiss farming sector is aging and the shift to a younger generation of farmers is delayed (Zorn, 2025). However, the upcoming generation has a new baseline: a substantial wolf population. The future shift in the baseline of wolf populations may support a more conservation mindset and therefore a greater acceptance of wolves. On the other hand, Whitehead and Hare (2025) emphasize caution as a shifting baseline may lead to "nostalgic landscapes based on anecdote, not evidence", where carnivores can be both romanticized and demonized and therefore lead to societal polarization.

Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work the author(s) used GPT-4o to improve wording and readability as well as stimulate and structure early-stage thinking. After using this tool/service, the author reviewed and edited the content as needed and take full responsibility for the content of the publication.

Declaration of Competing Interest

The author declares no conflict of interest.

[7] From 'strictly protected fauna species' (Bern Convention Appendix II) to 'protected fauna species' (Appendix III)

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Data availability

No data was used for the research described in the article.

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