# Participatory scenario planning to facilitate human-wildlife coexistence

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**Article impact statement:** Participatory scenario planning holds great promise to open new avenues for human-wildlife coexistence in landscapes around the world.

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Running head: Participatory Scenario Planning

## Abstract

Fostering human-wildlife coexistence requires transdisciplinary approaches that integrate multiple sectors, account for complexity and uncertainty, and ensure stakeholder participation. One such approach is participatory scenario planning, but to date, this approach has not been used in human-wildlife contexts. With this paper, we introduce a template for how participatory scenario planning can be applied to identify potential avenues for improving human-wildlife coexistence. Our template draws on three conceptual building blocks, namely the SEEDS framework, the notion of critical uncertainties, and the three horizons technique. To illustrate the application of the proposed template, we conducted a

case study in the Zambezi region of Namibia. We held five multi-stakeholder workshops that involved local people as well as numerous non-government and government stakeholders. We identified 14 important wildlife species that generated multiple services and disservices. The subsequent benefits and burdens, in turn, were inequitably distributed among stakeholders. Government actors played particularly influential roles in shaping social-ecological outcomes. We identified two critical uncertainties for the future, regarding the nature of governance (fragmented versus collaborative) and the type of wildlife economy (hunting versus photography based). Considering these uncertainties resulted in four plausible scenarios describing future human-wildlife coexistence. Stakeholders did not agree on a single preferred scenario, but nevertheless agreed on several high priority strategies. Bridging the remaining gaps among actors will require ongoing deliberation among stakeholders. Navigating the complex challenges posed by living with wildlife requires moving beyond disciplinary approaches. To that end, the template provided here could prove useful in many landscapes around the world.

## Introduction

Living side by side with wildlife is a challenge for people in many landscapes around the world. Human-wildlife conflicts can have negative consequences for people, including through losses in crops and livestock, and various other influences on human well-being (e.g. injury or psychological stress; Ohrens et al. 2019). Wildlife, too, suffers from human-wildlife conflicts because conflicts can spur persecution of animals or lead to a generally negative attitude towards their conservation (Kansky & Knight 2014; Harvey & Mazzotti 2019). Facilitating peaceful human-wildlife coexistence thus becomes an important goal for both social and ecological reasons.

Historically, conservation scientists primarily focused on ecological and economic issues of human-wildlife conflicts, while social dimensions received less attention (Beatrice and Glikman 2019). Measures implemented often failed to adequately consider the complexity and uncertainties involved in human-nature interactions (Hartel et al. 2019; Carter & Linnell 2016). Calls have been made for conservation to better integrate multiple perspectives (Hartel

et al. 2019), generate tangible conservation action (Nicole 2019), and engage diverse stakeholders in problem framing and resolution (Lorimer 2015). Although scarcely used in the context of human-wildlife coexistence (Hartel et al. 2019), such transdisciplinary approaches are generally gaining popularity in applied sustainability contexts (Nicole 2019; Sharpe et al. 2016).

Participatory scenario planning is a transdisciplinary approach that enables stakeholders to navigate future trajectories in complex and uncertain contexts (Daconto & Sherpa 2010). It is a systematic method to identify plausible future trajectories, and subsequently develop appropriate management responses (Oteros-Rozas et al. 2015). By involving researchers, practitioners and civil society organizations (Freeth & Drimie 2016), scenario planning clarifies and makes explicit similarities and differences between different stakeholders' aspirations. If stakeholders share similar aspirations they can then work together to implement a common vision. If different stakeholders differ in their aspirations, strategies to resolve these divergences can be proposed and implemented (Oteros-Rozas et al. 2015).

In the context of human-wildlife coexistence, scenario planning has several advantages. It sharpens understanding of complex system dynamics and promotes critical thinking about the future (Bohensky et al. 2011), fosters dialogue among stakeholders (Kovács et al 2016; Beach and Clark 2015), enhances capacity for collective action (Treves et al 2009), and fosters adaptive learning (Beach and Clark 2015). Despite these advantages, scenario planning has not been used in human-wildlife contexts (Ceauşu et al. 2019). With this paper, we introduce a step-by-step template for how to use scenario planning to address human-wildlife coexistence. Focusing on a case study in the Zambezi region of Namibia, we show how this template can be applied in practice. The template introduced here, we hope, can help to stimulate similar work in many other locations.

The Zambezi region hosts diverse wildlife, including large mammals such as elephant (*Loxodonta africana*), lion *(Panthera Leo*), and hippopotamus (*Hippopotamus amphibious*) (Kamwi et al. 2018). The region is also home to many thousands of people, who grow crops and rear livestock, mostly for subsistence (Kamwi et al. 2018). Human-wildlife conflict is a major challenge in the region, and has resulted in crop losses, livestock killing, property damage, human casualties, and the killing of wildlife (Namibian Ministry of Environment and Tourism, 2013). For example, household-level estimates indicate that annually,

households lose 7% of cash income from livestock and crops (Brian 2006). Human-wildlife conflicts have intensified over the last few decades due to larger wildlife populations and more human activities around wildlife habitat (Stoldt et al 2020). Over the last two decades, the official implementation of Community Based Natural Resource Management (CBNRM) has shaped human-wildlife coexistence. Local communities were organized into "conservancies" and given the rights to manage and benefit from wildlife (Namibian Ministry of Environment and Tourism, 2013). This change in governance generated new income opportunities for local people through tourism and trophy hunting (Kamwi et al. 2018) and improved conservation outcomes (NACSO 2020). Despite these successes, human-wildlife conflicts continue to be challenging for local residents (Salerno et al 2020), and concerns have been voiced about the future of both local livelihoods and wildlife populations.

Against this background, the primary aim of this paper was to provide a template of how scenario planning can be applied to human-wildlife contexts. A second aim was to demonstrate the utility of this template via a case study in the Zambezi region.

## Methods

### Theoretical foundation

To adopt scenario planning for human-wildlife contexts, we integrated three elements, namely the SEEDS framework, the notion of critical uncertainties, and the three-horizons technique (Fig. 1). Below we explain each of these.

#### The SEEDS framework

To conceptualize human-wildlife coexistence, we used the Social-Ecological framework for Ecosystem Disservices and Services (SEEDS) (Ceauşu et al. 2019). This framework is itself rooted in the Social-Ecological Systems framework (Ostrom 2007) and the Ecosystem Services framework (Millennium Ecosystem Assessment 2005), and was designed to facilitate structured data collection in human-wildlife contexts (Ceauşu et al. 2019). The SEEDS framework distinguishes six sub-components, namely wildlife units, services and disservices, services and disservices recipients, governance, interactions between these sub-components, and outcomes (Ceauşu et al. 2019). *Wildlife units* include key ecological information on relevant species; *services and disservices* describes direct and indirect benefits and disbenefits people obtain from wildlife; *recipients of services and disservices*

disaggregates stakeholders into "winners" and "losers" in relation to different wildlife species; the *governance system* relates to local formal and informal rules, and their implementation; *interactions* include coping strategies, cost and benefit sharing and conflicts; and *outcomes* relate to perceived changes in the prior five components.

### Critical uncertainties

The notion of critical uncertainties is central to scenario planning. Uncertainty about the future exists when a particular driver influencing the future is considered uncertain in terms of its magnitude (e.g. will there be a lot of population growth or only a little?), or in terms of its effects (e.g. will the increase of a species increase services or disservices?) (Ralston & Wilson 2006; Daconto & Sherpa 2010). An uncertainty is considered a critical uncertainty if (1) the level of uncertainty is high, and (2) the consequences of how the uncertainty plays out would have a major effect on the system.

Critical uncertainties provide a structured focus for the development of future scenarios (Ralston & Wilson 2006; Daconto & Sherpa 2010). A common approach is to consider two critical uncertainties (Millennium Ecosystem Assessment 2005; Oteros-Rozas et al 2015). Each then describes a gradient from one possible outcome to another (e.g. increase in species X boosts services *vs.* increase in species X boosts disservices). If two such gradients are crossed into a four-quadrant coordinate system, four possible futures emerge. This depiction, in turn, is called a "scenario matrix" – each quadrant describes one plausible future scenario.

### The three horizons technique

A scenario matrix on its own is insufficient to identify strategies for how to reach a desired future. Especially where all future uncertainty is external to the system, robust 'no-lose' strategies are appealing – such actions are suitable regardless of what the future holds. In many cases, however, not all critical uncertainty is beyond the control of stakeholders. In such cases, stakeholders can make choices about how they wish to act, thereby not only preparing for a future that happens to them, but actually helping to shape the future – and potentially steer their social-ecological system away from outcomes they wish to avoid, and towards outcomes deemed more desirable.

In such cases in particular – when some uncertainty is within the control of stakeholders – the three-horizons technique becomes an appealing complement to scenario planning. This technique has been used by applied futurists, most recently also in a sustainability context (Sharpe et al. 2016). It distinguishes three horizons, which depict (i) features of the present (the first horizon), (ii) features of the intermediate future (the second horizon) and (iii) features of the future (e.g. 20 years from now; the third horizon). Methodologically, participatory processes with stakeholders are used to identify first, which features of the present need to be wound down to reach a desired future (the first horizon); second, which features of the ultimate future are desired, and which of these are already nascent so that they can be enhanced (the third horizon); and third, which intermediate features are needed to manage the wind-down of unwanted features and the phasing-in of desired features. Second-horizon features thus typically denote tangible strategies or actions that can be undertaken to bridge the present with the future.

## Case study: data collection and analysis

To illustrate the proposed template (Fig. 1), we applied it to the Zambezi region. We involved conservancy members (young and old women and men), conservancy staff (game rangers and managers), traditional tribal authorities and local elders, and governmental, civil society and non-governmental organizations (Appendix S1, S2). We conducted five participatory workshops in July 2019. Stakeholders were selected following prior knowledge of stakeholders in the area, where one of us (RK) had previously conducted participatory workshops. Workshops were held in English and translated into SiLozi, the local language, to enable participants to discuss freely. Problems of power imbalances were minimised because participants had already spent significant time together (Appendix S1).

The first three workshops followed the same methods, but targeted different stakeholders: (1) stakeholders at a regional governance level (n = 13), (2) community members from Wuparu, Bamunu, Balyerwa and Myuni conservancies (n = 20), and (3) management stakeholders from these four conservancies, namely conservancy managers, chairman, vice chair, traditional authorities and game guards (n= 14). This first round of workshops was used to populate the SEEDS framework (for details, see Appendix S1). Towards the end of these workshops, stakeholders had articulated in short statements key drivers that had shaped

human-wildlife interactions over the last 20 years (CBNRM was introduced in 2000). For example, one such statement was: "Government has been the most important actor, followed by communities". In the final step, for each such general statement, participants reported the level of certainty or uncertainty that the statement would still hold true in the next 20 years. A statement was recorded as certain when stakeholders agreed among themselves, and as uncertain when stakeholders expressed uncertainty about likely changes, or when stakeholders disagreed on the changes. For example, the statement "Wildlife hunting will continue to provide benefits for local inhabitants" was deemed highly uncertain due to various global and national socio-economic variables. The first three workshops thus generated a detailed social-ecological understanding of local dynamics, and identified numerous potential uncertainties about the future. This understanding provided the basis for the scenario matrix and scenario narratives.

The research team collated all uncertainties generated in the three first-round workshops and identified uncertainties that were similar; deemed as highly uncertain by stakeholders; and likely to be highly influential in terms of changing the trajectory of the overall system. Having agreed on two such critical uncertainties, the research team generated a scenario matrix, and based on this, a scenario logic for each quadrant of the matrix. We considered for each component of the SEEDS framework how it would change in each scenario in 20 years from now. This resulted in a draft of four plausible scenario narratives with an internally coherent logic. An artist (Dr. Lydia Betz) visualized features of each of the four scenarios (Appendix S11).

The fourth workshop involved a mix of stakeholders from the three previous workshops (n = 25). Here, stakeholders discussed the four draft scenarios. They assessed their plausibility and internal logic and discussed risks and opportunities of each. Scenario narratives were adjusted based on these discussions, and the updated versions of the narratives presented in the last workshop.

The final workshop was attended by most of the previously represented stakeholder groups (n = 31). This workshop was inspired by the three horizons framework and focused on identifying strategies to facilitate future human-wildlife coexistence. Some uncertainty identified related specifically to system features within the control of local stakeholders; as

such, it was meaningful to discuss with participants what strategies they proposed to steer away from certain undesired scenarios or towards certain more desired scenarios.

First, stakeholders were asked to place themselves at a specific point anywhere within the scenario matrix depicted on the floor of the workshop room, so as to represent their preferred future. Next, participants with similar positions formed groups. Each group was asked to deliberate on the reasons for their choice, identify existing social-ecological system features that had to be wound down (first horizon), identify existing social-ecological system features that had to be strengthened to achieve their desired future (third horizon), and suggest concrete actions or strategies that should be taken to work towards their desired future (second horizon). Lastly, after collating all suggested actions – regardless of which vision they were based on – all workshop participants were asked in a plenary session to together identify those suggested actions deemed most likely to have a positive transformative impact. All methodological steps are explained in more detail in Appendix S1.

## Results

### SEEDS components

Fourteen important wildlife species were identified in the study area, namely elephant, buffalo (*Bubalus bubalis*), lion, hippopotamus, crocodile (*Crocodylus niloticus*), leopard *(Panthera pardus)*, kudu *(Tragelaphus strepsiceros),* sable *(Hippotragus niger)*, baboon *(Papio ursinus),* spotted Hyena *(Crocuta crocuta),* giraffe *(Giraffa giraffa),* bush pig *(Potamochoerus larvatus),* zebra *(Equus quagga),* and painted dog *(Lycaon pictus)* (Appendix S3). Of these, elephant, buffalo, lion, hippopotamus and crocodile were ranked as the five most important (in good ways, bad ways, or both; Appendices S4, S5). Various coping strategies were named for each species, including diverse forms of fencing and protecting fields (Appendix S5).

Stakeholders perceived that over the last 20 years, these most important species had generally become more abundant due to the establishment of conservancies. Further reasons included benefits of wildlife for people's livelihoods, increased awareness of local people of the importance of coexisting with wildlife, reduced quota-based hunting, and reduced poaching for meat. Despite overall wildlife increases, diseases, drought, poaching, and legal trophy hunting were perceived to have increased pressure on the lion and crocodile (Appendix S3).

Consistent with increasing populations of important wildlife, the associated benefits of these species were perceived to have increased. Tangible benefits included income from trophy hunting and safari-based tourism, meat from hunting, and employment in the tourism industry. Regulating ecosystem services such as seed dispersal, and cultural ecosystem services such as traditional ceremonies connected to wildlife, were also named as important benefits. Disservices from wildlife – killing of livestock, attacks on humans, and damages to crops and infrastructure – were also perceived to have increased over the last 20 years (Appendix S4, S5).

In terms of governance, many stakeholders were interested in or influenced human-wildlife coexistence. Some higher-level actors, especially from government, were considered highly influential, including the Ministry of Environment and Tourism (MET), the Anti-poaching Unit (AU), law enforcement bodies including the army, and the Integrated Rural Development and Nature Conservation organization (IRDNC). Their influence was justified by participants based on their roles in wildlife policy making and enforcement (Appendix S6).

In terms of services and disservices, the most powerful actors were also perceived to receive the highest benefits from wildlife (most notably, through revenue from trophy hunting), while being exposed to very low costs (Appendix S6). Local communities, in contrast, perceived that they received a larger share of disservices but had limited involvement in policy making related to wildlife. The benefits they received from wildlife were noted as important, but perceived costs remained high. Local people felt their agency was limited to trying to reduce impacts from wildlife and reporting wildlife-related problems (without this necessarily being heard by the relevant authorities).

## Future outcomes and critical uncertainties

The first three workshops produced 55 statements that depicted drivers related to human-wildlife coexistence (i.e. “outcomes” according to the SEEDS framework). These drivers covered a range of social-ecological topics, but only some were considered highly uncertain (Appendix S7). For instance, all stakeholders believed that coping strategies and community awareness would improve in the coming 20 years. Similarly, increases in human population and associated farmland expansion and habitat loss were deemed certain by stakeholders.

Uncertainty was expressed regarding the future distribution of benefits and costs from wildlife. The economic well-being of local people, the governance system of wildlife, and the extent of law enforcement were also considered uncertain. We defined two critical uncertainties that captured many of the individual uncertainties expressed by stakeholders, and that we deemed to have a large influence on the future of the social-ecological system. These were: (1) the economic and governance system — whether governance would be fragmented and sectoral or cross-sectoral, multi-level, and collaborative; and (2) the type of wildlife economy — whether trophy hunting or safari-based tourism would be prioritized because of global and national level policy decisions. These two critical uncertainties provided the basis for a four-quadrant scenario matrix (Appendix S7).

## Scenarios for human-wildlife coexistence

We derived four plausible scenarios and gave these recognizable and associative titles, namely "giraffe view" (collaborative governance and safari-based tourism); "monkey management" (fragmented, sectoral governance and safari-based tourism); "pride of lions" (collaborative governance and trophy hunting); and "sleeping jackals" (fragmented, sectoral governance coupled with trophy hunting) (Appendices S8, S11) (Fig. 2). The logic underpinning these scenarios predicted different social-ecological system outcomes, for instance how wildlife populations will change in the future, biodiversity conservation trajectories, and types of stakeholder beneficiaries (Appendix S12). Human population growth, farmland expansion and an increased frequency of droughts were considered in all scenarios, but the management response to these differed between the scenarios. Below, we summarize the scenarios (Appendix S12 contains full scenario narratives).

In the first scenario, "giraffe view", the Namibian government focuses on safari-based tourism rather than hunting because of growing recognition of a decline in trophy animals and public pressure to ban trophy hunting. Strong collaboration between stakeholders from local up to regional scale including cooperation with neighboring countries provides opportunities for stakeholder participation, sharing of knowledge and technologies, and improved awareness of mitigation measures to reduce human-wildlife conflicts. Achieving a sustainable balance of environmental, economic and social considerations is made an overall policy goal of the new multi-level framework now governing Namibia's international wildlife economy. While wildlife populations have increased because of the anti-poaching measures

and land use zoning to restrict farmland expansion, human-wildlife conflicts have decreased due to better management. Conservancies are active participants in wildlife governance, with widespread collaboration regarding wildlife conflicts, floods and droughts.

In the second scenario, "monkey management", declines in trophy animal populations led to a steady decrease in revenue from trophy hunting, sparking a reactive policy change to safari-based tourism. Triggered by a mismatch between policy agendas and local realities, institutional fragmentation has increased among multiple sectors and levels of governance and stakeholders pursue their own agendas. Government ministries remain powerful, and collaboration with conservancies is limited. With a generally poorly regulated environment, farmland and livestock herds continue to expand, encroaching into wildlife corridors. With the cessation of trophy hunting, many wildlife populations are recovering and human-wildlife conflicts have increased. Conservancies no longer receive income from trophy hunting, because non-local entrepreneurs tap revenues from increasing tourism. Unequal benefit distribution is thus a key feature of this scenario. Due to climate change, the incidence of floods and droughts has increased, affecting crop yields and wildlife populations, and damaging important infrastructure.

In the third scenario, "pride of lions", multi-sector and multi-level collaboration of stakeholders, reduced hunting quotas, controls on farmland expansion, and anti-poaching are priority strategies. Conservancies continue to benefit from trophy hunting due to better re-distribution of government revenue. Many wildlife populations are recovering, and active propagation of best practice coping strategies, facilitated by improved information flows between sectors and governance levels, has improved measures to mitigate human-wildlife conflicts throughout the region. Conservancies and government ministries now routinely work in partnerships with non-government organizations and private actors to ensure the sustainable management of wildlife. Rising challenges such as droughts, floods, and a growing human population are tackled collaboratively.

In the fourth scenario, "Sleeping jackals", signs that high-value game species were declining had intensified, when in 2030, new international legislation through the Convention on International Trade of Endangered Species banned trophy hunting altogether. With no alternative vision in place, the Zambezi region's economy rapidly declined. Conservancies found themselves with depleted wildlife populations as well as limited livelihood options.

People living in the conservancies were increasingly dissatisfied because they perceived they had all the problems from living with wildlife, while the government was keeping a large share of the resulting revenue for itself. To offset financial losses and feed a growing population, farmland expanded and livestock herd sizes grew, causing ongoing wildlife conflicts. The populations of previous trophy animal species are now at an all-time low, and poaching of the remaining wildlife has become increasingly widespread (especially of problem species such as the baboon and jackal). Some conservancies are de-gazetted because local people no longer receive tangible benefits from sympathetic wildlife management. Government agencies are struggling to respond to droughts and floods in a timely and adequate way.

## Strategy development

When asked about their preferred future (third horizon), participants formed eight different groups within the scenario matrix (Fig. 2). Six groups, representing 90.4 % of participants, were dispersed within two scenarios: “giraffe view” and “pride of lions”. Twenty participants (64.5%) positioned themselves towards the multi-level governance side of the governance axis, while only three (9.7%) positioned themselves towards the sectoral end of the governance axis. Eight participants (25.8%) positioned themselves between sectoral and multi-sectoral governance. Sixteen participants (51.6%) positioned themselves near trophy hunting, six (19.4%) near wildlife tourism, and nine (29%) midway between wildlife hunting and wildlife tourism (Fig. 2).

Based on their desired futures, groups of stakeholders identified existing system features that would need to be wound down (first horizon). Accordingly, widespread illegal poaching, conflicting interests of stakeholders, government inefficiency in coordination and rule enforcement, and uncontrolled farmland expansion were identified as key system features to be wound down by stakeholders favoring the “giraffe view” and “pride of lions” scenarios. For the stakeholders who preferred sectoral governance, power capture by few top-level stakeholders and lack of stakeholder autonomy in wildlife management were noted as existing system features that should be wound down (Appendix S9).

Cognizant of their preferred scenarios, groups of stakeholders proposed tangible strategies that should be put in place immediately to make headway towards their desired future

scenario (second horizon). For proponents of "giraffe view", proposed strategies included expanding tourism and social infrastructure such as tourism facilities, health posts and environmental education centers, promoting equitable benefit sharing, better coordination among stakeholders, and controlling farmland expansion (Appendix S9). Proponents of "pride of lions" suggested improving collaborative governance, promotion of conservation agriculture, devising locally specific and sustainable means of combating human-wildlife conflict, and maintaining wildlife corridors. Supporters of sectoral governance proposed empowering local people to make decisions related to wildlife, and ensuring a proper balance between stakeholder coordination and individual autonomy (Appendix S9).

Finally, despite differences among stakeholders in their preferred scenarios, several second-horizon strategies to move towards a better future were widely agreed on by participants. For example, participants widely agreed on the importance of increasing awareness of the community on the importance of wildlife, empowering marginalized groups through participation in tourism or hunting activities, and ensuring participation in decision making. Other widely agreed on strategies included better monitoring and evaluation of wildlife management programs, improving cross-sector and cross-boundary stakeholders coordination, as well as balancing conservation and livelihood improvements (Appendix S10).

## Discussion

Our work was inspired by three approaches – the SEEDS framework, the notion of critical uncertainties, and the three horizons technique – and provides a generally usable template for how to conduct scenario planning to improve human-wildlife coexistence. The approach outlined here should be seen as a starting point. Naturally, the specific methodological steps need to be adjusted according to the study area, stakeholders involved, and resources available. More elaborative versions could, for example, populate the SEEDS framework not via stakeholder opinion but via empirical research. Similarly, it would be possible to develop scenario narratives jointly with stakeholders, rather than have this integrative part be under the control of the research team. Finally, much more elaborate implementations of the three-horizons technique are possible.

That said, the general approach introduced here corresponds closely to key priorities identified in recent research on human-wildlife coexistence (Carter et al. 2019; Beatrice & Glikman 2019) – namely the integrated assessment of social and ecological challenges, and participatory, forward-looking approaches for identifying solutions to such challenges. We note that the ultimate success of participatory work in any area of sustainability (including biodiversity conservation) will hinge not on short exercises such as the one outlined here, but requires long-term engagement with particular study areas.

In the context of human-wildlife coexistence, as underlined by stakeholders in our study, ensuring stakeholder participation is essential not only from the perspective of equity but also to make findings relevant to policy and practice. Moreover, human-wildlife coexistence is challenged not only by conflicts between humans and wildlife, but also by possible conflicts among stakeholders (Carter et al. 2019; Redpath et al. 2013). Such conflicts could stem from a lack of communication among stakeholders (Carter & Linnell 2016) or strong divergence in their interests and vision related to the future of human-wildlife coexistence. As shown in our study, scenario planning provides a platform for exchange among stakeholders with divergent aspirations to deliberate and together devise ways of shaping their common future.

In our study, we identified four possible and equally plausible future scenarios, which appealed to different sets of stakeholders (Fig. 2). The approach shown here therefore should not be seen as an end point, but in some ways marks the starting point for how to further navigate contrasting stakeholder perspectives.

Interestingly, despite different participants in our case study preferring different futures, many stakeholders agreed on certain strategies that would be desirable for the future (Appendix S10). A such, there are widely supported actions that can be taken right now – even though there is as yet no universally agreed-upon longer-term vision for the region. Unlike traditional technocratic and legislative solutions (Redpath et al. 2013), scenario planning could help to generate less coercive strategies such as those suggested by workshop participants (Appendices S9, S10), for example, better collaboration and coordination between stakeholders, and empowerment of local people. Equity and pluralism are essential components of ensuring human-wildlife coexistence, and scenario planning is well suited to addressing these issues. Equity is both about processes and outcomes (Law et al. 2018), and pluralism fosters recognizing different stakeholders' values, interests, and preferences, as

well as acknowledging others' rights to access wildlife (Loring et al. 2017). Often, a critical challenge in the achievement of human-wildlife coexistence is that one party is perceived to assert its interests at the expense of another party's interests (Draheim et al. 2015; Redpath et al. 2015). This common problem was also found in our case study – costs were largely experienced by local people, while benefits were perceived to flow to higher-level government actors.

To conclude, it is increasingly acknowledged that navigating the complex social and ecological challenges posed by living with wildlife requires moving beyond disciplinary approaches. Our application of scenario planning is consistent with other work (Kansky et al. 2016) suggesting that successful human-wildlife coexistence is mediated both by biophysical factors such as wildlife populations, resource availability, and climatic stressors; as well as by social and governmental factors including human population growth, power relations among stakeholders, cultural values ascribed to wildlife, coping strategies, and equitable benefit sharing. Like all other tools or research approaches, the template provided here will not be a silver bullet for ensuring sustainable human-wildlife coexistence. We acknowledge that identifying preferred scenarios may be less meaningful in situations where stakeholders have little control over the future; and that much more elaborate applications of the three-horizons technique in particular, are possible. However, applying the set of techniques highlighted here could help to foster dialogue and identify new pathways towards a sustainable future for both people and wildlife. In that spirit, our template could be a starting point, and its specific application could be adjusted based on the available resources and local conditions. Most importantly, longer-term engagement with stakeholders is likely to improve the practical utility of the process outlined here.

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**Figure captions**

Fig. 1. Flowchart illustrating the elements that can be combined to apply scenario planning to improve human-wildlife coexistence.

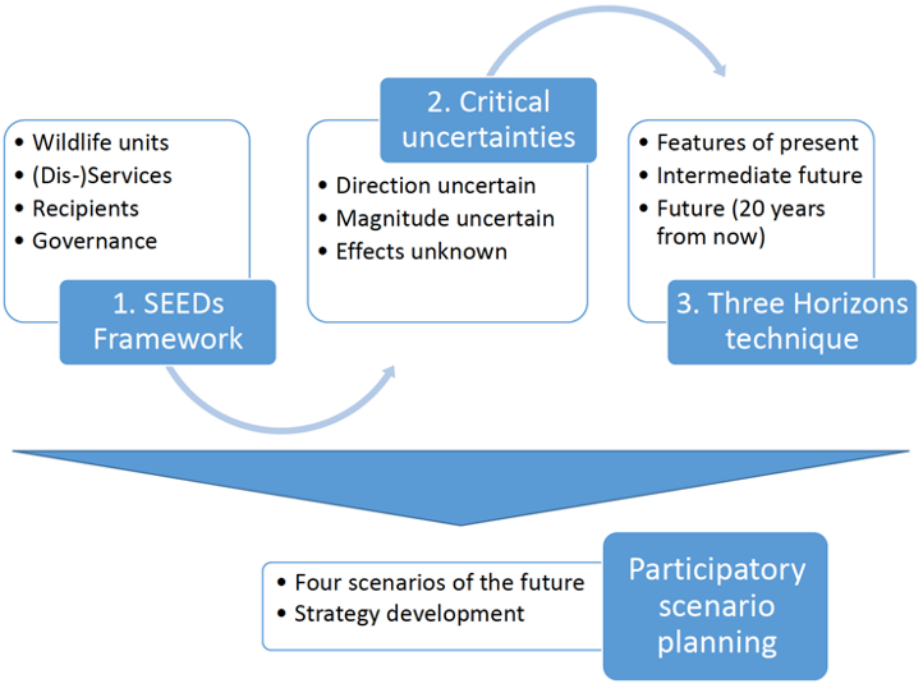

Fig. 2. Visual representation of key social-ecological characteristics under four plausible scenarios for 2040. The scenario logic recognises gradients (i) from highly sectoral governance to collaborative, multi-level governance (x-axis), and (ii) from a wildlife economy based on tourism to one based on trophy hunting (y-axis). The preferences of eight small groups of participants in the final workshop are represented by numbers adjacent to circles – for example, group 6 favoured the scenario "Giraffe View" (Group 1 = 2 participants out of 31 (6.5%), Group 2 = 6 (19.4%), group 3 = 7 (22.6%), Group 4 = 6 (19.4%), Group 5 = 2 (6.4%), Group 6 = 6 (19.4%), Group 7 = 1 (3.2%), Group 8 = 1 (3.2%).