







Integrating biodiversity conservation and local community perspectives in China through human dimensions research

Heidi Ma^{1,2}  | Di Zhang^{3,4} | Lingyun Xiao⁵ | Yifu Wang⁶  | Lu Zhang⁷  |
 Carolyn Thompson^{1,8}  | Jingyu Chen^{9,10} | Simon D. Dowell¹¹ |
 Jan Christoph Axmacher^{12,13}  | Zhi Lü⁴ | Samuel T. Turvey¹ 

¹Institute of Zoology, Zoological Society of London, London, UK; ²Royal Holloway University of London, Egham, UK; ³Polar Research Institute of China, Shanghai, China; ⁴School of Life Sciences, Peking University, Beijing, China; ⁵Xi'an Jiaotong-Liverpool University, Suzhou, China; ⁶School of Biological Sciences, Kadoorie Biological Sciences Building, The University of Hong Kong, Hong Kong, China; ⁷School of Life Sciences, Sun Yat-sen University, Guangzhou, China; ⁸Department of Department of Genetics, Evolution and Environment, University College London, London, UK; ⁹Cloud Mountain Conservation, Dali Biodiversity Conservation and Research Center, Dali, China; ¹⁰Institute of Anthropology, National Tsing Hua University, Hsinchu, Taiwan; ¹¹North of England Zoological Society, Chester Zoo, Chester, UK; ¹²Department of Geography, University College London, London, UK and ¹³Faculty of Environmental and Forest Sciences, Agricultural University of Iceland, Reykjavík, Iceland

Correspondence

Samuel T. Turvey

Email: samuel.turvey@ioz.ac.uk

Funding information

Arcus Foundation, Grant/Award Number: G-PGM-1911-3071

Handling Editor: Shuai Wang

Abstract

1. Biodiversity in China coexists alongside large ethnically diverse rural human populations within linked 'biocultural' social-ecological systems. Cumulative and changing local anthropogenic pressures linked to human population growth and economic development are driving unsustainable resource exploitation, habitat loss and extensive species declines. However, these pressures vary between species and systems, and efforts to conserve regional biodiversity may also have unintended negative impacts on local communities and their long-term relationship with nature.
2. Based on our extensive experience working across China's diverse but vulnerable biocultural landscapes, we showcase a series of case studies that illustrate the differing interactions between biodiversity and local community use of natural resources, and the differing consequences of conservation management on local livelihoods.
3. We highlight that some social-ecological relationships in China can maintain and support biodiversity, and we advocate for management underpinned by interdisciplinary conservation research that engages local communities, associated with robust evidence-based assessment and evaluation frameworks to ensure effective monitoring and optimization of impacts.
4. We frame a series of steps required to understand and mitigate local pressures on threatened species in China and identify potential 'win-win' approaches for the regional maintenance of biodiversity, ecosystem services and sustainable

Heidi Ma and Di Zhang joint first authors.

This is an open access article under the terms of the [Creative Commons Attribution](https://creativecommons.org/licenses/by/4.0/) License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited.

© 2022 The Authors. *People and Nature* published by John Wiley & Sons Ltd on behalf of British Ecological Society.

livelihoods, with directions proposed for future research, engagement and management.

KEYWORDS

biocultural conservation, capacity building, Hainan, social science, threatened species, Tibetan Plateau, Yangtze River

1 | INTRODUCTION

China is a vast, 'megadiverse' country containing a wide range of ecosystems and endemic species and supporting >10% of the world's vascular plant and terrestrial vertebrate species (Gong et al., 2020; Liu & Diamond, 2005; Myers et al., 2000). This biodiversity coexists alongside an extremely large rural human population of over 550 million people (World Bank, 2021; Zhang, Zhang, & Liu, 2020). China's central, eastern and southern provinces have supported high human densities for millennia, leading to intense long-term local demand for land and natural resources, and extensive associated premodern forest losses and wildlife extinctions (Marks, 2017; Miller, 2020; Turvey, Crees, et al., 2015; Turvey et al., 2019). Throughout the 20th and into the 21st centuries, escalating human population growth and economic development have continued to drive extreme and unsustainable resource exploitation and landscape modification. As a consequence, extensive species range contractions, population declines and extinctions have established China as a global conservation priority (Coggins, 2003; Shapiro, 2001, 2016). About one-third of China's terrestrial area is experiencing conflict between conservation needs and human activities (Peng et al., 2021). Despite heavy investment in national efforts to combat environmental deterioration and biodiversity loss (e.g. the Natural Forest Protection Programme implemented since 2000; the nature reserve network and recent development of the national park system; the Ecological Redlines initiative and transfer payments to areas with key ecological functions; Qiao et al., 2021; Ren et al., 2015; Tang, 2020), Chinese terrestrial vertebrate populations decreased overall by 50% between 1970 and 2010 (Xie et al., 2015), and 21.4% of Chinese vertebrate species are threatened by human activities, higher than the global average (Gong et al., 2020; Hoffmann et al., 2010; Jiang, 2016). Threatened species in China are now often confined to small habitat patches within a mosaic of heavily modified landscapes and human settlements, with extensive potential for human-wildlife interactions, exploitation and disturbance, and high risk of extinction (Gong et al., 2017; Li et al., 2013). These cumulative and ongoing anthropogenic pressures have led to recent species-level extinctions, such as the global loss of the Yangtze River dolphin *Lipotes vexillifer* (Turvey et al., 2007).

Along with its diverse ecosystems and species assemblages, China also contains rich social and cultural diversity, with widely varying levels of development and distinct rural-urban wealth and development gradients. China's 55 officially recognized ethnic minority groups, which together comprise 8.9% of the national population, are associated with unique belief systems and cultural practices (Liu & Diamond, 2005; Mullaney, 2011; National Bureau of Statistics, 2021). Concerningly, 80% of China's poorest counties are located in areas

that are considered ecologically fragile, and more than 40% are populated by ethnic minorities (Deng et al., 2016). China's rural communities, and especially its poorest communities, are closely reliant upon natural resources and ecosystem services within linked 'biocultural' social-ecological systems, with different communities and ethnic groups varying in their relationships to nature in terms of traditional beliefs, customs and resource requirements (Coggins, 2003; Liu et al., 2016; Wang, Zhao, et al., 2020; Zhou et al., 2020). Many of these communities live alongside China's most highly threatened species, especially in southwestern mountain areas, and are playing a determining role in biodiversity conservation (Gao et al., 2013; Shen et al., 2015; Zhao et al., 2021; Zhou & Grumbine, 2011).

Wildlife in China is protected and managed by multiple levels of administration. In 2021, the Chinese government updated the Lists of Wildlife Under Special State Protection, with increased coverage to 47% of threatened species included within China's Biodiversity Red List (Huang et al., 2021). Regulatory protection of wildlife is supplemented by habitat protection, which is dominated by a 'fortress conservation' protected area approach (Li et al., 2016). Before their recent incorporation into China's new national park network, nature reserves provided the highest level of landscape protection, with other types of protected areas (scenic spots, forest parks, geological parks, wetland parks, desert parks) also included within the country's protected area network (Coggins, 2017; Huang et al., 2021; Xu et al., 2019). Although there are benefits to this approach, criticisms and challenges exist around the spatial mismatch of nature reserves and threatened biodiversity, with less than 18% of available habitat of threatened vertebrate species captured within the existing protected area network (Xu et al., 2017). Furthermore, China's existing approach to landscape protection risks exclusion and disconnection of low-income communities from natural resources and traditional sources of income and livelihood, upon which they may be highly dependent (Wang, 2019; Wang et al., 2012; Xie et al., 2014).

There are now increasing efforts to involve local communities in the management of natural resources within some Chinese protected areas, compensate for their costs, and develop alternative sources of income (He et al., 2018; Sheng et al., 2020; Zhao et al., 2018). However, this type of local engagement is still not practiced widely in Chinese conservation, and the effectiveness of such efforts is not yet routinely evaluated. Furthermore, the interaction of top-down management policies with local religious, cultural and economic value systems can have unintended ecological consequences due to complex linkages and feedback within coupled human-natural systems, and changing external socio-cultural pressures can modify local-scale interactions with biodiversity and

alter management sustainability. These issues highlight a need to engage closely with rural communities across China, both to establish evidence-informed baselines that are explicit about the identity, drivers, dynamics and sustainability of their interactions with local biodiversity and ecosystem services, and to develop frameworks to involve these communities (including ethnic minority communities with their specific customs and social systems) in conservation policymaking, monitoring and evaluation. This is especially pertinent as the Post-2020 Global Biodiversity Framework, due to be adopted at the 15th meeting of the Conference of the Parties to the Convention on Biological Diversity, emphasizes the importance of local community involvement (Convention on Biological Diversity, 2020).

Challenges to successful conservation in China are underpinned by local dynamics operating within the country's diverse social-ecological systems, which are difficult to generalize. Here, we consider local dynamics to be human–environment or human-species interactions at the individual, village or community scale, in contrast to changes at wider provincial or national levels. Based on our extensive experience with species conservation projects across China's diverse yet vulnerable landscapes, we illustrate this range of conservation challenges by considering a series of specific case studies representing different Chinese social–ecological systems (Figure 1). These serve to illustrate and characterize the different ways in which rural communities across China interact with and are dependent on nature, how and why such interactions may be changing, and how modern conservation management policies can either marginalize or integrate rural and Indigenous voices and needs.

1.1 | Case study 1: Varying impacts of Indigenous relationships on Chinese gibbons

Gibbons were once distributed across much of central and southern China (Zhou & Zhang, 2013), but China's four surviving gibbon species are now restricted to remnant populations in three southwestern provinces. The rarest Chinese gibbon (and the world's rarest primate), the Hainan gibbon *Nomascus hainanus*, survives only within Bawangling National Nature Reserve in Hainan, established in 1980 to protect the species and recently incorporated into Hainan Tropical Rainforest National Park (Liu et al., 2020). This species' historical decline was driven in part by unsustainable hunting for local traditional medicine by Li and Miao ethnic minority communities (Chan et al., 2005). The Bawangling landscape was historically used by these minority communities, who are among the poorest in China, but they are no longer allowed access to the forest for collection of food, medicinal plants and firewood, or grazing of cattle (Fauna & Flora International China Programme, 2005). Enforcement of a strict exclusion policy following reserve establishment led to severe conflict with local communities (Fauna & Flora International China Programme, 2005), who still express a desire for legal access to local natural resources (Ma, 2021). Poaching of birds, turtles and small mammals and other illegal resource extraction remains a problem, with activities such as continued cattle grazing also driving ongoing erosion of forest habitat within

the protected area (Zhang et al., 2010). Although gibbon hunting has ceased, ongoing human disturbance (people entering the reserve to collect natural resources; local activities in villages adjacent to the reserve boundary close to established gibbon groups) is suggested as a possible reason for limited recovery of the Hainan gibbon population (Turvey, Traylor-Holzer, et al., 2015). Community comanagement of the reserve, including support for local livelihood development through wild honey production and nature and culture-based tourism, has been periodically discussed over the past two decades, but has not led to participatory management, and opportunities for local employment from the reserve (e.g. being hired as wardens) remain limited.

Conversely, populations of Skywalker hoolock gibbons *Hoolock tianxing* in Yunnan have tended to survive near Lisu ethnic minority communities, who have traditional taboos against hunting gibbons associated with the perceived similarity between gibbons and people (e.g. perception of gibbons as ancestors or powerful forest entities). However, gibbons have disappeared from regions where Lisu communities have shifted their livelihoods away from forest-based resource use to business and trade in more urbanized areas, which has been associated with loss of local nature traditions including hunting taboos (Zhang, Guan, et al., 2020).

1.2 | Case study 2: Local versus external demand for Chinese giant salamanders and pangolins

Chinese giant salamanders *Andrias* spp., the world's largest amphibians, formerly occurred across much of central and southern China (Chen et al., 2018). Historical taboos against eating them were widespread in rural communities, although they were also sometimes hunted for local consumption, particularly by ethnic minority groups including the Tujia and Yao (Cunningham et al., 2016; Turvey et al., 2021). However, the development of a large-scale national giant salamander farming industry since the 2000s has led to commercial demand for wild breeding stock. This has greatly increased incentives for poaching, leading to range-wide overexploitation by local communities to sell animals to farms (Cunningham et al., 2016).

A comparable shift in societal attitudes and demand has affected local exploitation of the Chinese pangolin *Manis pentadactyla*. While pangolins have been utilized in Traditional Chinese Medicine for centuries, wild populations persisted across large areas of China into the 20th century (Yang et al., 2018). In Hainan, historical hunting by rural communities was relatively uncommon before the 1960s, due to local myths that pangolins fed on the bones of the dead and represented either extreme fortune or bad luck (Wang et al., 2021). However, in the 1960s the Chinese government promoted a nationwide state-run commercial trade in pangolins, leading to taboos being outweighed by external financial incentives. This triggered overexploitation of pangolin populations by large-scale hunting (Wang et al., 2021). As a result, both giant salamander and pangolin populations are now heavily depleted and extirpated across large areas of China (Nash et al., 2016; Turvey, Chen, et al., 2018).

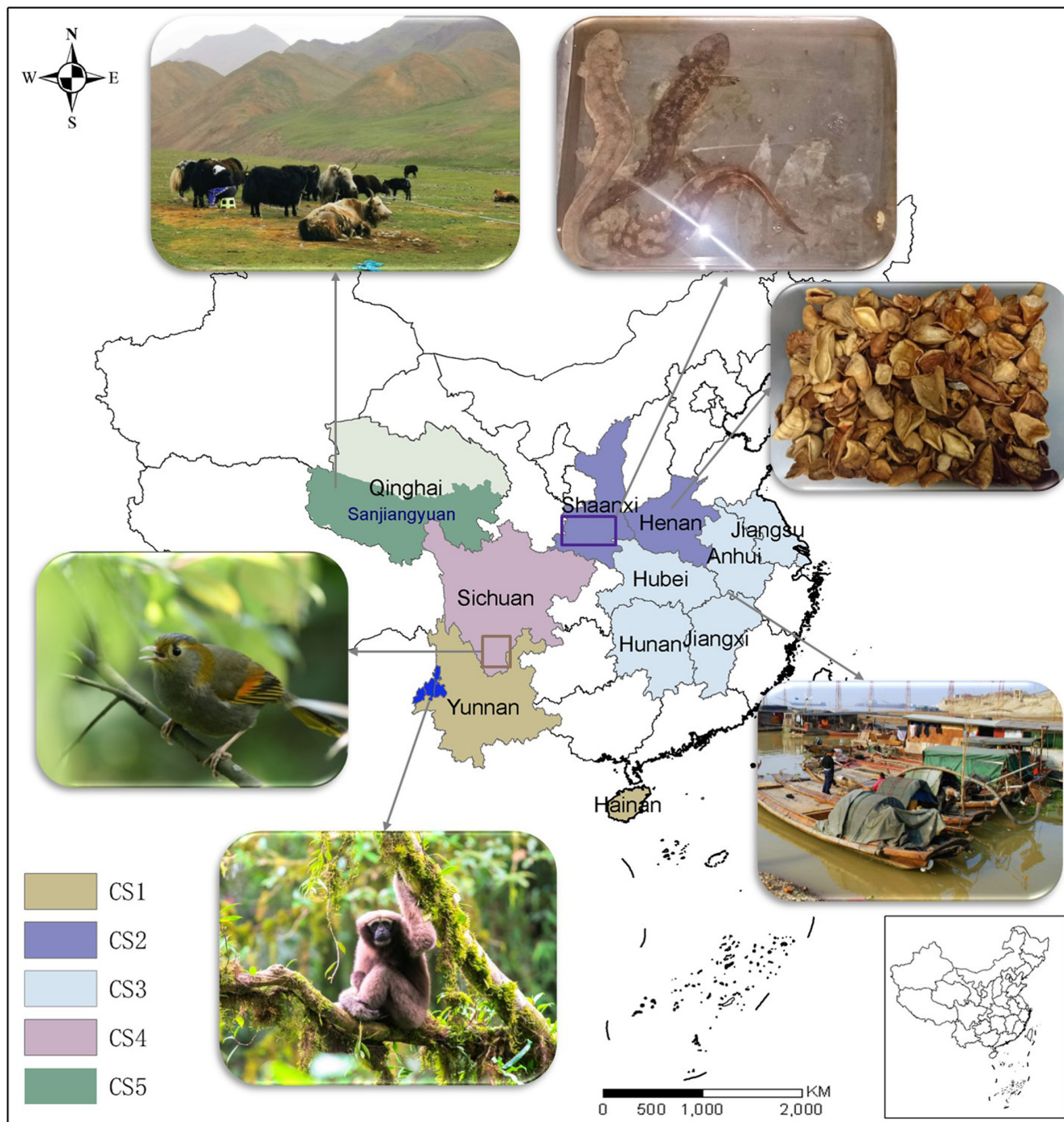


FIGURE 1 Illustrations and locations of the case studies. Clockwise from top left: Yaks owned by Tibetan herders; Chinese giant salamanders (*Andrias davidianus*); pangolin scales; fishing boats on the Yangtze River; Skywalker gibbon (*Hoolock tianxing*); and Omeishan liocichla (*Liocichla omeiensis*).

1.3 | Case study 3: Community impacts of precautionary fisheries regulation for Yangtze cetacean conservation

The middle-lower Yangtze River supports a rich freshwater fauna that includes one surviving endemic freshwater cetacean, the Critically Endangered Yangtze finless porpoise *Neophocaena asiaeorientalis asiaeorientalis*. The river ecosystem has been drastically altered by

multiple anthropogenic activities including industrial development, damming, habitat modification and loss, heavy ship traffic, water pollution from industrial, agricultural and domestic sources, and depletion and collapse of fish stocks (Wang et al., 2016). The system also supports a large number of low-income fishing communities who are directly dependent upon the river for food and other ecosystem services, including water resource provisioning, hydrological regulation and soil retention (Zheng et al., 2020).

As part of a wider national strategy to protect and restore the degraded Yangtze system and its depleted natural resources, seasonal fishing bans have been implemented since 2003, and a 10-year ban on all commercial fishing came into force in January 2020 (Mei et al., 2020). Compensation, relocation and training schemes are being developed for Yangtze fishing communities, including a proposed fisheries adjustment plan providing these alternative livelihood opportunities for 278,300 fishers (Chen et al., 2019; Zhang, Kang, et al., 2020). However, these mitigating measures have not yet become available to most communities, which have experienced almost two decades of restrictions and major disruption to this social-ecological system, with fishers having had to find alternative work, receive no income, or continue fishing illegally during bans (Turvey, Hao, et al., 2015).

Yangtze finless porpoises are known to be killed accidentally in legal and illegal fishing gear and are dependent upon increasingly depleted fish stocks for food. Accordingly, Yangtze fishing bans have been promoted as an important component of porpoise conservation legislation (Huang et al., 2016; Mei et al., 2019; Wang, 2009). However, the main cause(s) of unsustainable porpoise mortality are unclear. Robust evidence remains lacking to suggest a primary role of fisheries interactions in driving porpoise decline, and Yangtze fisheries restrictions represent a precautionary conservation approach for porpoises (Mogensen et al., 2022). Indeed, other factors (e.g. vessel collisions) have been identified as likely to constitute important causes of porpoise mortality (Turvey et al., 2013), but have not received similar attention in conservation legislation.

1.4 | Case study 4: Community-based solutions to forest bird conservation in Sichuan

The montane forests of Liangshan in southern Sichuan support high regional biodiversity and contain several endemic bird species, including the Sichuan partridge *Arborophila rufipectus* and Omeishan liocichla *Liocichla omeiensis* (Bo et al., 2009; Fu et al., 2013; Stattersfield et al., 1998) as well as an important population of giant panda *Ailuropoda melanoleuca* (Li et al., 2019). These forests were previously threatened by extensive state-controlled logging, and widespread logging bans and forest protection measures were introduced in the late 1990s (Liao, 1999), including the establishment of a network of nature reserves at local, provincial and national levels designed to protect, restore and connect habitat for threatened and endemic species (Dowell & Bo, 2003). The communal use of natural forest resources is integral to rural economies in this region, including local Yi ethnic minority communities who rely on forests for hunting, firewood and medicinal and food plants (Dowell et al., 1999; Jing et al., 2020). However, these activities pose a threat to wildlife through exploitation, habitat degradation and disturbance. While forest cover has increased in the area, human disturbance has intensified, leading to reduction in suitable habitat for key species (Li et al., 2019).

Recognition of local community needs has been central to the development of the protected area network in Liangshan, and enhancing local livelihoods was an integral component of regional conservation planning from the outset, driven by both provincial and county-level forest departments, and more recently by the nature reserve management teams themselves as they built capacity and achieved greater autonomy (Dowell & Bo, 2003). International donors have contributed to capacity-building efforts, including training reserve staff and piloting sustainability and alternative livelihood schemes (e.g. biogas, fuel-efficient stoves, beekeeping, new agricultural techniques). While not all of these initiatives have been successful (e.g. attempts to cultivate bamboo shoots for the commercial market to reduce pressure on wild collection have largely failed so far), this range of innovative actions demonstrates the degree to which reserve management teams have been keen to engage with local communities (Dowell & Bo, 2003). However, properly designed social research and evaluation is currently lacking due to low awareness and acknowledgement of the usefulness of conservation social science research, as well as limited capacity and expertise to carry it out (Bennett et al., 2017). It is therefore difficult to fully evaluate the impact of this inclusive approach on both people and wildlife and its acceptance by local ethnic minority groups, or to identify, share and disseminate best-practice methods.

1.5 | Case study 5: Unexpected outcomes of policies to reduce grazing pressure in China's western rangelands

Reducing anthropogenic threats to the ecosystems of the Sanjiangyuan region of the Qinghai-Tibetan Plateau is of critical importance, as this region contains the headwaters of Asia's three largest rivers and provides habitats for threatened species such as the snow leopard *Panthera uncia*. As part of the 'retire livestock to restore rangeland' policy, the Chinese government's Ecological Subsidy and Award System programme allocated an annual budget of 2.2 billion USD from 2012 as payment for ecosystem services (PES) for the western rangelands to restore degraded grasslands (Li et al., 2016). The PES policy was implemented in the form of pure cash payments to herders, based on the assumption that payments would replace part of their pastoral income, thus reducing grazing pressure by decreasing the number of yaks (Ministry of Agriculture, P.R.C. and Ministry of Finance, P.R.C., 2011; Yang, 2019). However, contrary to assumptions by policymakers that traditional nomadic practices were driving overgrazing, Indigenous Tibetan pastoralists have been shown to actively use sustainable practices such as managing livestock herd size to mitigate grazing pressure (Yeh et al., 2017), and well-documented evidence indicates that nomadic pastoralists historically coexisted with high densities and diversities of large-bodied ungulates and predators on the plateau (Schaller, 1998). Although the PES policy increased cash incomes for local herders (Gruschke, 2011; Sulek, 2011), it failed to reduce livestock grazing intensity (Li et al., 2017; Yu et al., 2021). There are strong indications

that PES payments and other nonpastoral cash income may in fact have subsidized rather than replaced traditional pastoralism among Tibetan herders in Sanjiangyuan (Xiao et al., 2022). In this region, yaks serve as a symbol of wealth in the community and are traditionally used as insurance against natural disasters (mostly heavy snow), while sheep are used as a means of payment for living expenses (Sulek, 2011); sheep can therefore easily be replaced by other, less labour-intensive cash income sources such as governmental subsidies, with herders using any extra cash income to purchase yaks as savings, and with nonpastoral cash incomes seen as unstable by herders (Nyima, 2014).

2 | DISCUSSION

These case studies present a small fraction of the diversity of China's social-ecological systems and the challenges they face. They help to illustrate: (1) the range of variation in local behaviours and values, and their potential impacts on biodiversity across China; (2) how changes in both local and external socio-economic factors and other pressures can affect these interactions; (3) the often conflicting demands from environmental protection and local livelihoods within cohabited landscapes, and variation in the extent to which community needs and voices are incorporated into conservation planning; and (4) the differing and sometimes negative impacts on both local communities and regional biodiversity of well-intended policy decisions (Figure 2). Crucially, they also highlight the pervasive problem of gaps in our current understanding of local-scale pressures on biodiversity, including consequences of ecological knowledge loss, drivers of demand for wildlife, identification of the key threats

affecting species survival and effectiveness of conservation interventions. Addressing these knowledge shortfalls is urgently needed to identify appropriate, effective management and policy responses to regulate environmental threats that have minimal negative impact on vulnerable communities, and to assess the potential for 'win-win' approaches for the balance of both biodiversity and sustainable livelihoods.

The perceived role of rural communities in regulating natural environments within China has shifted over recent decades, from being seen as drivers of biodiversity loss and habitat degradation to representing an invaluable source of Indigenous knowledge that can guide sustainable practice and provide potential leadership in sustainable practices (e.g. Shen et al., 2015). For instance, initial perceptions by the conservation community that farmers in southwestern Yunnan practiced highly destructive slash-and-burn agriculture have been replaced by the alternative perspective that much of this agriculture represents locally sustainable shifting cultivation (Hathaway, 2017). It is thus imperative to use evidence to enable accurate evaluation of the status of local community interactions with biodiversity across China, and to identify environmental and socio-economic factors and management strategies that are associated with sustainable versus unsustainable resource use, effective management of threatened species, maintenance of ecosystem services and continued integrity of local cultures and livelihoods (Chen et al., 2012; He et al., 2018; Lv et al., 2017; Wang et al., 2012). Understanding China's pressing conservation issues, which span a wide spectrum of human-environmental interactions, can highlight successful 'win-win' strategies and provide invaluable insights for supporting biocultural diversity at a global scale.

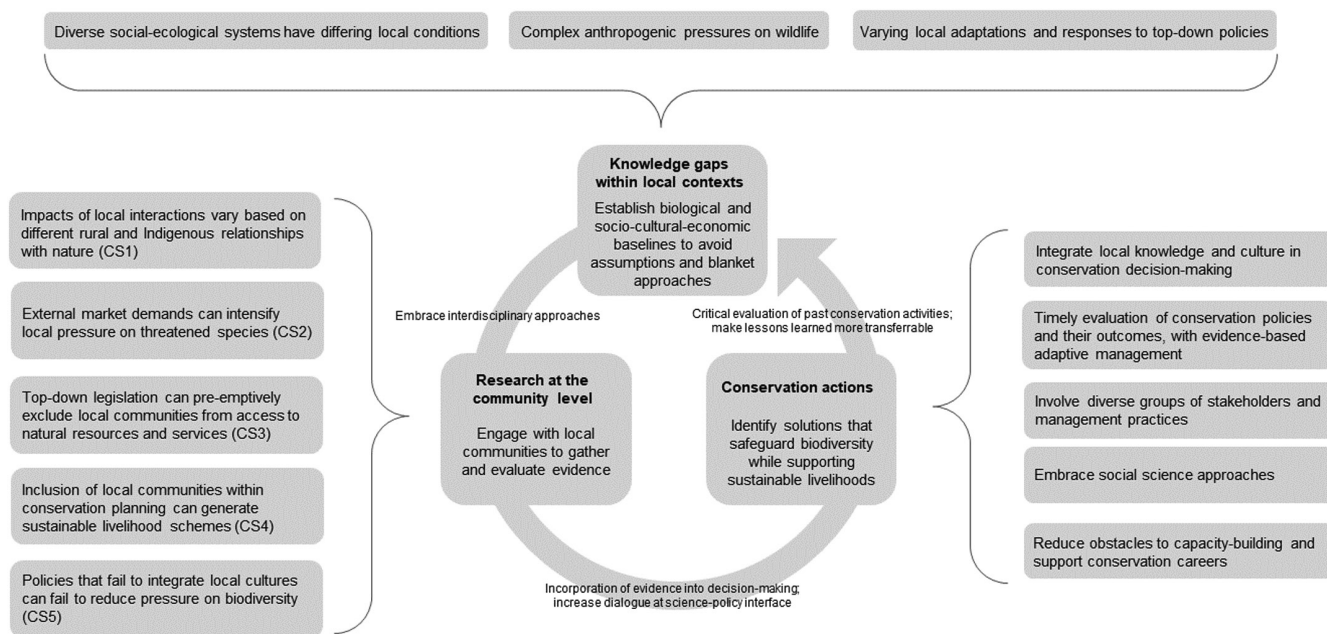


FIGURE 2 Conceptual diagram showing how the five case studies (CS1-5) illustrate variation in human-nature interactions and potential impacts on biodiversity, including associated local and external drivers, the need to incorporate evidence from local contexts into conservation decision-making, and how this can be achieved through interdisciplinary research at the community level.

This approach necessitates considering a series of successive questions related to the interactions between rural communities and biodiversity within local landscapes across China. Current knowledge gaps include details of local-scale community interactions with their natural environments, the identification of drivers of rural behaviours that impact biodiversity, and whether such harmful interactions can be mitigated while also supporting vulnerable communities. Furthermore, gaps also exist in understanding local communities' perspectives, including what management policies are appreciated and how protected areas are perceived, what resources can be protected effectively by traditional management strategies and what value systems provide environmentally sustainable outcomes.

To address these knowledge gaps, we consider the following topics: (1) What are the types of evidence needed to understand the dynamics and sustainability of human–biodiversity interactions at local scales in China; (2) What are the existing obstacles to collecting evidence and developing an integrated social science approach for conservation in China; and (3) What general principles can be transferred from successful community-led conservation practices within China to other social–ecological systems?

2.1 | Embracing social science approaches to understand human–biodiversity interactions in China

In China, effective implementation of evidence-based conservation that incorporates the maintenance of human well-being represents a significant challenge. Social–ecological systems are diverse across different Chinese landscapes, but an understanding of their specific contexts and dynamics remains limited. Such understanding is essential to avoid the risk of generalizing discourses and a lack of localized cultural nuance (cf. Jeffreys, 2016; Margulies et al., 2019; Vu & Nielsen, 2021), and behavioural change interventions that do not consider the specific socio-economic and ecological contexts of each system or understand the values held by target audiences (e.g. the deep-rooted preference for using wild rather than cultivated components in Traditional Chinese Medicine) may not achieve the goal of promoting nature-friendly behaviours (Thomas-Walters et al., 2020). For example, investigation of local environmental perceptions has revealed that most Indigenous communities living adjacent to the last Hainan gibbon population do not appreciate that species can become extinct, highlighting the need to develop locally appropriate educational programmes to promote environmental awareness (Ma et al., 2021).

On the bright side, social science methods such as questionnaire-based surveys are increasingly used to gather local and traditional ecological knowledge (e.g. species' status and trends; past and present human–environmental interactions and extinction drivers) to inform conservation planning for poorly known and highly threatened species, although these approaches

are not yet applied consistently or across all relevant contexts (Lin et al., 2019; Nash et al., 2016; Pan et al., 2016; Turvey et al., 2010, 2017, 2021). Such methods can also help collect data on the perceptions, attitudes and characteristics (e.g. socio-economic, demographic, cultural) of people both impacting and affected by conservation activities across different Chinese social–ecological systems, which has helped to identify commonalities in factors associated with interactions (Bennett, 2016; Pyhälä et al., 2016). For example, key factors driving wildlife loss include local attitudes and behaviours that influence both direct consumption and indirect impacts on habitats, while the settings in which these interactions take place are typically communities that live close to wildlife and have high dependency on natural resources, such as fishing communities (Liu et al., 2016; Wang, Turvey, et al., 2020; Zhang, Guan, et al., 2020; Zhang & Yin, 2014). Moreover, there has been substantial humanities and social science scholarship on grassroots environmental movements in China, such as local campaigns to save threatened species (Stalley & Yang, 2006; Steinhart & Wu, 2016; Sun & Zhao, 2007). Increased societal participation in citizen science projects has also generated valuable conservation evidence, for example contributing to mapping biodiversity hotspots (Hu et al., 2017). Studies in the tourism sector on the expanding domestic market for wildlife leisure activities (e.g. bird-watching, wildlife photography) also indicate that these emerging activities provide both opportunities and challenges for conservation and sustainable development (Basnet et al., 2021; Cong et al., 2017; Walther & White, 2018).

2.2 | Obstacles to an integrated approach for Chinese conservation

China supports an extensive conservation science community, with many world-leading experts on threatened species. However, whereas understanding China's social–ecological systems requires an interdisciplinary approach that draws upon diverse skill sets and methodologies, conservation research in China remains predominantly natural science-focused, with a lack of interdisciplinary training (Fan et al., 2020). Indeed, although Chinese scientists are paving the way with integrated social science approaches in some areas of conservation research, such as primate conservation (Fan et al., 2011; Guan & Li, 2016; Zhang, Guan, et al., 2020), many of the interdisciplinary conservation studies conducted so far in China have resulted from international collaborations with external conservation researchers rather than from Chinese-led initiatives.

Competitive academic career advancement in China is based on scholarly outputs and impact factors, which has tended to drive specialization and discourage practical training and networking to enable development of interdisciplinary skills (Fan et al., 2020). Conservation research in China has typically been conducted by scientists with training in pure zoology or ecology, and there is still limited awareness or even active discouragement of exploring

methods and frameworks from disciplines outside the natural sciences, especially from subjects with traditionally less likelihood of producing 'high-impact' publications. As a result of these competitive pressures, conservation scientists in China often shift their research focus away from conservation to other areas within the natural sciences (Lu, 2015). Chinese conservationists also face difficulties when accessing international research due to language barriers (Amano et al., 2016) and governmental restrictions on access to external online knowledge platforms, which together promote inequality in accessing information and being presented with career-advancement opportunities (Maas et al., 2021). It is therefore crucial that the next generation of China's conservationists, in both research and nonacademic careers, are provided with greater interdisciplinary and practical training to become fully equipped to tackle the complex challenges of balancing conservation and community development (Blickley et al., 2013; Gao & Li, 2021). Establishing and maintaining international research networks, comparable to the research hubs at the Cambridge Conservation Initiative and the University of Oxford's Interdisciplinary Centre for Conservation Science, would present additional opportunities for interdisciplinary training and support (Fan et al., 2020). While research placements abroad are not necessarily requirements for career progression, visiting scholar grants and graduate student scholarships, such as those funded by the China Scholarship Council and the UK's Chevening Scholarship and Newton Fund, can further support relevant career development. We also encourage public and private sector funders to increase scholarships for students from diverse backgrounds, as financial barriers to higher education in conservation often limit access to careers (Archer et al., 2022). Ideally, a review and overhaul of China's existing performance metric and evaluation system could further support career advancement and professional development of early-career researchers working in conservation science.

Integrating Indigenous voices and perspectives and the well-being of low-income rural communities into conservation in China faces challenges not only within scientific research, but also within management and policymaking. Trying to transform its society towards an 'Ecological Civilization', the conservation of biodiversity and environmental processes is increasingly taking precedence over economic development within many contexts in China (Li & Shapiro, 2020). Acknowledging the need to integrate development and conservation, poverty alleviation is a major focus on the Chinese government's policy agenda, and supporting local communities towards more eco-friendly and sustainable livelihoods is held up as an approach to implement this agenda (Zhao et al., 2021). However, conservation in China is still often dominated by top-down governance approaches (with policies typically issued at the provincial or national level), which often overlook the inclusion and participation of local communities and have frequently generated local resentment and tensions (Xu et al., 2012; Zheng & Cao, 2014). As in many other countries (Jordan et al., 2020), the reduced livelihood benefits linked to top-down conservation approaches in China are also often borne disproportionately by already impoverished rural communities (Wang, 2019).

2.3 | How transferable are effective strategies across different Chinese social-ecological systems?

Reflecting on successful cases within China, such as effective ways to incorporate traditional or local ecological knowledge into the conservation of key species (Tang & Gavin, 2010) or to involve local communities in reserve management (Wang et al., 2017; Zhao et al., 2018), has potential to provide insights into general principles for mitigating negative human impacts on biodiversity without compromising community well-being and development. Recognition of specific community needs, within a framework of assessing their possible impacts on local biodiversity, can be more successful when coordinated and championed by specific stakeholders. For example, Shanshui Conservation Center, a Chinese conservation nongovernmental organization (NGO), played a pivotal role in helping local communities increase participation in conservation management in Sanjiangyuan, leading to the safeguarding of both critical conservation areas and cultural traditions (Shen & Tan, 2012). This success can be attributed to the NGO's bridging role between local communities and nature reserve management authorities, which helped the authorities recognize that Tibetan cultural and religious systems play important roles in conserving wildlife and supported the development and integration of effective community-based conservation mechanisms (Shen et al., 2015; Shen & Tan, 2012). Long-term involvement of conservation NGOs elsewhere in China has also supported communities living near protected areas in several provinces (e.g. Guangxi, Sichuan, Yunnan) to improve comanagement of natural resources in association with obtaining local benefits, such as selling locally produced rice and honey and conducting activities such as hosting nature education camps (Wang et al., 2017). Strong local traditions and governance structures have also been shown to assist in protection of other natural environments across China, such as sacred mountains and *fengshui* forests within villages, which hold not only spiritual value and act as sources of natural resources for local communities, but also provide crucial wildlife habitats outside formally protected areas (Coggins & Minor, 2014; Zhu, 2020). This has led to the effective maintenance of biodiversity and the sustainable coexistence of wildlife and local communities for millennia within some traditional cultural rather than natural Chinese landscapes, even within some relatively intensive agricultural systems (Liu et al., 2013). There is tremendous practical and ethical value in empowering grassroots organizations to contribute to conservation, as they are often best positioned to mobilize local community agency and knowledge, encourage awareness and participation and apply interdisciplinary expertise. Indeed, a recent shift towards such bottom-up empowerment has partly been a response to the reform of China's national park system (Wang, 2019; Zhou & Grumbine, 2011). However, narratives that aim to identify and define the dynamics of such systems can be problematic if they are predominantly constructed by actors from outside of the landscape instead of by local communities (Zeng, 2019).

Nonetheless, due to China's great biocultural diversity, such locally successful strategies may not be easily transferrable across

different social–ecological systems. Highly localized cultural contexts, including the extent and dynamics of wider engagement with local institutions or other relevant stakeholders, have been shown to be a key component in the success of conservation interventions (Waylen et al., 2010). We therefore advocate for researchers to embrace complexities in socio-ecological systems, including the drivers underpinning local communities' values, knowledge, attitudes and behaviours, and to be cautious of simple narratives. However, it is also important to try to identify general patterns and principles that underlie success or failure in integrated conservation efforts across China's different social–ecological systems. One likely key factor is community empowerment. Lessons from early conservation projects in China, such as World Wildlife Fund's involvement in Asian elephant conservation in Xishuangbanna, Yunnan, showed that communities were neither passively accepting nor strongly resistant to externally introduced conservation interventions; instead, communities that were able to use their own knowledge and agency became involved most successfully in shaping conservation management (Hathaway, 2013).

3 | FUTURE DIRECTIONS

Conservation activities in China are conducted across, and also challenged by, a diverse range of ecosystems and socio-cultural contexts. As conservation researchers, we need to provide robust evidence that identifies local communities' needs, impacts, attitudes,

awareness and cultural value systems, to guide best-practice management. As conservation practitioners, we need to engage directly with social–ecological systems to encourage sustainable practices and effect necessary change. Examining well-documented examples within the Chinese context is crucial if successful integration of human and biodiversity needs is to be replicated elsewhere. We propose that robust interdisciplinary research on social–ecological dynamics is needed to provide a more in-depth and nuanced understanding of China's conservation challenges and opportunities at the community level. Therefore, we need not only qualitative case studies, but also methods to evaluate such systems quantitatively (e.g. wide-scale comparative assessment of the varying factors that might influence successful establishment of integrated conservation projects in different Chinese landscapes), so that the lessons learned can help generate more widely applicable principles that inform local management recommendations.

3.1 | Recommended actions

We outline a series of steps for conservation researchers, practitioners, management authorities and policymakers to guide future work in China (Figure 3):

- Routine use of evidence in conservation decision-making by making the most of available empirical information (Sutherland et al., 2004). Where evidence is lacking or biased, identify critical

		Stakeholders			
		Local & Indigenous Communities	Researchers	Conservation practitioners	Policymakers
Recommendations	Routine use of evidence in conservation decision-making	Identify patterns and drivers of human-biodiversity interactions			
		Conduct empirical conservation studies with integrated approaches, fill knowledge gaps, avoid generalizations			
		Integrate the evidence into decision making, make available for policymakers and public			
	Evaluation of past conservation activities and learnt experience	Use social science and interdisciplinary approaches			
		Understand and respect the diversity of local contexts and value systems			
		Critically reflect on what conservation activities have been effective			
Increase dialogue at the science-policy interface	Bridge the conversation gap between national-level directives and local-level implementation				
	Encourage participation across sectors of society				
Integrate local, traditional, and Indigenous knowledge	Knowledge sharing by, engagement with, and empowerment of local communities				
	Acknowledge the value of local knowledge and practices				
	Integrate development and conservation, support sustainable livelihoods				
Support the next generation of interdisciplinary conservation scientists and practitioners	Early-stage career training				
	Adopt more comprehensive career evaluation criteria				
	Expand international networks and research hubs for knowledge exchange and career development opportunities				

FIGURE 3 Recommended actions for better integrating evidence-based conservation at the community level through participation, research and policymaking at the grassroots and national scales, and the relevant stakeholders for each action.

gaps and focus research efforts on filling these gaps (Christie et al., 2020). Make scientific evidence accessible to those outside of the core research community, including local NGOs, governing authorities and the general public. For example, Shanshui Conservation Center frequently engages in activities explicitly designed to encourage cross-sector integration, such as community participation in wildlife monitoring, citizen science projects, creation of public outreach content and consultations for government policymaking (Shanshui Conservation Center, 2020). While this approach places more responsibility on researchers to multi-task, demonstrating how scientific evidence is collected, analysed and applied through these activities increases the understanding of science-driven decision-making among nonresearchers, and thus encourages evidence-based conservation at a societal level.

- Critical evaluation of past conservation activities and learnt experience. This approach needs to be honest and also include an effective evaluation of community-based approaches and interventions, using the modern social science-based methods at our disposal. For example, before designing and conducting conservation outreach activities, it is necessary to critically evaluate past activities to understand what methods and messages have been most effective in the past (Qian et al., 2022), while also taking into account the diversity of specific local settings and value systems.
- Increase dialogue at the science-policy interface, between and across disciplines and levels of management, ranging from local rangers to policymakers. Progress on these aspects will help bridge the gap between national-level directives and local-level implementation. For example, lessons from the earliest proposals for creating national parks in Yunnan highlight the need for participation at all levels and across sectors (development, tourism, education) to ultimately create win-win situations for biodiversity and people (Zhou & Grumbine, 2011).
- Integrate local, traditional and Indigenous knowledge and value systems and cultural practices into conservation, while also being aware of their limitations. This requires acknowledging the value of such knowledge and practices in informing conservation decisions, and actively engaging with the individuals and communities who have long-term involvement in environmental management practices.
- Support the next generation of interdisciplinary conservation scientists and practitioners. Early-stage career training including social science methods could greatly benefit conservation researchers and practitioners in working with diverse groups of stakeholders using interdisciplinary approaches. Together, they can contribute to the seeking of 'win-win' approaches for the regional maintenance of biodiversity and sustainable livelihoods.

3.2 | What are the goals?

We envision that evidence-based conservation science should flourish and become the foundation of China's biodiversity conservation

agenda. Specifically, incorporating conservation biology into a broader interdisciplinary field that explicitly recognizes the tight coupling of social and natural systems in the Anthropocene would help to tackle challenges at the human-nature interface, at which most threatened species and ecosystems in China now exist.

We thus advocate for the conservation of China's cultural and natural heritage in tandem, especially through the establishment of culturally appropriate and sensitive management approaches (Foggin, 2014; Shen et al., 2015; Zhang, Guan, et al., 2020). Finding common ground between the requirements of local communities and biodiversity conservation (e.g. through shared needs for ecosystem services; Allendorf & Yang, 2013; He et al., 2018) would help to provide opportunities to address goals in sustainable economic development, such as poverty alleviation. Researchers and practitioners should also be highly sensitive to the risk that marginalized communities, often without a voice in the decision-making process, can sometimes become 'environmental scapegoats' and blamed for biodiversity loss, even if other factors might be more responsible but are harder or less desirable to address (Dressler et al., 2021; Eilenberg, 2022). Nonetheless, social development goals must be balanced against effective maintenance of threatened and endemic biodiversity (Zhao et al., 2018, 2021), as well as being critically assessed against erroneous assumptions about human-wildlife interactions (Treves & Santiago-Ávila, 2020).

Since the 1980s, the concept of biological diversity has been adopted in the development of Indigenous spaces in China, especially through communities' engagement with environmental issues (Hathaway, 2011). However, while this is therefore not a new concept, combining cultural and biological conservation goals has yet to be applied successfully at a wide scale across China's priority conservation areas. China's past, ongoing and future efforts to confront its environmental problems are insightful for conservation science and will also shape the process and outcomes of global conservation endeavours. The challenges to China's conservation issues are complex and diverse, but there are myriad opportunities to obtain viable solutions that balance ecological and human needs.

AUTHOR CONTRIBUTIONS

Heidi Ma, Samuel T. Turvey and Di Zhang conceived the paper and led on the writing of the manuscript. Heidi Ma, Samuel T. Turvey, Lingyun Xiao, Lu Zhang, Simon D. Dowell and Yifu Wang provided case studies. Carolyn Thompson and Jingyu Chen contributed to the writing. All authors discussed, edited and approved the final version.

ACKNOWLEDGEMENTS

We thank the communities that we have worked with across China, including Indigenous and ethnic minority peoples, for sharing their knowledge and perspectives. We also acknowledge the support of local and regional governmental bureaus and officials that made our research possible. We thank Pengfei Fan for providing a photograph used in our figure.

FUNDING INFORMATION

HM and CT are supported by the Arcus Foundation (grant no. G-PGM-1911-3071).

CONFLICT OF INTEREST

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

This manuscript does not contain any data.

ORCID

Heidi Ma  <https://orcid.org/0000-0001-9883-4377>

Yifu Wang  <https://orcid.org/0000-0001-5937-2261>

Lu Zhang  <https://orcid.org/0000-0002-1795-9563>

Carolyn Thompson  <https://orcid.org/0000-0001-8214-3264>

Jan Christoph Axmacher  <https://orcid.org/0000-0003-1406-928X>

[org/0000-0003-1406-928X](https://orcid.org/0000-0003-1406-928X)

Samuel T. Turvey  <https://orcid.org/0000-0002-3717-4800>

REFERENCES

- Allendorf, T. D., & Yang, J. (2013). The role of ecosystem services in park-people relationships: The case of Gaoligongshan Nature Reserve in southwest China. *Biological Conservation*, 167, 187–193.
- Amano, T., González-Varo, J. P., & Sutherland, W. J. (2016). Languages are still a major barrier to global science. *PLoS Biology*, 14, e2000933.
- Archer, L. J., Müller, H. S., Jones, L. P., Ma, H., Gleave, R. A., da Silva Cerqueira, A., McMurdo Hamilton, T., & Shennan-Farpon, Y. (2022). Towards fairer conservation: Perspectives and ideas from early-career researchers. *People and Nature*, 4, 612–626.
- Basnet, D., Yang, J., Dorji, T., Xiao, Q., Lama, A. K., Yue, M., Wu, N., Wei, Y., Gurung, K., Li, R., Gupta, N., Kanwal, K. S., & Yi, S. (2021). Bird photography tourism, sustainable livelihoods, and biodiversity conservation: A case study from China. *Mountain Research and Development*, 41, D1–D9.
- Bennett, N. J. (2016). Using perceptions as evidence to improve conservation and environmental management. *Conservation Biology*, 30, 582–592.
- Bennett, N. J., Roth, R., Klain, S. C., Chan, K., Christie, P., Clark, D. A., Cullman, G., Curran, D., Durbin, T. J., Epstein, G., Greenberg, A., Nelson, M. P., Sandlos, J., Stedman, R., Teel, T. L., Thomas, R., Verissimo, D., & Wyborn, C. (2017). Conservation social science: Understanding and integrating human dimensions to improve conservation. *Biological Conservation*, 205, 93–108.
- Blickley, J. L., Deiner, K., Garbach, K., Lacher, I., Meek, M. H., Porensky, L. M., Wilkerson, M. L., Winford, E. M., & Schwartz, M. W. (2013). Graduate student's guide to necessary skills for nonacademic conservation careers. *Conservation Biology*, 27, 24–34.
- Bo, D., Dowell, S., Garson, P., & He, F. (2009). Habitat utilisation by the threatened Sichuan partridge *Arborophila rufipectus*: Consequences for managing newly protected areas in southern China. *Bird Conservation International*, 19, 187–198.
- Chan, B. P. L., Fellowes, J. R., Geissmann, T., & Zhang, J. (2005). *Hainan gibbon status survey and conservation action plan*. Kadoorie Farm & Botanic Garden.
- Chen, H., Shivakoti, G., Zhu, T., & Maddox, D. (2012). Livelihood sustainability and community based co-management of forest resources in China: Changes and improvement. *Environmental Management*, 49, 219–228.
- Chen, S., Cunningham, A. A., Wei, G., Yang, J., Liang, Z., Wang, J., Wu, M., Yan, F., Xiao, H., Harrison, X. A., Pettorelli, N., & Turvey, S. T. (2018). Determining threatened species distributions in the face of limited data: Spatial conservation prioritization for the Chinese giant salamander (*Andrias davidianus*). *Ecology and Evolution*, 8, 3098–3108.
- Chen, Y., Qu, X., Xiong, F., Lu, Y., Wang, L., & Hughes, R. M. (2019). Challenges to saving China's freshwater biodiversity: Fishery exploitation and landscape pressures. *Ambio*, 49, 926–938.
- Christie, A. P., Amano, T., Martin, P. A., Petrovan, S. O., Shackelford, G. E., Simmons, B. I., Smith, R. K., Williams, D. R., Wordley, C. F., & Sutherland, W. J. (2020). Poor availability of context-specific evidence hampers decision-making in conservation. *Biological Conservation*, 248, 108666.
- Coggins, C. (2003). *The tiger and the pangolin: Nature, culture, and conservation in China*. University of Hawaii Press.
- Coggins, C. (2017). Conserving China's biological diversity: National Plans, transnational projects, local and regional challenges. In E. Sternfeld (Ed.), *Routledge handbook of environmental policy in China*. Routledge.
- Coggins, C., & Minor, J. (2014). Fengshui forests as a socio-natural reservoir in the face of climate change and environmental transformation. *Asia Pacific Perspectives*, 15(2), 4–29.
- Cong, L., Newsome, D., Wu, B., & Morrison, A. M. (2017). Wildlife tourism in China: A review of the Chinese research literature. *Current Issues in Tourism*, 20, 1116–1139.
- Convention on Biological Diversity. (2020). *Update of the zero draft of the Post-2020 global biodiversity framework*. Montreal. <https://www.cbd.int/doc/c/3064/749a/0f65ac7f9def86707f4eaeaf/post2020-prep-02-01-en.pdf>
- Cunningham, A. A., Turvey, S. T., Zhou, F., Meredith, H. M. R., Guan, W., Liu, X., Sun, C., Wang, Z., & Wu, M. (2016). Development of the Chinese giant salamander *Andrias davidianus* farming industry in Shaanxi Province, China: Conservation threats and opportunities. *Oryx*, 50, 265–273.
- Deng, J., Sun, P., Zhao, F., Han, X., Yang, G., & Feng, Y. (2016). Analysis of the ecological conservation behavior of farmers in payment for ecosystem service programs in eco-environmentally fragile areas using social psychology models. *Science of the Total Environment*, 550, 382–390.
- Dowell, S. D., & Bo, D. (2003). A conservation breakthrough in Sichuan. *World Birdwatch*, 25, 22–25.
- Dowell, S. D., Dai, B., Martins, R. P., & Williams, R. S. R. (1999). Sustainable management to prevent extinction: The case of the Sichuan hill-partridge *Arborophila rufipectus*. In N. J. Adams & R. H. Slotow (Eds.), *Proceedings of the 22nd International Ornithological Congress* (pp. 2084–2096). BirdLife South Africa.
- Dressler, W. H., Smith, W., Kull, C. A., Carmenta, R., & Pulhin, J. M. (2021). Recalibrating burdens of blame: Anti-swidden politics and green governance in the Philippine uplands. *Geoforum*, 124, 348–359.
- Eilenberg, M. (2022). The last enclosure: Smoke, fire and crisis on the Indonesian forest frontier. *Journal of Peasant Studies*, 49, 969–998.
- Fan, P., Xiao, W., Huo, S., Ai, H., Wang, T., & Lin, R. (2011). Distribution and conservation status of the vulnerable eastern hoolock gibbon *Hoolock leuconedys* in China. *Oryx*, 45, 129–134.
- Fan, P., Yang, L., Liu, Y., & Lee, T. M. (2020). Build up conservation research capacity in China for biodiversity governance. *Nature Ecology and Evolution*, 4, 1162–1167.
- Fauna & Flora International China Programme. (2005). *Action plan for implementing co-management in the Bawangling Nature Reserve and adjacent communities in Qingsong township*. Fauna & Flora International China Programme.
- Foggin, J. M. (2014). Managing shared natural heritages: Towards more participatory models of protected area management in western China. *Journal of International Wildlife Law and Policy*, 17, 130–151.
- Fu, Y., Dowell, S. D., & Zhang, Z. (2013). Emei Shan liocichla: Population, behavior and conservation. *Chinese Birds*, 4, 260–264.

- Gao, H., Ouyang, Z., Chen, S., & Van Koppen, C. S. A. (2013). Role of culturally protected forests in biodiversity conservation in southeast China. *Biodiversity and Conservation*, 22, 531–544.
- Gao, Y., & Li, B. V. (2021). Evaluation of the status, job satisfaction and occupational stress of Chinese nature reserve staff. *Global Ecology and Conservation*, 29, e01731.
- Gong, S., Shi, H., Jiang, A., Fong, J. J., Gaillard, D., & Wang, J. (2017). Disappearance of endangered turtles within China's nature reserves. *Current Biology*, 27, R170–R171.
- Gong, S., Wu, J., Gao, Y., Fong, J. J., Parham, J. F., & Shi, H. (2020). Integrating and updating wildlife conservation in China. *Current Biology*, 30, R915–R919.
- Gruschke, A. (2011). From yak herders to yartsa traders: Tibetan nomads and new market options in Qinghai's Yushu region. *China Tibetology*, 3, 95–118.
- Guan, Z., & Li, M. (2016). *An assessment of anthropogenic threats to Hoolock gibbon (Hoolock leuconedys) populations and potential conservation measures in Yingjiang County in West Yunnan, China*. Gibbon Conservation Alliance and Yunnan Academy of Biodiversity SWFU.
- Hathaway, M. (2011). Global environmentalism and the emergence of indigeneity: The politics of cultural and biological diversity in China. In G. M. Sodrikoff (Ed.), *The anthropology of extinction: Essays on culture and species death* (pp. 103–124). Indiana University Press.
- Hathaway, M. (2013). *Environmental winds: Making the global in southwest China*. University of California Press.
- Hathaway, M. (2017). Discovering China's tropical rainforests: Shifting approaches to people and nature in the late twentieth century. In W. Graf von Hardenberg, M. Kelly, C. Leal, & E. Wakild (Eds.), *The nature state: Rethinking the history of conservation* (pp. 176–193). Routledge.
- He, S., Su, Y., Wang, L., Gallagher, L., & Cheng, H. (2018). Taking an ecosystem services approach for a new national park system in China. *Resources, Conservation and Recycling*, 137, 136–144.
- Hoffmann, M., Hilton-Taylor, C., Angulo, A., Böhm, M., Brooks, T. M., Butchart, S. H. M., Carpenter, K. E., Chanson, J., Collen, B., Cox, N. A., Darwall, W. R. T., Dulvy, N. K., Harrison, L. R., Katarinya, V., Pollock, C. M., Quader, S., Richman, N. I., Rodrigues, A. S. L., Tognelli, M. F., ... Stuart, S. N. (2010). The impact of conservation on the status of the world's vertebrates. *Science*, 330, 1503–1509.
- Hu, R., Wen, C., Gu, Y., Wang, H., Gu, L., Shi, X., Zhong, J., Wei, M., He, F., & Lu, Z. (2017). A bird's view of new conservation hotspots in China. *Biological Conservation*, 211, 47–55.
- Huang, G., Ping, X., Xu, W., Hu, Y., Chang, J., Swaisgood, R. R., Zhou, J., Zhan, X., Zhang, Z., Nie, Y., Cui, J., Bruford, M., Zhang, Z., Li, B., Zhang, L., Lv, Z., & Wei, F. (2021). Wildlife conservation and management in China: Achievements, challenges and perspectives. *National Science Review*, 8, nwab042.
- Huang, S.-L., Mei, Z., Hao, Y., Zheng, J., Wang, K., & Wang, D. (2016). Saving the Yangtze finless porpoise: Time is rapidly running out. *Biological Conservation*, 210, 40–46.
- Jeffreys, E. (2016). Translocal celebrity activism: Shark-protection campaigns in mainland China. *Environmental Communication*, 10, 763–776.
- Jiang, Z. (2016). Assessing the surviving status of vertebrates in China. *Biodiversity Science*, 24, 495–499.
- Jing, W. C. S., Ticktin, T., Zeng, Y., & Kede, A. (2020). An ethnobotanical survey of wild edible plants used by the Yi people of Liangshan prefecture, Sichuan Province, China. *Journal of Ethnobiology and Ethnomedicine*, 16, 1–27.
- Jordan, N. R., Smith, B. P., Appleby, R. G., van Eeden, L. M., & Webster, H. S. (2020). Addressing inequality and intolerance in human–wildlife coexistence. *Conservation Biology*, 34, 803–810.
- Li, C., Connor, T., Bai, W., Yang, H., Zhang, J., Qi, D., & Zhou, C. (2019). Dynamics of the giant panda habitat suitability in response to changing anthropogenic disturbance in the Liangshan Mountains. *Biological Conservation*, 237, 445–455.
- Li, J., Wang, W., Axmacher, J. C., Zhang, Y., & Zhu, Y. (2016). Streamlining China's protected areas. *Science*, 351, 1160.
- Li, J., Yin, H., Wang, D., Jiagong, Z., & Lu, Z. (2013). Human-snow leopard conflicts in the Sanjiangyuan region of the Tibetan plateau. *Biological Conservation*, 166, 118–123.
- Li, L., Fassnacht, F. E., Storch, I., & Bürgi, M. (2017). Land-use regime shift triggered the recent degradation of alpine pastures in Nyanpo Yutse of the eastern Qinghai-Tibetan plateau. *Landscape Ecology*, 32, 2187–2203.
- Li, Y., & Shapiro, J. (2020). Ecological civilization as political philosophy. In Y. Li & J. Shapiro (Eds.), *China goes green: Coercive environmentalism for a troubled planet*. Wiley.
- Liao, Y. (1999). Rebuild the green Great Wall—Report from the stop-logging areas in West Sichuan. *Decision and Information*, 173, 4–5.
- Lin, M., Xing, L., Fang, L., Huang, S., Yao, C., Turvey, S. T., Gozlan, R. E., & Li, S. (2019). Can local ecological knowledge provide meaningful information on coastal cetacean diversity? A case study from the northern South China Sea. *Ocean & Coastal Management*, 172, 117–127.
- Liu, H., Ma, H., Cheyne, S. M., & Turvey, S. T. (2020). Recovery hopes for the world's rarest primate. *Science*, 368, 1074.
- Liu, J., & Diamond, J. (2005). China's environment in a globalizing world. *Nature*, 435, 1179–1186.
- Liu, J., Hull, V., Yang, W., Viña, A., Chen, X., Ouyang, Z., & Zhang, H. (2016). *Pandas and people: Coupling human and natural systems for sustainability*. Oxford University Press.
- Liu, Y., Duan, M., & Yu, Z. (2013). Agricultural landscapes and biodiversity in China. *Agriculture, Ecosystems and Environment*, 166, 46–54.
- Lu, X. (2015). Hot genome leaves natural histories cold. *Science*, 349, 1064.
- Lv, Z., Wang, H., Gu, L., Wen, C., Zhang, D., Luo, M., Hu, R., Gu, Y., Yao, J., Zhang, X., Wu, K., Shi, X., Zhu, Z., Jin, T., Zhang, Y., Gong, Z., Feng, J., Zhao, X., & Li, X. (2017). China nature watch report 2016. Shanshui Conservation Center (visited 10 June 2019). <http://en.shanshui.org/wp-content/uploads/2019/10/20191011050323413.pdf>
- Ma, H. (2021). *Local perceptions of biodiversity loss and conservation: Insights from rural communities around a key protected area in Hainan, China*. PhD thesis. Royal Holloway, University of London.
- Ma, H., Papworth, S. K., Ge, T., Wu, X., Yu, C., Zhang, H., & Turvey, S. T. (2021). Local awareness and interpretations of species extinction in a rural Chinese biodiversity hotspot. *Frontiers in Conservation Science*, 2, 689561.
- Maas, B., Pakeman, R. J., Godet, L., Smith, L., Devictor, V., & Primack, R. (2021). Women and global south strikingly underrepresented among top-publishing ecologists. *Conservation Letters*, 14, e12797.
- Margulies, J. D., Wong, R. W. Y., & Duffy, R. (2019). The imaginary 'Asian super consumer': A critique of demand reduction campaigns for the illegal wildlife trade. *Geoforum*, 107, 216–219.
- Marks, R. B. (2017). *China: An environmental history* (2nd ed.). Rowman & Littlefield.
- Mei, Z., Cheng, P., Wang, K., Wei, Q., Barlow, J., & Wang, D. (2020). A first step for the Yangtze. *Science*, 367, 1314.
- Mei, Z., Han, Y., Dong, L., Turvey, S. T., Hao, Y., Wang, K., & Wang, D. (2019). The impact of fisheries management practices on the survival of the Yangtze finless porpoise in China. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 29, 639–646.
- Miller, I. M. (2020). *Fir and empire: The transformation of forests in early modern China*. University of Washington Press.
- Ministry of Agriculture, P.R.C., and Ministry of Finance, P.R.C. (2011). Implementation guidelines about the grassland ecological conservation compensation policy in 2011.
- Mogensen, L. M. W., Mei, Z., Hao, Y., Harrison, X. A., Wang, D., & Turvey, S. T. (2022). Precautionary principle or evidence-based conservation? Assessing the information content of threat data for the Yangtze finless porpoise. *Frontiers in Marine Science*, 8, 791484.
- Mullaney, T. S. (2011). *Coming to terms with the nation: Ethnic classification in modern China*. University of California Press.

- Myers, N., Mittermeier, R. A., Mittermeier, C. G., Fonseca, G. A. B., & Kent, J. (2000). Biodiversity hotspots for conservation priorities. *Nature*, 403, 853–858.
- Nash, H. C., Wong, M. H. G., & Turvey, S. T. (2016). Using local ecological knowledge to determine status and threats of the critically endangered Chinese pangolin (*Manis pentadactyla*) in Hainan, China. *Biological Conservation*, 196, 189–195.
- National Bureau of Statistics. (2021). *Communique of the seventh National Population Census*. Accessed 26 May 2022. (in Chinese) <http://www.stats.gov.cn/tjsj/>
- Nyima, T. (2014). In the name of conservation and harmonious development: The separation of pastoralists from pastures in Tibet. In T. Brox & I. Bellér-Hann (Eds.), *On the fringes of the harmonious society: Tibetans and Uyghurs in socialist China* (pp. 127–158). Nordic Institute of Asian Studies.
- Pan, Y., Wei, G., Cunningham, A. A., Li, S., Chen, S., Milner-Gulland, E. J., & Turvey, S. T. (2016). Using local ecological knowledge to assess the status of the critically endangered Chinese giant salamander *Andrias davidianus* in Guizhou Province, China. *Oryx*, 50, 257–264.
- Peng, Q., Yang, R., Cao, Y., Wang, F., Hou, S., Tseng, T. H., Wang, X., Wang, P., Zhao, Z., Yu, L., & Locke, H. (2021). One-third of lands face high conflict risk between biodiversity conservation and human activities in China. *Journal of Environmental Management*, 299, 113449.
- Pyhälä, A., Fernández-Llamazares, Á., Lehvävirta, H., Byg, A., Ruiz-Mallén, I., Salpeteur, M., & Thornton, T. F. (2016). Global environmental change: Local perceptions, understandings, and explanations. *Ecology and Society*, 21, 25.
- Qian, J., Mills, M., Ma, H., & Turvey, S. T. (2022). Assessing the effectiveness of public awareness-raising initiatives for the Hainan gibbon *Nomascus hainanus*. *Oryx*, 56, 249–259.
- Qiao, D., Yuan, W. T., & Ke, S. F. (2021). China's natural Forest protection program: Evolution, impact and challenges. *International Forestry Review*, 23, 338–350.
- Ren, G., Young, S. S., Wang, L., Wang, W., Long, Y., Wu, R., Li, J., Zhu, J., & Yu, D. (2015). Effectiveness of China's national forest protection program and nature reserves. *Conservation Biology*, 29, 1368–1377.
- Schaller, G. B. (1998). *Wildlife of the Tibetan steppe*. University of Chicago Press.
- Shanshui Conservation Center. (2020). *2020 Annual Report*. Shanshui Conservation Center.
- Shapiro, J. (2001). *Mao's war against nature: Politics and the environment in revolutionary China*. Cambridge University Press.
- Shapiro, J. (2016). *China's environmental challenges*. Polity Press.
- Shen, X., Li, S., Wang, D., & Lu, Z. (2015). Viable contribution of Tibetan sacred mountains in southwestern China to forest conservation. *Conservation Biology*, 29, 1518–1526.
- Shen, X., & Tan, J. (2012). Ecological conservation, cultural preservation, and a bridge between: The journey of Shanshui Conservation Center in the Sanjiangyuan region, Qinghai-Tibetan Plateau, China. *Ecology and Society*, 17(4), 38.
- Sheng, G., Chen, H., Ferretti-Gallon, K., Innes, J. L., Wang, Z., Zhang, Y., & Wang, G. (2020). Moving toward a greener China: Is China's national park pilot program a solution? *Land*, 9(12), 1–23.
- Stalley, P., & Yang, D. (2006). An emerging environmental movement in China? *The China Quarterly*, 186, 333–356.
- Stattersfield, A. J., Crosby, M. J., Long, A. J., & Wege, D. C. (1998). *Endemic Bird Areas of the world: Priorities for biodiversity conservation*. BirdLife International.
- Steinhardt, H. C., & Wu, F. (2016). In the name of the public: Environmental protest and the changing landscape of popular contention in China. *The China Journal*, 75, 61–82.
- Sulek, E. (2011). Disappearing sheep: The unexpected consequences of the emergence of the caterpillar fungus economy in Golok, Qinghai, China, Himalaya. *The Journal of the Association for Nepal and Himalayan Studies*, 30, 9.
- Sun, Y., & Zhao, D. (2007). Multifaceted state and fragmented society: Dynamics of environmental movement in China. In Y. L. Dali (Ed.), *Discontented Miracle: Growth, Conflict, and Institutional Adaptations in China* (pp. 111–160). World Scientific Publishing.
- Sutherland, W. J., Pullin, A. S., Dolman, P. M., & Knight, T. M. (2004). The need for evidence-based conservation. *Trends in Ecology and Evolution*, 19, 305–308.
- Tang, X. (2020). The establishment of national park system: A new milestone for the field of nature conservation in China. *International Journal of Geoheritage and Parks*, 8, 195–202.
- Tang, R., & Gavin, M. C. (2010). Traditional ecological knowledge informing resource management: Saxoul conservation in Inner Mongolia, China. *Society & Natural Resources*, 23, 193–206.
- Thomas-Walters, L., Verissimo, D., Gadsby, E., Roberts, D., & Smith, R. J. (2020). Taking a more nuanced look at behavior change for demand reduction in the illegal wildlife trade. *Conservation Science and Practice*, 2(9), 1–10.
- Treves, A., & Santiago-Ávila, F. J. (2020). Myths and assumptions about human-wildlife conflict and coexistence. *Conservation Biology*, 34, 811–818.
- Turvey, S. T., Barrett, L. A., Hao, Y., Zhang, L., Zhang, X., Wang, X., Huang, Y., Zhou, K., Hart, T., & Wang, D. (2010). Rapidly shifting baselines in Yangtze fishing communities and local memory of extinct species. *Conservation Biology*, 24, 778–787.
- Turvey, S. T., Bryant, J. V., Duncan, C., Wong, M. H. G., Guan, Z., Fei, H., Ma, C., Hong, X., Nash, H. C., Chan, B. P., Xu, Y., & Fan, P. (2017). How many remnant gibbon populations are left on Hainan? Testing the use of local ecological knowledge to detect cryptic threatened primates. *American Journal of Primatology*, 79, e22617.
- Turvey, S. T., Bryant, J. V., & McClune, K. A. (2018). Differential loss of components of traditional ecological knowledge following a primate extinction event. *Royal Society Open Science*, 5, 172352.
- Turvey, S. T., Chen, S., Tapley, B., Liang, Z., Wei, G., Yang, J., Wang, J., Wu, M., Redbond, J., Brown, T., & Cunningham, A. A. (2021). From dirty to delicacy? Changing exploitation in China threatens the world's largest amphibians. *People and Nature*, 3, 446–456.
- Turvey, S. T., Chen, S., Tapley, B., Wei, G., Xie, F., Yan, F., Yang, J., Liang, Z., Tian, H., Wu, M., Okada, S., Wang, J., Lü, J., Zhou, F., Papworth, S. K., Redbond, J., Brown, T., Che, J., & Cunningham, A. A. (2018). Imminent extinction in the wild of the world's largest amphibian. *Current Biology*, 28, R592–R594.
- Turvey, S. T., Crees, J. J., & Di Fonzo, M. M. I. (2015). Historical data as a baseline for conservation: Reconstructing long-term faunal extinction dynamics in late Imperial–modern China. *Proceedings of the Royal Society B*, 282, 20151299.
- Turvey, S. T., Hao, Y., & Wang, D. (2015). *Identifying conservation solutions for the Yangtze finless porpoise (Neophocaena asiaeorientalis asiaeorientalis) through community research*. International Whaling Commission Report.
- Turvey, S. T., Pitman, R. L., Taylor, B. L., Barlow, J., Akamatsu, T., Barrett, L. A., Zhao, X., Reeves, R. R., Stewart, B. S., Wang, K., Wei, Z., Zhang, X., Pusser, L. T., Richlen, M., Brandon, J. R., & Wang, D. (2007). First human-caused extinction of a cetacean species? *Biology Letters*, 3, 537–540.
- Turvey, S. T., Risley, C. L., Moore, J. E., Barrett, L. A., Hao, Y., Zhao, X., Zhou, K., & Wang, D. (2013). Can local ecological knowledge be used to assess status and extinction drivers in a threatened freshwater cetacean? *Biological Conservation*, 157, 352–360.
- Turvey, S. T., Traylor-Holzer, K., Wong, M. H. G., Bryant, J. V., Zeng, X., Hong, X., & Long, Y. (2015). *International conservation planning workshop for the Hainan gibbon: Final report*. Zoological Society of London, London/IUCN SSC Conservation Breeding Specialist Group.
- Turvey, S. T., Walsh, C., Hansford, J. P., Crees, J. J., Bielby, J., Duncan, C., Hu, K., & Hudson, M. A. (2019). Complementarity, completeness and quality of long-term faunal archives in an Asian biodiversity

- hotspot. *Philosophical Transactions of the Royal Society B*, 374, 20190217.
- Vu, H. N. D., & Nielsen, M. R. (2021). Evidence or delusion: A critique of contemporary rhino horn demand reduction strategies. *Human Dimensions of Wildlife*, 26, 390–400.
- Walther, B. A., & White, A. (2018). The emergence of birdwatching in China: History, demographics, activities, motivations, and environmental concerns of Chinese birdwatchers. *Bird Conservation International*, 28, 337–349.
- Wang, D. (2009). Population status, threats and conservation of the Yangtze finless porpoise. *Chinese Science Bulletin*, 54, 3473–3484.
- Wang, G., Innes, J. L., Wu, S. W., Krzyzanowski, J., Yin, Y., Dai, S., Zhang, X., & Liu, S. (2012). National park development in China: Conservation or commercialization? *Ambio*, 41, 247–261.
- Wang, H., Liu, X., & Wang, H. (2016). The Yangtze River floodplain: Threats and rehabilitation. *American Fisheries Society Symposium*, 84, 263–291.
- Wang, H., Zhao, Q., Bai, Y., Zhang, L., & Yu, X. (2020). Poverty and subjective poverty in rural China. *Social Indicators Research*, 150, 219–242.
- Wang, J. (2019). National parks in China: Parks for people or for the nation? *Land Use Policy*, 81, 825–833.
- Wang, Y., Leader-Williams, N., & Turvey, S. T. (2021). Exploitation histories of pangolins and endemic pheasants on Hainan Island, China: Baselines and shifting social norms. *Frontiers in Ecology and Evolution*, 9, 608057.
- Wang, Y., Turvey, S. T., & Leader-Williams, N. (2020). Knowledge and attitudes about the use of pangolin scale products in traditional Chinese medicine (TCM) within China. *People and Nature*, 2, 903–912.
- Waylen, K. A., Fischer, A., McGowan, P. J. K., Thirgood, S. J., & Milner-Gulland, E. J. (2010). Effect of local cultural context on the success of community-based conservation interventions. *Conservation Biology*, 24, 1119–1129.
- World Bank. (2021). *China rural population 1960–2021*. World Development Indicators, World Bank Group.
- Xiao, L., Lu, Z., & Mishra, C. (2022). When money meets tradition: How new cash incomes could be problematic for a vulnerable ecosystem. *Biological Conservation*, 272, 109575.
- Xie, G., Cao, S., Yang, Q., Xin, L., Fan, Z., Gao, Y., Lin, D., Ge, L., & Humphrey, S. (2015). *Living Planet Report: China 2015. Development, species and ecological civilization*. WWF.
- Xie, Y., Gan, X., & Yang, W. (2014). Strengthening the legal basis for designating and managing protected areas in China. *Journal of International Wildlife Law and Policy*, 17, 115–129.
- Xu, J., Zhang, Z., Liu, W., & McGowan, P. J. K. (2012). A review and assessment of nature reserve policy in China: Advances, challenges and opportunities. *Oryx*, 46, 554–562.
- Xu, W., Pimm, S. L., Du, A., Su, Y., Fan, X., An, L., Liu, J., & Ouyang, Z. (2019). Transforming protected area management in China. *Trends in Ecology & Evolution*, 34, 762–766.
- Xu, W., Xiao, Y., Zhang, J., Yang, W., Zhang, L., Hull, V., Wang, Z., Zheng, H., Liu, J., Polasky, S., Jiang, L., Xiao, Y., Shi, X., Rao, E., Lu, F., Wang, X., Daily, G. C., & Ouyang, Z. (2017). Strengthening protected areas for biodiversity and ecosystem services in China. *Proceedings of the National Academy of Sciences of the United States of America*, 114, 1601–1606.
- Yang, L., Chen, M., Challenger, D. W. S., Waterman, C., Zhang, C., Huo, Z., Liu, H., & Luan, X. (2018). Historical data for conservation: Reconstructing range changes of Chinese pangolin (*Manis pentadactyla*) in eastern China (1970–2016). *Proceedings of the Royal Society B*, 285, 20181084.
- Yang, M. H. (2019). Policy of giving rewards and subsidies (GRS) for grassland ecological conservation in Tibetan plateau. In L. M. S. Palni, R. B. Dhar, & O. P. Tandon (Eds.), *The state of ecology of the Tibetan plateau*. Academic Foundation.
- Yeh, E., Samberg, L. H., Gaerrang Volkmar, E., & Harris, R. B. (2017). Pastoralist decision-making on the Tibetan plateau. *Human Ecology*, 45, 333–343.
- Yu, Y., Wu, Y., Wang, P., Zhang, Y., Yang, L. E., Cheng, X., & Yan, J. (2021). Grassland subsidies increase the number of livestock on the Tibetan plateau: Why does the “payment for ecosystem services” policy have the opposite outcome? *Sustainability*, 13, 6208.
- Zeng, L. (2019). Dai identity in the Chinese ecological civilization: Negotiating culture, environment, and development in Xishuangbanna, southwest China. *Religions*, 10(12), 646.
- Zhang, H., Kang, M., Shen, L., Wu, J., Li, J., Du, H., Wang, C., Yang, H., Zhou, Q., Liu, Z., Gorfine, H., & Wei, Q. (2020). Rapid change in Yangtze fisheries and its implications for global freshwater ecosystem management. *Fish and Fisheries*, 21, 601–620.
- Zhang, H., Zhang, S., & Liu, Z. (2020). Evolution and influencing factors of China's rural population distribution patterns since 1990. *PLoS ONE*, 15, e0233637.
- Zhang, L., Guan, Z., Fei, H., Yan, L., Turvey, S. T., & Fan, P. (2020). Influence of traditional ecological knowledge on conservation of the sky-walker hoolock gibbon (*Hoolock tianxing*) outside nature reserves. *Biological Conservation*, 241, 108267.
- Zhang, L., & Yin, F. (2014). Wildlife consumption and conservation awareness in China: A long way to go. *Biodiversity and Conservation*, 23, 2371–2381.
- Zhang, M., Fellowes, J. R., Jiang, X., Wang, W., Chan, B. P. L., Ren, G., & Zhu, J. (2010). Degradation of tropical forest in Hainan, China, 1991–2008: Conservation implications for Hainan gibbon (*Nomascus hainanus*). *Biological Conservation*, 143, 1397–1404.
- Zhao, X., Garber, P. A., & Li, M. (2021). Alleviating human poverty: A successful model promoting wildlife conservation in China. *Conservation Science and Practice*, 3, e511.
- Zhao, X., Zhu, Z., Lu, Z., Xiao, L., Mei, S., & Wang, H. (2018). An observation to the new initiative of community conservation guard posts in the pilot Three-River-source National Park. *Biodiversity Science*, 26, 210–216.
- Zheng, H., & Cao, S. (2014). Threats to China's biodiversity by contradictions policy. *Ambio*, 44, 23–33.
- Zheng, L., Liu, H., Huang, Y., Yin, S., & Jin, G. (2020). Assessment and analysis of ecosystem services value along the Yangtze River under the background of the Yangtze River protection strategy. *Journal of Geographical Sciences*, 30, 553–568.
- Zhou, D., & Grumbine, R. E. (2011). National parks in China: Experiments with protecting nature and human livelihoods in Yunnan Province, People's Republic of China (PRC). *Biological Conservation*, 144, 1314–1321.
- Zhou, Y., Guo, Y., & Liu, Y. (2020). Health, income and poverty: Evidence from China's rural household survey. *International Journal for Equity in Health*, 19, 36.
- Zhou, Y., & Zhang, P. (2013). Distribution and vicissitude of gibbons (Hylobatidae) in China during the last 500 years. *Acta Theriologica Sinica*, 33, 258–266.
- Zhu, Z. (2020). *The evolving ecological culture of Tibetan pastoralists and its interaction with environmental changes in the Sanjiangyuan region*. PhD thesis. Peking University.

How to cite this article: Ma, H., Zhang, D., Xiao, L., Wang, Y., Zhang, L., Thompson, C., Chen, J., Dowell, S. D., Axmacher, J. C., Lü, Z., & Turvey, S. T. (2022). Integrating biodiversity conservation and local community perspectives in China through human dimensions research. *People and Nature*, 4, 1415–1474. <https://doi.org/10.1002/pan3.10408>