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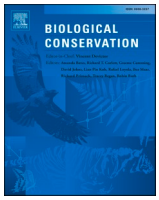

A comparison of perceived social equity associated with different governance types of protected areas

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ABSTRACT

Despite the increasing attention to social equity of protected areas, few studies have focused on how different governance types influence varying perceptions of fairness. Using the institutional analysis and development framework as an analytical tool, our study examines how local perceptions of recognitional, procedural, and distributional equity vary across differing governance types and the factors accounting for these variations. The Giant Panda National Park, a recently established national park in China, provides an ideal case to test this idea, as it simultaneously implements three types of governance of protected areas, including state-led, co-managed, and community-based conservation. Through 578 questionnaires and 73 in-depth interviews, we conducted both quantitative and qualitative comparisons across the three governance types. Quantitative analysis show that local residents expressed overwhelmingly dissatisfaction with the state-led regime in terms of procedural, distributional, and combined social equity scores. While the co-management and community-based governance types received generally positive evaluations, their impacts across differing equity aspects varied. The qualitative analysis of coded interviews further displays a variety of pros and cons of each governance type. Our empirical study reveals the messy, diverse, and rather limited impacts of institutional drivers on perceived social equity. We argue that the better social equity outcomes can be achieved by proper inclusion of stakeholders and successful empowerment of local residents, especially in the decision-making and benefit-sharing process of protected areas.

1. Introduction

Governance processes and structures of social-ecological systems are of great significance to ensure the conservation effectiveness of protected areas (Herrera et al., 2019; Fidler et al., 2022). The failure of some protected areas to deliver socioeconomic and environmental outcomes is attributed to their inappropriate institutional structures, or the way in which different interest groups interact in the decision-making processes (Turner et al., 2016; Abukari and Mwalyosi, 2020). Despite the variety in its definitions, governance herein refers to structures, processes and traditions that determine how power and responsibilities are exercised, how decisions are taken, and how stakeholders express their views (Lockwood et al., 2010; Borrini-Feyerabend et al., 2013; Corrigan et al., 2018). According to the guideline of International Union for Conservation of Nature (IUCN), governance regimes of protected areas can be classified into four categories, including governance by government, shared governance, private governance, and governance by indigenous people and local communities. However, the governance on the ground is much more complex due to the diversity in management bodies, political regimes, funding sources, land tenure systems, with frequent overlaps between these four types (Macura et al., 2016). Such different governance types of protected areas with diverse types of institutional arrangements, different levels of local involvement, accountability and responsibility by state and non-state actors who make decisions over resource use and access, may have different impacts on conservation effectiveness (Macura et al., 2016; Zhang et al., 2023a).

Over the past decade, social equity has increasingly emerged as one of crucial dimensions to evaluate management effectiveness of protected

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areas (Lockwood et al., 2010; Zafra-Calvo et al., 2017; Bennett et al., 2020). Archi Target 11 urged signatories to manage protected areas equitably, claiming that the costs of conserved areas should not be primarily borne by local communities (Zafra-Calvo et al., 2019; Li et al., 2023). Mitigating inequity is not only an inherent moral goal of sustainable development, but also an instrumental consideration in governing protected areas, because inadequate consideration of social equity can largely undermine the conservation objectives of protected areas (Bennett et al., 2020). Perceptions of social equity are proven to have influence on local people's attitudes, motivations, and participation behaviours, which can consequently affect the conservation and socioeconomic outcome of protected areas (Bennett, 2016; Li et al., 2023; Zhang et al., 2024).

An increasing number of studies have compared ecological impacts of different protected area governance regimes (Macura et al., 2016; Fidler et al., 2022), usually measured by land cover changes (Nolte et al., 2013; Schleicher et al., 2017; Herrera et al., 2019). However, limited studies have successfully incorporated social equity considerations in such comparisons (Moreaux et al., 2018; Bennett et al., 2020; Soliku and Schraml, 2020). There is evidence suggesting that the state-led conservation is more likely to facilitate optimistic socioeconomic perceptions if it is tailored to the needs of local residents (Zhang et al., 2023b). Others argue that localized and more inclusive protected area governance institutions tend to increase local compliance and fairness perceptions (Andrade and Rhodes, 2012; Cinner et al., 2012; Oldekop et al., 2015; Mutekwa and Gambiza, 2017). Therefore, there is still little agreement about how social equity can be better achieved with differing governance regimes of protected areas (Hampton-Smith et al., 2024). This is partly because this issue can be contextually dependent and requires multiple situated studies for answers to emerge. Comparative studies of these issues are particularly few in China (Wang et al., 2019; Zhang et al., 2024).

Consequently, the critical questions arise: Which governance types can facilitate more positive perceptions of fairness among local communities in protected areas? How do recognitional, procedural, and distributional fair perceptions vary across different governance types? Previous studies in this area often employed quantitative approaches to assess the perceived social equity (Bennett et al., 2020; Zhang et al., 2024), or relied on qualitative methods, such as focused group discussions and semi-structured interviews, to better explore the causality between varying governance and local perceptions (Wang et al., 2019; Soliku and Schraml, 2020). Our study used a mixed methods approach, integrating both quantitative and qualitative analyses to provide a more comprehensive understanding of the institutional drivers of divergent fairness perceptions (Macura et al., 2016; Vanclay, 2017; Lecuyer et al., 2019; Schéré et al., 2021).

To prevent the interference of variance in socioeconomic and ecological contexts, our study is grounded on the newly formed Giant Panda National Park (GPNP) in China. Despite its consistency in the socio-ecological system, the GPNP authority has enforced a variety of institutional arrangements, ranging from state-led, co-managed, to the bottom-up community-based conservation in differing protected regions. For instance, Wolong region of GPNP was renowned for its state-led conservation model since the 1960s, Tangjiahe and Baishuijiang regions had embarked on co-management interventions since the 1970s and 1990s, the Pingwu region have experimented various of community-based efforts in villages inside and adjacent to the GPNP since the 2000s (Zhu et al., 2014; Zhang and Yang, 2020; Zhang et al., 2023a). Therefore, GPNP can provide an ideal system to test perceived social equity performances across differing governance types of protected areas.

The aim of this paper is:(1) to provide both qualitative and quantitative comparisons of perceived social equity (recognitional, procedural, and distributional) across different governance regimes of protected areas, (2) to assess the extent to which fairness perceptions of local communities are affected as a results of divergent governance regimes, and (3) to explore variables leading to variations in local fairness perceptions of protected areas. The study is based on the proposition that different governance regimes of protected areas within similar context can significantly affect variations in perceived social equity. The institutional analysis and development framework is applied as an analytical tool to identify potential variables of these subjective perceptions. By helping to better understand the relationships between governance types and perceived social equity outcomes, our research offers practical recommendations for protected area management and facilitates fairer and more effective conservation actions.

2. Methods

2.1. Governance regimes in Giant Panda National Park, China

Over the past 60 years, the number of protected areas has increased considerably to approximately 11,800 in China, covering >18 % of the country's territory (SFGA, 2019). Despite the impressive record of creating new parks, China's state-led protected area system was criticized of being a fortress conservation model and excluding local residents in the decision-making process (Yuan et al., 2016; Mao and Zhang, 2020). To promote better local participation, the notion of co-management has been introduced to China's protected areas by International Crane Foundation, Global Environment Facility, and other international non-government organizations (NGOs) since the 1990s (Zhang and Yang, 2020; Zhang et al., 2025). Herein, co-management is defined as the formal sharing of accountabilities, responsibilities, and benefits among the state, local resource users, and other stakeholders in the governance of protected areas, such as signing co-management agreements, forming co-management committees, and recruiting local rangers (Zhang and Yang, 2020). Meanwhile, community-based conservation efforts have been prospered in scattered rural areas with high biodiversity values, displaying in various forms including sacred mountains and lakes, Fengshui forest, mini reserves, and community-conserved areas (Liao et al., 2017).

Our study focused on the comparison of the above-mentioned three governance types in China's protected areas, namely state-led governance, co-management, and community-based conservation. In our study, state-led governance refers to protected areas established and managed by the central government with limited consideration or involvement of local communities. Co-management includes protected areas with various co-management interventions or attempts to work with surrounding residents, aiming at fairly sharing rights, responsibilities, and benefits among differing stakeholders (Plummer et al., 2012). Community-based conservation refers to conserved areas primarily managed by local residents or individual owners, which may or may not be recognized by the central government (Zhang et al., 2023b).

As one of China's five pioneer national parks, the Giant Panda National Park (GPNP) was therefore selected as the study case for its diversity and representativeness in governance types. Covering a total area of 21,978 km^2 across Sichuan, Gansu, and Shanxi provinces, the GPNP was consolidated in the year of 2021, representing a strategic integration and spatial optimization of 73 pre-existing protected areas (Tang et al., 2023) (see Fig. 1). Given the diversity in historical, political, and socioeconomic contexts, the GPNP administration has adopted a range of governance types tailored to different regions. The Wolong region in Sichuan province was established in 1963 as one of the first comprehensive national reserves in China to protect the forest ecosystem and rare species of flora and fauna. This region is particularly recognized for its state-dominated approach in terms of conservation affairs (Sheng and Wang, 2023). The Tangjiahe region in Sichuan province was documented to have practiced a variety of strategies to collaborate with local communities since the 1970s, much earlier before the concept of co-management was firstly introduced to China. After 50 years of attempts, the co-management strategies in Tangjiahe region

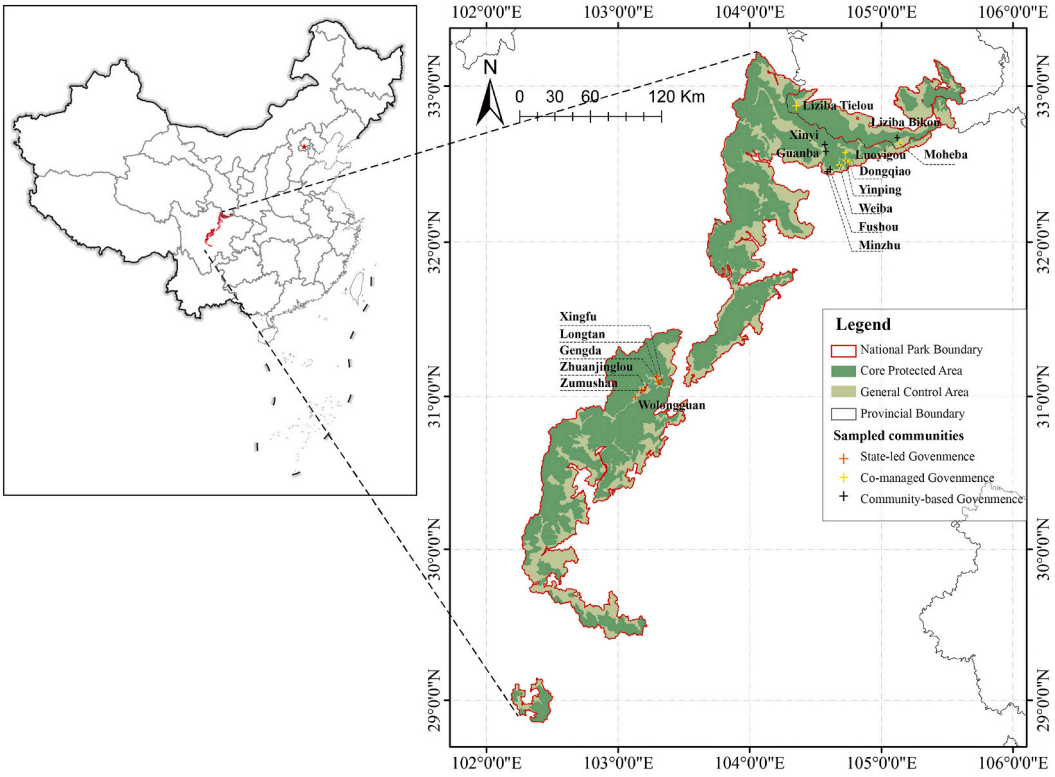

Fig. 1. The sampled communities in the Giant Panda National Park.

encompassed the establishment of co-management committees, the fostering of community-based tourism, and the formation of fire-prevention agreements (Zhang et al., 2023a). Similarly, the Baishuijiang region in Gansu province was observed to have adopted co-management agreements with local communities to reconcile the needs of local development with the goals of biodiversity conservation (Zhu et al., 2014). Additionally, a multitude of community-led conservation efforts have emerged in Pingwu region in Sichuan province since the 21st century. These initiatives have been notably vibrant in villages of Guanba, Fushou, Xinyi, and Minzhu, supported by different non-government partners (Zhang and Yang, 2021).

2.2. Indicators of social equity

Justice, fairness, and equity all imply fair treatment of stakeholders in the context of protected areas(Schroeder and Pisupati, 2010). Therefore, these three terms were used interchangeably in this paper (McDermott et al., 2013; Schreckenberg et al., 2016; Zhang et al., 2024). Recognitional, procedural, and distributional equity are among the widely accepted fundamental and interlinked components for measuring social justice in conservation studies (Schreckenberg et al., 2016; Zafra-Calvo et al., 2017; Zhang et al., 2024). Recognitional equity requires authorities to respect different culture, beliefs, knowledge system, legal and traditional rights of stakeholders (Martin et al., 2016). Procedural equity involves the transparent, effective and fair inclusion of local people in the decision-making, planning, implementation and monitoring processes (Friedman et al., 2020; Zhang et al., 2024). Distributional equity takes account of the fair distribution of costs and benefits associated with conservation issues (Gurney et al., 2021). In this study, we measure the concept of social justice from these three aspects, using the scale preliminarily developed by Zafra-Calvo et al. (2017) and later adapted by Bennett et al. (2020), Li et al. (2023) and Zhang et al. (2024) . The descriptions of surveyed questions have been adjusted according to the contexts of GPNP (Table 1).

2.3. Variable selection based on the institutional analysis and development framework

Developed by Elinor Ostrom and associates, the institutional analysis and development framework enables the explanation of complex governance questions, such as how institutions affect the decision-making process of various stakeholders, how institutions change over time, and how the institutional and non-institutional factors may affect each other to co-shape outcomes (Ostrom, 2011; McGinnis, 2011). This framework provides a conceptual map to make cross-institutional comparisons among differing governance systems (Ostrom, 2011; Nyaupane et al., 2020). Particularly, it helps scholars and policymakers to understand how different biophysical, socioeconomic, and institutional contexts can enable individuals' interactions, and how these interactions are linked to more efficient or equitable outcomes of common-pool resources (Nyaupane et al., 2020). However, limited researches have incorporated the institutional analysis and development framework into the governance assessment of protected areas to systematically diagnose its underlying institutional, biophysical, socioeconomic, and demographic factors (Nyaupane et al., 2020; Li et al., 2023; Su et al., 2023).

The institutional analysis and development framework includes three major components: context, action situation, and outcomes that can be evaluated by certain criteria. Building on this foundation, our study was contextualized in the equitable management assessment of protected areas (Fig. 2). The core variable, institutional arrangement, is simplified and represented into three governance regimes, namely the state-led, co-managed, and community-based governance types. This simplification is because more detailed institutional rules, such as the ranger selection policy and enforced co-management activities, can vary across time and space, causing complexities and ambiguity to equity assessments in protected areas. Control variables describing biophysical conditions, community attributes, and individuals' demographics are incorporated due to their potential impact on perceived social equity (Abukari and Mwalyosi, 2020; Bennett et al., 2020; Nyaupane et al.,

Table 1
Description of the scales and indicators regarding recognitional, procedural, and distributional equity. (Note: All survey responses have been recorded in a five-point Likert scale, 1 = strong disagree, 2 = somehow disagree, 3 = neutral, 4 = somehow agree, 5 = strongly agree).

Scale	Label	Indicator	Description
Recognitional equity	RE1	Culture	GPNP respects our local culture and traditional customs
	RE2	Livelihood	GPNP imposes no negative impact on my traditional livelihood
	RE3	Legal and traditional rights	GPNP respects my legal and traditional rights
	RE4	Land ownership	I have no land ownership conflicts with GPNP
	RE5	Traditional knowledge	Local diversity of knowledge is acknowledged by the GPNP authority
Procedural equity	PE1	Decision-making	Local residents are engaged in the decision-making process of GPNP
	PE2	Participation	Local people can participate in the conservation initiatives of GPNP
	PE3	Transparency	Local communities have access to the information of GPNP
	PE4	Accountability	Local people are aware of the rights and responsibility of the GPNP authority
	PE5	FPIC	Free, prior, and informed consent (FPIC) are conducted for local residents before the decision-making of conservation affairs
Distributional equity	DE1	Conservation burden	The costs of conservation are fairly distributed among local residents in GPNP
	DE2	Ecological compensation	Local people receive fair compensation of conservation affairs in GPNP
	DE3	Compensation for HWCs	Local residents can receive equitable amount of compensation for human-wildlife conflicts (HWCs) in GPNP
	DE4	Benefits distribution	The economic and other benefits of conservation are fairly distributed among local people in GPNP
	DE5	Employment distribution	Local residents have fair access to job opportunities in GPNP

2020; Su et al., 2023) (Table 2). In addition, the action situation, in this context, refers to protected areas where local actors build their interactions. The equitable outcomes are evaluated by the local judgements towards the recognitional, procedural, and distributional justice as mentioned above (Zafra-Calvo et al., 2017; Zhang et al., 2024).

2.4. Data collection

Preliminary fieldwork was conducted onsite in the autumn of 2018 to collect information about the governance arrangements and community characteristics of different regions in GPNP. After repeated negotiation and discussions with authorities, Wolong, Tangjiahe, and Pingwu regions in Sichuan provinces and Baishuijiang region in Gansu provinces were finalized for the quantitative survey. All six villages managed by the conservation authority were identified as the state-led governance type in Wolong region. A number of four villages in the gateway Qingxi town of GPNP were incorporated for the decades of co-management efforts. Similarly, another four villages that have enforced community-based conservation since different time periods were included in Pingwu region. In Baishuijiang region, two co-management villages were selected for the signed agreements with the GPNP authority, and one village renowned for its community-based conservation was chosen as well. A total of 17 villages representing three types of governance types were selected consequently, including six for state-led governance, six for co-management, and the remaining five for community-based governance. In addition, these chosen villages display variance in its biophysical and community attributes conditions, with differing locality to the GPNP.

In the summer of 2022 and 2023, a total of 578 questionnaires were completed, including 217 for state-led governance, 225 for co-management, and the 118 for community-based conservation, covering 14.0 %, 8.9 %, and 8.5 % households of each governance type respectively (Table 3). Respondents were encountered and approached randomly by twelve trained interviewers, with snowball sampling method adopted as a supplementary method due to the limited number of permanent residents in most communities. In such cases, we randomly chose a household in the community or consulted the village leader to introduce us to other potential interviewees. The householder was invited to take the interview, otherwise a family member with the strongest connection to GPNP would be recommended instead. All those interviews gained verbal informed consent before proceeding. Ultimately, we identified a total number of 560 questionnaires (96.9 %) to be valid after eliminating those with insufficient or incorrect data. (See Table 4.)

The questionnaires included two sections. The first section consisted of a broad set of questions related to the interviewees' demographics (gender, ethnicity, age, education, occupation, and position) and household characteristics (family size, family income, and length of residency), covering the variables from D1 to D9 listed in Table 2. The

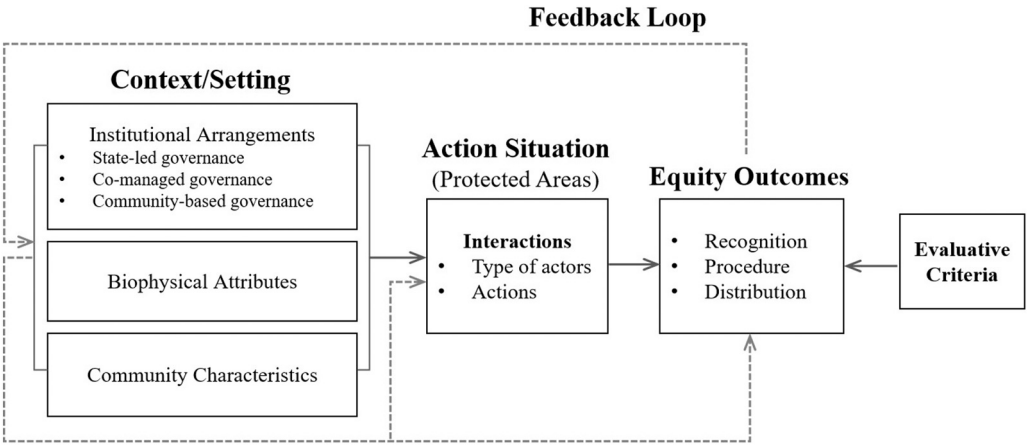

Fig. 2. The assessing framework of social equity related to protected areas based on the institutional analysis and development framework.(Adapted from Ostrom, 2011 and Nyaupane et al., 2020).

Table 2
Variables affecting perceived social equity of protected areas based on institutional analysis and development framework.

Topics	Variable name		Description	Variable type
Institutional arrangements	G1	Governance types	The governance regime of protected areas (state-led governance = 1,co-managed governance = 2, community-based governance = 3)	Categorical
Biophysical conditions	B1	Location to the GPNP	The location of community to the GPNP (Adjacent = 1, partially inside = 2, inside = 3)	Categorical
	B2	Accessibility to cities	The distance to the nearest cities (<30 km = 3, 30–60 km = 2, >60 km = 1)	Categorical
	B3	Tourism resources	The number of tourism resources and attractions in the village	Continuous
Community attributes	C1	Population size	The total number of registered populations in the community (<500 = 1，500–1000 = 2，> 1000 = 3)	Categorical
	C2	Labor flow rate	The proportion of migrant workers living outside of the community (<30 % = 1，30–60 % = 2，> 60 % = 3)	Categorical
	C3	Development level	Annual per capital income of the community (<30,000 yuan = 1，30,000–60,000 yuan = 2，> 60,000 yuan = 3)	Categorical
Demographic features	D1	Gender	Male = 1, female = 2	Categorical
	D2	Ethnicity	Han = 1, Tibetan = 2, Qiang = 3, others = 4	Categorical
	D3	Age	What is your birth year?	Continuous
	D4	Education	No school = 1, primary school = 2, junior school = 3, high school = 4, bachelor's degree = 5, master's degree and above = 6.	Categorical
	D5	Forest ranger	Yes = 1, No = 0	Categorical
	D6	Village leader	Yes = 1, No = 0	Categorical
	D7	Family size	The number of members in the household	Categorical
	D8	Annual family income	<10,000 yuan = 1，10,000–30,000 yuan = 2，30,000–50,000 yuan = 3，50,000–70,000 yuan = 4，70,000–100,000 yuan =5，100,000–200,000 yuan = 6，> 200,000 yuan = 7	Categorical
	D9	Length of residency	< 10 years = 1, 10-20 years = 2, >20 years =3	Categorical

Table 3
Characteristics of sampling communities.

Region	Community	Governance type	Households	Questionnaire size	Interview amount	Location with GPNP
Wolong	Wolong	State-led	300	42 (14.0 %)	4	Inside
	Zumushan		354	37 (10.5 %)	6	Inside
	Zhuanjinglou		107	20 (18.7 %)	1	Inside
	Longtan		222	40 (18.0 %)	4	Inside
	Gengda		199	35 (17.6 %)	1	Inside
	Xingfu		325	43 (13.2 %)	1	Inside
Tangjiahe	Luoyigou	Co-managed	470	42 (8.9 %)	7	Inside
	Yinping		642	63 (9.8 %)	4	Adjacent
	Dongqiao		445	40 (9.0 %)	3	Adjacent
	Weiba		318	37 (11.6 %)	3	Adjacent
Pingwu	Minzhu	Community-based	282	24 (8.5 %)	1	Partially inside
	Fushou		173	23 (13.3 %)	1	Adjacent
	Guanba		128	24 (18.8 %)	4	Partially inside
	Xinyi		105	18 (17.1 %)	6	Partially inside
Baishuijiang	Moheba	Co-managed	167	21 (12.6 %)	5	Inside
	Liziba Tielou		205	22 (10.7 %)	1	Inside
	Liziba Bikou	Community-based	208	29 (13.9 %)	4	Inside

Table 4
Model summary for key drivers affecting combined social equity scores of GNTP. (Notes: This table only displays variables with a significance level <0.05, and the complete analysis results are detailed in Supplementary materials – Table S9. Significance levels: * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$).

Variable name	Unstandardized coefficients (B)	Standardized coefficients (Beta)	Error	t value	Pr (>|t|)
(Intercept)	2.67306	0.25447	10.504	< 2e-16	***
Governance types (G1)	0.11156	0.04437	2.514	0.01221	*
Tourism resources (B3)	−0.12001	0.04389	−2.735	0.00645	**
Labor flow rate (C2)	0.11574	0.04804	2.409	0.01631	*
Village leader (D6)	0.22299	0.09337	2.388	0.01727	*

second section presented 15 questions with respect to recognitional, procedural, and distributional equity, measured by formulating statements based on a five-point Likert scale in Table 1(see further details in Supplementary materials – Table S1).

Interviews with 17 village committees were performed in our study, each of which lasting for 20 to 30 min. The village secretaries or chiefs were approached in all sampling communities. The interview questions focused on the basic information of institutional, biophysical, and social characteristics of the community according to institutional analysis and development framework. The responses were further classified and recorded as categorical variables according to Table 2 (Supplementary materials – Table S2–1).

Additionally, 73 semi-structured interviews were also conducted with key informants of park-people relation, including community chiefs, representatives, rangers, innkeepers, restaurant owners, and temporary labors of GPNP. Interview questions primarily focused on their personal interactions with the park authority, their opinions about past and present park-people relationships, and their viewpoints towards how the GPNP authority treated local communities (Supplementary materials – Table S2–2). All of those interviews, ranging from 20 to 60 min, were recorded and coded later for the qualitative analysis.

All participants gave verbal consent to our interviews rather than signing informed consent forms due to cultural norms in this part of China (Vanclay, 2017).

2.5. Data analysis

We first performed the reliability analysis to test the internal reliability of equity scale collected using questionnaires. The overall Cronbach's alpha coefficient was 0.870, which was above the eligible index of 0.7, indicating that the obtained survey results had good internal reliability. The content validity was also assessed here, with the value of Kaiser-Meyer-Olkin (KMO) as an indicator. With the overall KMO value exceeding the standard level of 0.8, our questionnaire data was shown to have eligible content validity. We then calculated descriptive statistics for all survey items focused on GPNP demographics and characteristics, as well as for individual indicators related to the social equity.

To calculate scores of recognitional, procedural, distributional, and combined social equity, we accounted for the weights of all indicators according to the principal component analysis (Jolliffe and Cadima, 2016). All scores of these social equity dimensions passed the Shapiro-Wilk normality test ($p < 0.1$), as well as the Levene test ($p > 0.05$), indicating the conformance of data to a normal distribution and its suitability for subsequent comparative analyses. An analysis of variance (ANOVA) was then conducted to compare the significant effects of the three community governance models on the four overall fairness scores. Subsequently, Tukey's HSD post hoc test was used to analyze the intergroup differences statistically (Marraffini et al., 2024).

Furthermore, the stepwise regression analysis was used to examine the intertwined relationship between all identified variables and the combined social equity score (Harrell, 2015). Specifically, the dependent variable was defined as the combined social equity score, and the explanatory variables included variables describing the institutional arrangements, biophysical conditions, community attributes and demographic features. The variance inflation factor values of each variable were <10, indicating no multicollinearity issues suggested in this model. All the quantitative data analysis was detailed in Supplementary materials – Table S3, completed in R Version 4.4.0 (R Core Team, 2023).

In addition to above-mentioned quantitative analyses, all the interviews were recorded, transcribed, and further analyzed qualitatively by our research group in Atlas.Ti 24 (Hay and Cope, 2021). Before the formal coding, the first, third, and fourth author separately carried out the pre-descriptive coding of social equity issues in the same interview transcript. Those three pre-coding results were later compared and discussed by all authors, in order to ensure all authors hold consistent views concerning each social equity dimension or issue. Then, each interview transcript was independently descriptively coded by two authors to ensure all valuable information were marked. Following this, all authors came together to compare, refine or merge, and categorize the descriptive codes into recognitional, procedural, or distributional equity dimensions (see Supplementary material– Table S4). During the post-coding analysis, we triangulated our qualitative findings with the quantitative data analysis. The themes identified from the interviews were compared with the statistical patterns derived from the questionnaire data. Qualitative insights into perceived inequities in certain dimension were examined alongside quantitative measures of these variables to assess consistency.

3. Results

3.1. Demographic profile of respondents

Our of the 560 respondents, the proportions for males and females were almost equal. The majority of the respondents were Han Chinese (66 %), with some Tibetans (30 %) and a small minority of Qiang people (4 %). Most of the surveyed respondents fell into the elder age or poorly educated brackets, with 70 % aged over 51 years old and 59 % only having attended primary or middle school. A vast majority of respondents (95 %) reported to have resided in GPNP for over 10 years. Merely 4 % of them were recruited as forest rangers, and around 10 % of them were elected as village leaders. Those surveyed households had a relatively low income, with 70 % of them earning <50,000 yuan annually (see Supplementary materials – Table S5).

3.2. Perceptions of social equity indicators

As depicted in Fig. 3A, the descriptive analysis of the individual items related to social equity showed varied results but slightly skewed towards negative perceptions (see Supplementary materials – Table S6). Notably, positive feedback was merely reported in four out of 15 equity indicators, including the recognition of legal and traditional rights (RE3, mean = 3.10) and the traditional knowledge (RE5, mean = 3.17) in the recognitional equity dimension, conservation burdens (DE1, mean = 3.14) and ecological compensation (DE2, mean = 3.05) in the distributional equity dimension. By contrast, negative judgements were widely reported in the remaining 11 equity indicators, and the most criticized indicator was the decision-making power (PE1, mean = 2.70), with around half (49 %) of respondents reporting to be excluded in the decision-making process of GPNP. However, different governance types displayed varied perception patterns regarding each individual indicator of social equity, shown in Fig. 3B-D.

3.3. Comparing perceived social equity across three governance types

To compare between governance types, we further supplemented the analysis with Tukey's HSD post hoc test (see Supplementary materials–Table S7). The results revealed that the combined equity scores of the co-managed (CE = 3.08) and community-based (CE = 3.03) governance regimes was significantly higher than that of the state-led (CE = 2.71) type, shown in Fig. 4A. However, these two winning governance types were observed to have varied effects on different equity dimensions, according to Fig. 4B-D. While local people living in co-managed conservation areas displayed more positive-going attitudes towards the procedural (PE = 3.40) and distributional equity (DE = 3.26), residents in community-based conservation regions were more likely to develop optimistic perceptions towards recognitional equity (RE = 3.41). On the contrary, the state-led governance received the most criticisms in procedural, distributional, and combined social equity dimension.

According to the coded interviews, a total of 26 justice issues related to three equity dimensions were identified. And the frequency distributions of those justice issues across state-led, co-managed, and community-based governance types were displayed in Fig. 5 (see Supplementary materials –Table S8). It was evident that, in state-led conservation areas, respondents expressed the most complaints about procedural equity, with 47.1 % indicating severe nepotism and 41.2 % citing park-people conflicts of values and ideas. Apart from this, the unequal distribution of opportunities (52.9 %) and projects (35.3 %) received the most concern. In co-managed conservation areas, distributional equity received the most criticism with 65.2 % of respondents highlighting inadequate compensation for HWCs. In community-based governance areas, respondents are most unsatisfied with procedural equity, with three quarters of interviewers pointing to a lack of transparency and half of them noting insufficient communication—both significantly higher than the other governance models areas. Similarly to co-managed areas, inadequate compensation for HWCs (68.8 %) was the leading concern in terms of distributional equity, along with complaints about the unequal distribution of conservation projects granted by the park authority (43.75 %).

3.4. Identifying other influencing variables of fairness perceptions

We used the stepwise regression analysis to assess how different

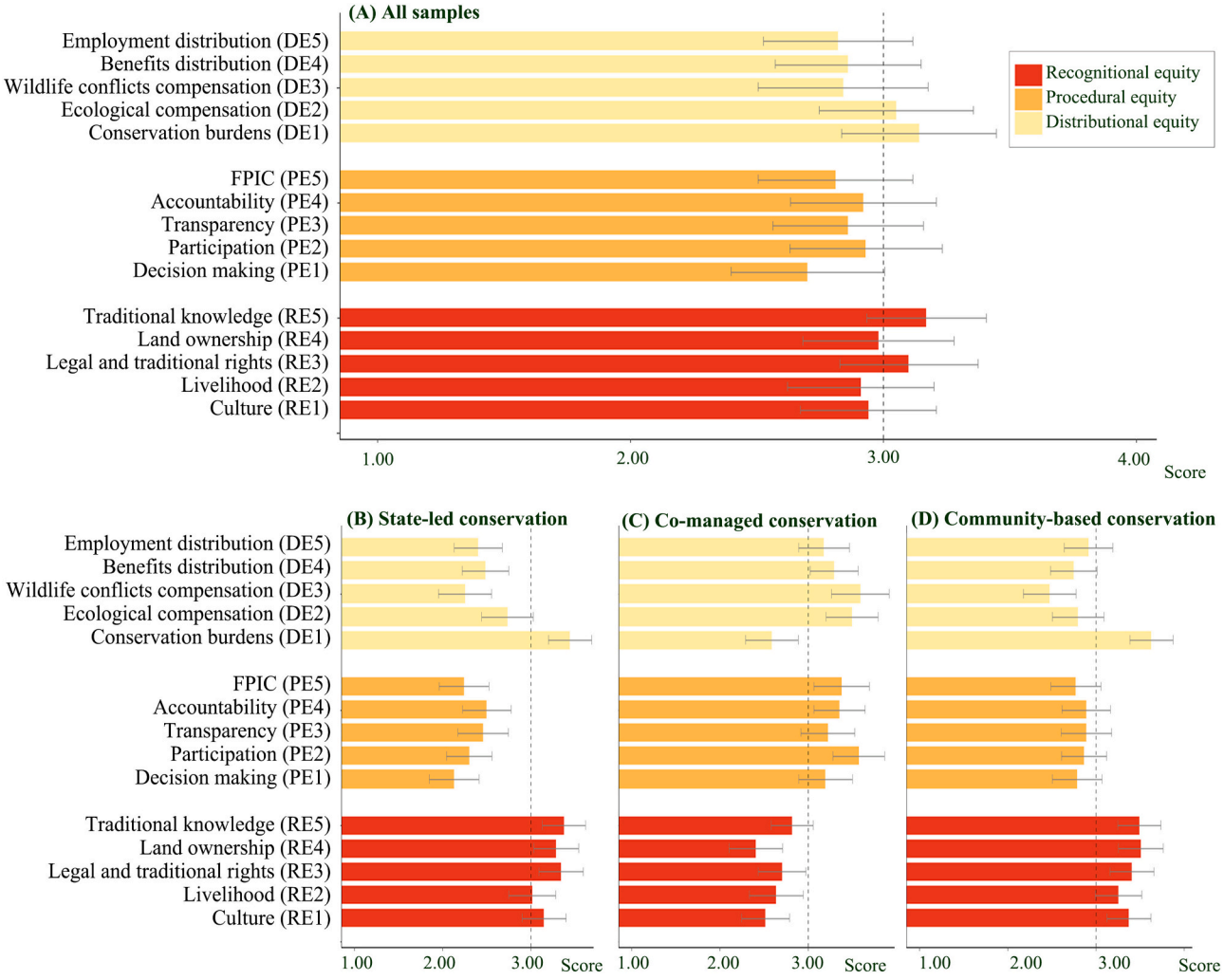

Fig. 3. Mean score of social equity indicators across (A) all samples, (B) state-led conservation, (C) co-managed conservation, and (D) community-based conservation. (Note: The dashed line represents the median of the questionnaire evaluation scale.)

predictors could have influences on local fairness perceptions towards GPNP (See Supplementary materials–Table S9). The explanatory power (adjusted R2) of the stepwise regression model was 0.0758, indicating that 7.58 % of the variance in perceived social equity was explained by identified variables. Surprisingly, local communities with more abundant tourism resources (B = -0.120, $p < 0.01$) were less likely to develop positive perceptions of fairness. By contrast, communities with a higher labor flow rate (B = 0.116, $p < 0.05$) were more likely to generate optimistic fairness perceptions. Notably, although the relationship between differing governance types and perceived social equity was statistically significant, its impact was relatively limited (B = 0.112, $p < 0.05$). Similarly, a weak impact was observed for the predictor of village leader (B = 0.223, $p < 0.05$). Apart from this, the relationships between the remaining 12 variables and perceived social equity were insignificant.

4. Discussion

Our study assessed the variations in perceived recognitional, procedural, and distributional equity as a result of differing governance types of protected areas and examined the factors that influence local fairness perceptions according to institutional analysis and development framework. One prominent finding is that the state-controlled stewardship is highly likely to result in negative fairness perceptions among local residents. In GPNP, local criticisms and grievances were overwhelmingly centered on the state-led governance type, especially in the procedural and distributional equity dimensions. For instance, interviewees in Wolong region complained that the majority of job opportunities in GPNP administration were occupied by non-local elites, leading to a boost in the unemployment rates of surrounding communities. In contrast, local fairness perceptions towards the co-managed and community-based governance types were generally more positive-going. This suggests that better social equity outcomes can be achieved with the proper inclusion of local communities into the governance of protected areas, despite the variety in forms of participation and the extent to which local residents are empowered (Oldekop et al., 2015; De Vente et al., 2016; Zhang et al., 2023b). Previous studies have also demonstrated that state-controlled stewardship of natural resources can lead to coercive policies that overlook local interests (Larson and Soto, 2008; Berkes, 2009; Nyaupane et al., 2020). Such a fortress conservation model is highly likely to intensify social conflicts and social injustice (Brockington and Igoe, 2006; Soliku and Schraml, 2020).

Despite the generally positive evaluations of co-management and community-based governance in GPNP, their impacts on recognitional, procedural, and distributional equity varied. While the co-management regime was significantly associated with more optimistic perceptions for procedural and distributional equity, community-based conservation was linked to more positive local perceptions for recognitional equity. Notably, our qualitative analysis further revealed an clear decline in the recognition of local culture, land-use rights, and traditional livelihoods

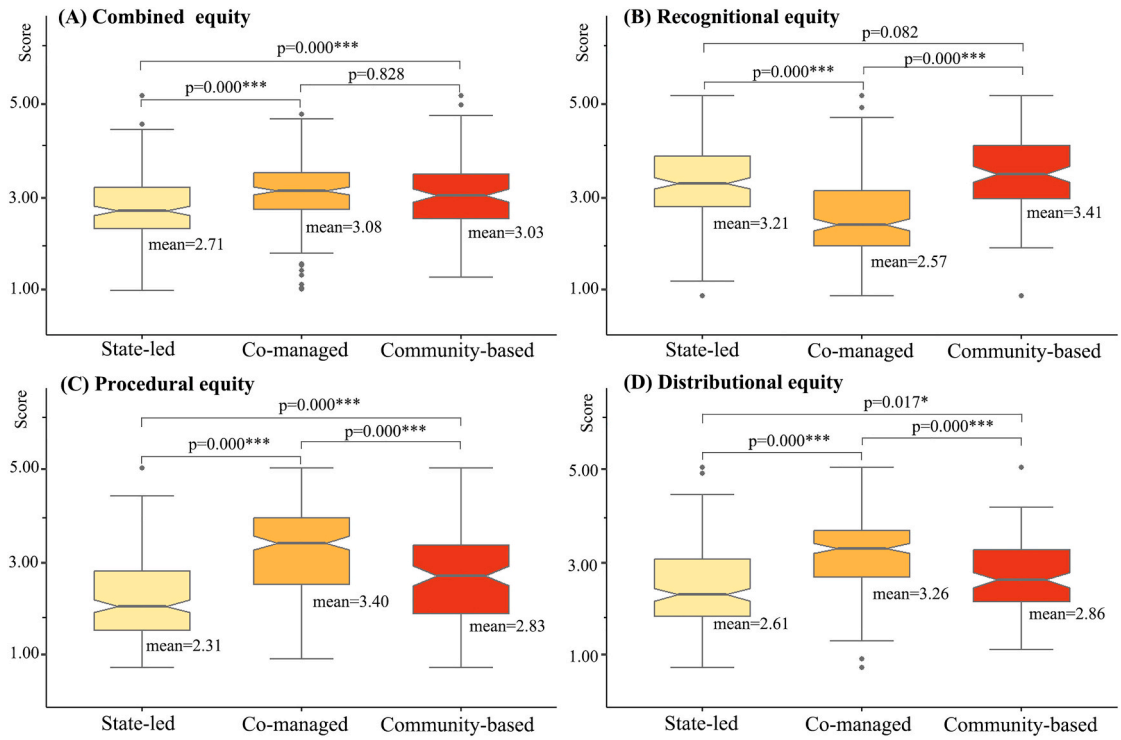

Fig. 4. Comparisons in average scores of perceived (A) combined, (B) recognitional, (C) procedural and (D) distributional equity scores across different governance types of protected areas. (Note: The *p*-value represents the level of significance in pairwise comparisons from the Tukey's HSD post hoc test. Significance levels: *: $p \leq 0.05$; **: $p \leq 0.01$; ***: $p \leq 0.001$.)

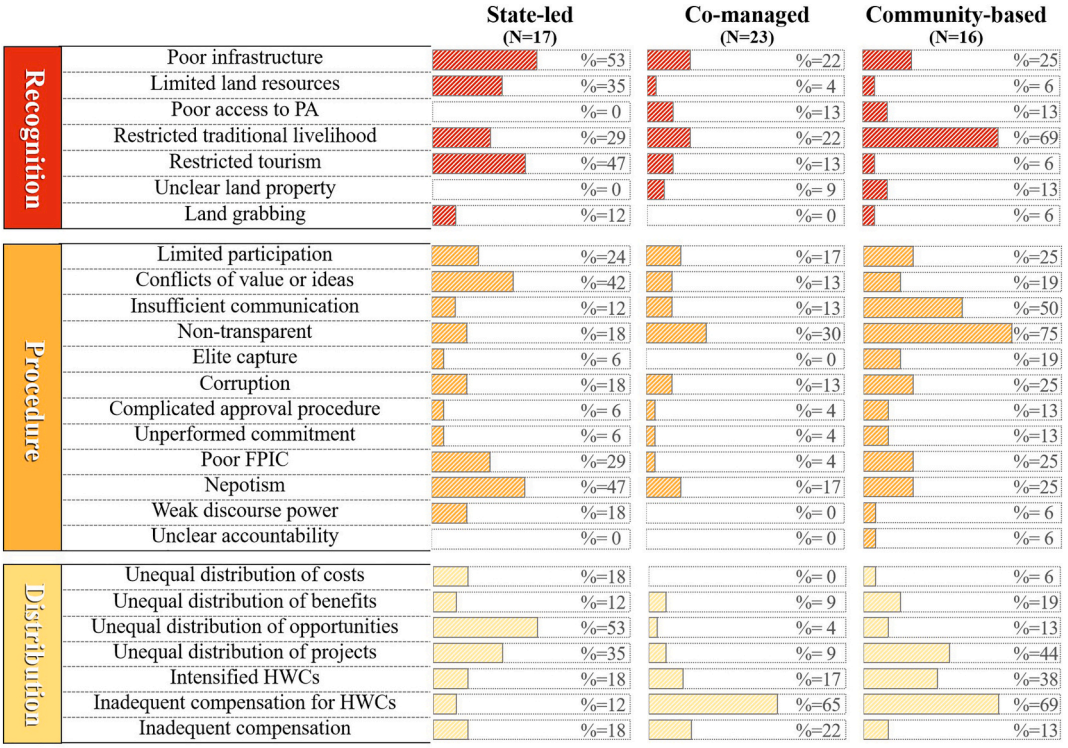

Fig. 5. The frequency distributions of reported justice issues in different governance types of protected areas. Bar represents the proportion of interviews reporting certain justice issues.

under the co-management arrangements. This finding is reasonable accounting for the complexity and dynamics of co-management regime, as both the state and community actors are fragmented and changeable over time (Carlsson and Berkes, 2005; Armitage et al., 2009). In addition, our coded interviews suggested that local complaints towards community-based approach were still widespread, particularly targeting

at non-transparent procedures, insufficient communication, and unequal distribution of projects. This highlighted the fact that community-based conservation can still depend on excluding residents from decision-making process and benefit streams (Zhang et al., 2023b). In Tanzania, the wildlife management areas, a promised alternative to the fortress conservation model, have been criticized for failing to deliver social benefits under a decentralized governance regime (Keane et al., 2019). Similarly, the community-based natural resource management in Southern Africa was observed to suffer from limited community empowerment, unequal benefit sharing, and even social conflicts (Bwalya and Kapembwa, 2020).

However, it is worthwhile to note that the effects of differing governance types on perceived social equity appear to be relatively limited. This finding is evident from our qualitative comparisons, which clearly displayed the diverse disadvantages of each governance regime. The regression analysis further supports it, highlighting that various factors can have larger effects on local fairness perceptions than the governance type alone. This is potentially because the simplification of complex institutional interactions into three different governance types only partially accounts for the variability in the perceived social equity among local residents. As noted by Soliku and Schraml (2020), variations in local attitudes towards protected areas can also be influenced by factors such as the degree of power devolution to local people, governing regulations and rules, and the responsibilities of different actors within the governance structure. Differing co-management activities can lead to divergent local perceptions towards the protected areas with different levels of the incorporation of local interests and needs (Soliku and Schraml, 2020; Zhang et al., 2023b). This finding also indicated the complexity of the structures, processes, and interventions of the governance regimes for protected areas, pointing out the difficulties in isolating and assessing conservation governance effects (Macura et al., 2016).

Beyond the considerations of different governance types, other key factors, including respondents' position and socioeconomic characteristics of communities, were found to have accounted for the variability in perceived social equity. Interestingly, community leaders interviewed in our study were more likely to report optimistic fairness perceptions than those residents without official positions in the community. This is potentially due to the fact that village elites or leaders can have more access to information, participation channels, and benefit-sharing opportunities in GPNP (Zhang et al., 2023a). In addition, communities with less tourism resources were found to be more likely to harvest positive-going fairness perceptions among local dwellers. This finding contrasted with the previous study showing the proximity with tourist attractions was also positively associated with higher scores of procedural and distributional judgements (Li et al., 2023). This phenomenon could be driven by the restriction and monitoring policy of tourism development enacted by the GPNP. Conflicts in values and benefits towards tourism between local communities and the park authority can consequently lead to unfair perceptions and hostile attitudes towards conservation (Zeng et al., 2022; Li et al., 2024). More importantly, local communities with a higher proportion of emigration were more likely to develop positive fairness perceptions. This is potentially because migrants with alternative livelihood sources can develop a lower dependency on nature resources, which can consequently lead to more optimistic viewpoints towards conservation equity (Fedele et al., 2021). All these findings aligned very well with the notion of institutional analysis and development framework, indicating that social justice and other institutional outcomes were determined by a range of factors, ranging from biophysical conditions, community attributes, and rules-in-use (McGinnis, 2011; Nyaupane et al., 2020). How different actors rely on those objective conditions and how those actors may interact with each other can significantly co-influence the perceived management outcomes (Su et al., 2023).

5. Conclusion

With the international policy targets calling for better social equity of protected areas, the deeper understanding of what kinds of governance work for better equity outcomes becomes an indispensable part of moving conservation forward. Combining both quantitative and qualitative analyses, our study aimed at comparing local fair perceptions towards recognitional, procedural, and distributional equity across three differing governance models in the context of GPNP. The following three main conclusions can be drawn: First, the state-led governance has received the most local criticisms in the procedural, distributional, and combined equity dimensions, compared to the slightly positive-going fairness perceptions towards co-managed and community-based governance regimes. Second, a range of other factors, such as position of respondents and the community's tourism resources were identified as significant variables in shaping local fairness perceptions towards the protected area. Third, the interviews shows that each governance type displaying a variety of pros and cons, indicating that the impact of differing governance regimes on local fairness perceptions remain messy and diverse. All the above findings suggested that more optimistic equity outcomes can be achieved with better local empowerment in the decision-making and benefit-sharing process of protected areas.

One limitation of this paper is that we merely compared perceived social equity across differing governance regimes at a certain time. However, the notion of equity is very likely to change over time due to political and socioeconomic reasons (Wang et al., 2019). Therefore, we suggest future researches paying more attention to track the long-term variation of fairness perceptions, in order to gain a more holistic understanding of the equity outcomes. In addition, our comparative analysis of different governance types was conducted in a national park newly consolidated in southwestern China. Such single-case study may decrease the reliability of our findings because its social equity outcomes may be site-specific. It would be more convincing if future research can verify those results or test the consistency of those findings in other conserved areas.

CRediT authorship contribution statement

Yin Zhang: Writing – review & editing, Writing – original draft, Visualization, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Ying Lou:** Writing – review & editing, Visualization, Validation, Formal analysis, Data curation. **Yuqi Zhang:** Writing – review & editing, Methodology, Investigation. **Meili Chen:** Writing – review & editing, Methodology, Investigation, Data curation. **Shengzhi Li:** Writing – review & editing, Methodology, Investigation, Data curation. **Dan Brockington:** Writing – review & editing, Supervision.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.biocon.2024.110950.

Data availability

The original contributions presented in the study are included in the article/Supplementary Material.

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