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Benefits Beyond Borders: Assessing Landowner Willingness-to-Accept Incentives for Conservation Outside Protected Areas

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Unplanned land-use change surrounding protected areas (PAs) can lead to degradation and fragmentation of wildlife habitats, thereby placing tremendous pressure on PAs especially in tropical countries. Incentivizing the expansion of habitats beyond PAs will not only benefit wildlife but also has the potential to create livelihood opportunities for marginalized communities living adjacent to PAs. Our study explored landowners' willingness to participate in an incentive-based, wildlife-friendly land-use program using a discrete choice modeling approach. We surveyed 699 landowners living in 287 villages within a five-kilometer buffer around Nagarahole and Bandipur National Parks in India. We found that landowners preferred wildlife-friendly land-use over their ongoing farming practices. Landowners preferred short-term programs, requiring enrolling smaller parcels of land for wildlife-friendly land-use, and offering higher payment amounts. Landowners with larger landholdings, a longer history of living next to the PA, and growing fewer commercial crops were more likely to prefer enrolling large parcels of land. Landowners who grew more commercial crops were likely to prefer long term programs. We also estimated the average monetary incentive to be INR 64,000 (US$ 914) per acre per year. Wildlife-friendly land use, in developing economies like India with shrinking wildlife habitats and expanding infrastructural developments, could supplement rural incomes and potentially expand habitat for wildlife, thereby being a promising conservation strategy.

Keywords: agriculture, choice experiment, incentive, land sharing, land-use, wildlife

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INTRODUCTION

Protected Areas (PAs) are designated with the aim of conserving the world's biodiversity. In 2010, the Parties to the United Nations (UN) Convention on Biological Diversity (CBD) set five strategic goals and 20 Aichi targets to reduce the rate of biodiversity loss by 2020 (CBD, 2010). Aichi Target 11 calls explicitly for PA expansion to increase ecological representativeness and improve connectivity through well-connected PA networks and other effective area-based conservation measures (CBD, 2010). However, PA expansion has not been met globally and biodiversity loss

continues (Stokstad, 2020). New targets for 2030 are being set and one of the proposals suggests bringing 30% of total land and marine habitat under protection (CBD, 2020).

Protected areas have been one of the most effective conservation strategies and represent the last remaining strongholds for certain imperiled species (Pacifici et al., 2020). By themselves, PAs are inadequate to conserve biodiversity and arrest its decline in the long-term (Geldmann et al., 2019).This is because the existing global PA network is under immense human pressure (Jones et al., 2018) and less than 10% are structurally connected (Saura et al., 2018; Ward et al., 2020). Poor connectivity driven by habitat loss and fragmentation can negatively impact ecological processes and dispersal of wide-ranging species (Crooks et al., 2011; Jayadevan et al., 2020; Nayak et al., 2020). Further, political pressure, insufficient funds, and land tenure prevent absolute protection of land adjoining PAs where wildlife co-occurs with people (Watson et al., 2014).

Protected Areas and their surrounding human-modified regions are linked components of an interacting ecological system, rather than mutually independent entities (Anand et al., 2010). Accordingly, the focus of conservation has evolved, recognizing the dynamic relationships between people and nature (Kareiva and Marvier, 2012). Planning conservation efforts that take both people and nature into consideration is challenging but essential. Identifying regions for habitat expansion centered around where potential beneficiaries are located could also ensure that sites surrounding PAs are more accessible for on-ground conservation effort and subsequent monitoring (Naidoo et al., 2019). A more inclusive and pragmatic approach can integrate the role of private lands adjoining statutory PAs in biodiversity conservation (Kamal et al., 2015; Drescher and Brenner, 2018). Private lands have the potential to contribute to conservation by supplementing additional habitat for wildlife, restoring structural connectivity, reinforcing corridors and buffer zones, and providing economic benefits through financial and market-based instruments such as payments for ecosystem services and ecotourism (Pegas and Castley, 2014; Maciejewski et al., 2016; Clements et al., 2018; Kremen and Merenlender, 2018; Capano et al., 2019). Expanding conservation initiatives beyond PAs requires understanding private landowners' interest in and willingness to undertake conservation through different land management strategies (Selinske et al., 2015; Gooden, 2019).

Private land conservation models such as agroforest ecosystems often harbor biodiversity of significant conservation value (Bhagwat et al., 2008; Anand et al., 2010; Ferreira et al., 2020). Multifunctional systems like these provide a wide range of economic, sociocultural, and environmental benefits including enhancing livelihood and food security, reducing biodiversity decline, and mitigating climate change (Kremen and Miles, 2012; Kremen and Merenlender, 2018). Agroforestry is particularly beneficial for smallholders as it produces diverse products and services on a small parcel of land (Hughes et al., 2020). Small farms also tend to have a high capacity for sustaining biodiversity and rural livelihoods (Kumaraswamy and Kunte, 2013; Ricciardi et al., 2021). Policies favoring smallholders, given their reliance on traditional farming techniques and in depth knowledge of the land, could benefit biodiversity conservation. This approach could further conserve local agroecosystems and rural livelihoods by increasing farmer resilience to external threats such as fluctuating crop prices or environmental variability (Harvey et al., 2008). While private land conservation is not new in African and Latin American countries, it is not yet a widespread practice in South Asian countries such as India (Karanth and Karanth, 2012; Drescher and Brenner, 2018; Capano et al., 2019).

India being a megadiverse country with a growing human population and <5% total land cover under protection, there is considerable concern over how the new biodiversity targets being set in the post-2020 framework could be met (ENVIS, 2021). Achieving 30% protected land area is contested in a country like India, and could come at the cost of people's livelihood requirements. Unlike other nations such as the United States and China, where large tracts of land with sparse human population are accorded PA status, India's PAs are relatively small, poorly connected, and surrounded by dense settlements (Pimm et al., 2018; Ghosh-Harihar et al., 2019). Despite benefits to the local communities, such as tourism, access to forest resources and grazing lands, and employment with park management, the socioeconomic, psychological, and human costs of living alongside wildlife are often high (Ogra, 2008; Baskaran et al., 2013; Karanth and Kudalkar, 2017). These often result in declining tolerance and increasing resentment among the local communities toward the forest, wildlife, and PA management in the form of retaliatory killing, arson, and even tussles with the PA management (Talukdar and Gupta, 2017; Kalam et al., 2018).

There is potential to foster stewardship and build tolerance among local landowners living beside PAs toward wildlife. This can be accomplished by building partnerships with local landowners to promote and support conservation efforts on private lands by directly transferring conservation benefits to local communities through innovative land-use policy and incentive schemes (Anand et al., 2010; Karanth and Karanth, 2012; Ghosh-Harihar et al., 2019). To this end, the objectives of our study were to examine the willingness of private landowners to (1) enroll in voluntary incentive-based wildlife-friendly land-use programs, and (2) undertake tourism activities on their land in the future. We also examined socioeconomic, demographic, and geographic factors that influenced landowner's choice to practice wildlife-friendly land-use.

We hypothesized that a landowner would be likely to choose a wildlife-friendly land-use program if the risk associated with the venture was low. We used a small proportion of land to be enrolled for the program, short enrollment period, and high payment amount as descriptors of low risk (Moon and Cocklin, 2011). We predicted younger landowners with higher economic security would be willing to take greater risk and invest in a novel wildlife-friendly land-use program. Wealthier farmers are likely to see the wildlife-friendly land-use income as less motivating. In contrast, landowners who lost crops to wildlife earlier may resent wildlife and hence, be unwilling to enroll larger parcels of land and for longer periods of time. With inadequate understanding of private land conservation in Asia (Capano et al., 2019), our study

from India represents one of the few that examines landowners' interest in undertaking wildlife-friendly land-use.

MATERIALS AND METHODS

Study Area

Bandipur and Nagarahole National Parks are located in a landscape comprising tropical (dry and moist) deciduous forest and savannah in the global biodiversity hotspot, Western Ghats (**Figure 1**; Devidas and Puyravaud, 1995). This landscape represent PAs with very hard edges and almost zero forest cover outside the core boundary. The landscape supports some of the largest global populations of wide-ranging species such as tigers (*Panthera tigris*), elephants (*Elephas maximus*) along with populations of threatened taxa such as leopards (*Panthera pardus*), and Asiatic wild dogs (*Cuon alpinus*) (Jathanna et al., 2015; Karanth et al., 2020). This protected landscape has been facing tremendous pressures from linear infrastructure such as roads and power line projects (Jayadevan et al., 2020; Nayak et al., 2020). Increasing tourism pressure is another threat faced by these PAs, with more than 100,000 tourists visiting them annually (Karanth et al., 2017). The area adjacent to the parks comprises three districts with population densities ranging between 135 and 443 people/km^2 (Census, 2011). The buffer area consists of communities whose primary source of income is from rainfed/unirrigated agriculture, animal husbandry, and daily-wage labor (Karanth et al., 2013; Margulies and Karanth, 2018; Karanth and Vanamamalai, 2020). Majority of the annual household income is less than US $1600 (Karanth and Vanamamalai, 2020). Local communities often face wildlife-related losses in the form of crop-raiding, livestock depredation, property damage, and occasional injuries to and loss of human lives. Between 2014 and 2019, compensation was claimed for nearly 20,000 cases of wildlife-related losses by people living adjacent to these PAs (ibid).

Data Collection

We conducted interviews with farmers living within a five-kilometer buffer area around the two PAs from April to July 2019 (**Figure 1**). We obtained ethical approval for the study from the Human Subjects Review Board of the Centre for Wildlife Studies. All respondents were older than 18 years and consent was sought orally. A team of 16 trained volunteers conducted the surveys in the local language Kannada. We chose a previously established 13 sq.km grid-based sampling approach by Karanth et al. (2013) in the study area. We sampled 287 villages from 132 grids out of a potential 154 grids. Twenty-two grids were not sampled due to lack of consent, accessibility, or presence of water bodies or forest. We selected respondents by randomly selecting lands in each village. We ensured that surveyed lands were not directly adjacent

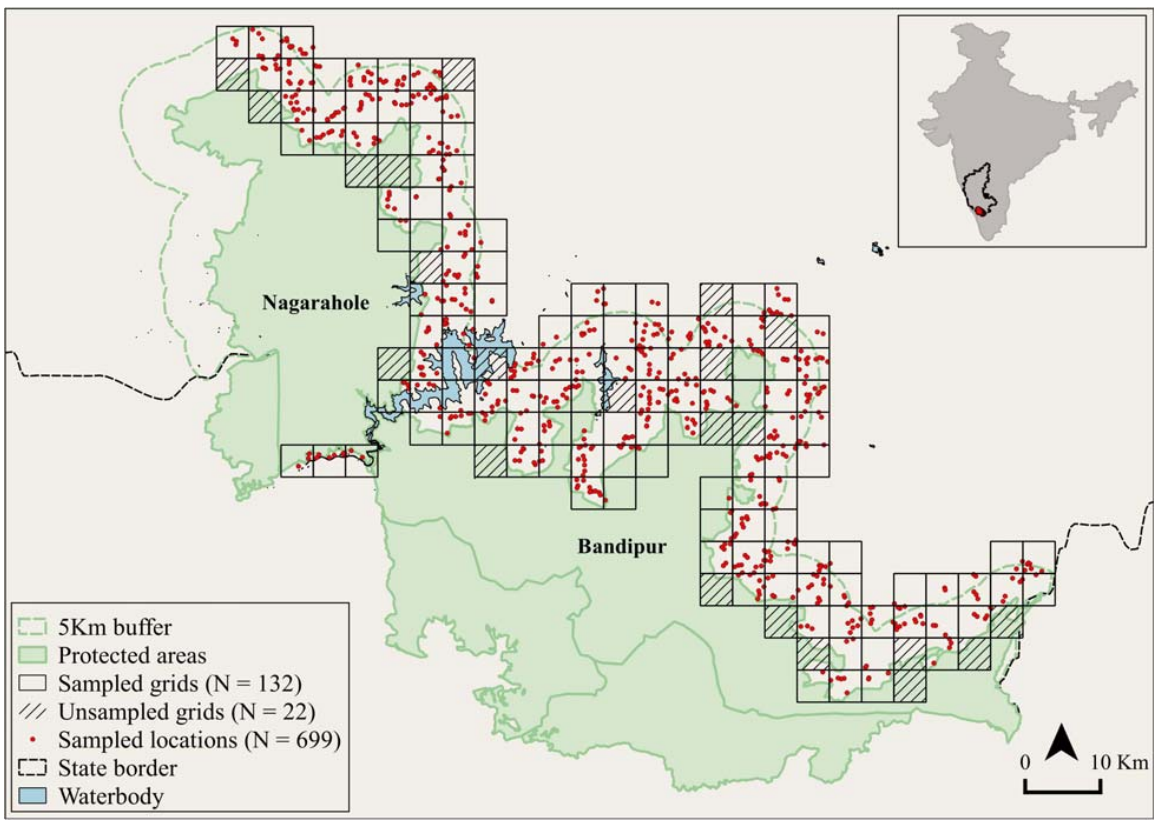

FIGURE 1 | Map of the study location with India shown in inset.

to one another. Surveys were carried out at the land parcel that the owners were willing to enroll in the program. We used the Open Data Kit (v1.25.2) to minimize errors due to paper-based data collection methods (Hartung et al., 2010).

Choice Experimental Design

We used a discrete choice experiment to examine the drivers of landowner's willingness to undertake wildlife-friendly land-use. Choice experiment is a stated preference method in economics used to elicit an individual's preferences for alternative hypothetical states (Hensher et al., 2005). Multiple attributes with varying levels describe alternatives presented to an individual. An attribute is a feature that influences an individual to choose an alternative state and a level is a measure that varies at fixed intervals (ibid). Responses are used to estimate the influence of attributes on preferences and establish their relative importance (ibid). We followed the study design and survey protocols as presented in Puri et al. (2021). We considered three attributes namely, percentage of land to be allocated, number of years of enrollment, and payment amount per acre per year. The details of the attributes are presented in **Table 1**.

The "Land" attribute was defined as the proportion of total land area to be set aside for wildlife-friendly land-use. Given the considerable heterogeneity in landholding across landowners in India, we consider the proportion of total land instead of specifying the land units in acres. Since the regeneration of degraded or highly modified agricultural lands is a long term process, our second attribute, "Year," represented the duration of the program enrollment. The monetary attribute considered here is the "Payment" that the landowners would receive per year per acre of land allowed for wildlife-friendly land-use. With the annual income of most households in the landscape being less than $1600, all payment levels were set below this value (Karanth and Vanamamalai, 2020). We focused on only three attributes to reduce the cognitive burden on landowners while making decisions and reduce attribute non-attendance (Carlsson et al., 2010).

In the choice experiment, we presented landowners with a questionnaire containing descriptions of wildlife-friendly land-use contracts. Based on results from our pilot study (conducted in November 2018), we developed a D-efficient design with fixed priors (d-error of 0.12), with a total of nine choice cards and we blocked them into three choice sets (Louviere et al., 2008; Bliemer and Collins, 2016). Each landowner was presented with three choice cards. In each choice set, they were asked to choose between two types of wildlife-friendly land-use contracts and a status quo option (to not enroll in any program). An example of a choice card presented to landowners is provided in **Figure 2**.

TABLE 1 | Attributes and corresponding levels used in the choice experiment.

Attribute	Description	Level
Land	Amount of land to be enrolled	25% 50% 75%
Year	Contract period	4 years 8 years 12 years
Payment	Amount paid per acre per year	INR 45,000 (US$ 643) INR 60,000 (US$ 857) INR 75,000 (US$ 1071) INR 90,000 (US$ 1285)

INR, Indian rupees (US$ 1 = INR 70 at the time of the survey).

The choice experiment survey was explained with the help of visual tools such as photographs. In addition to the choice experiment survey, we recorded landowner's background information including: (1) demographic factors (age and education, family size, and number of years living next to the PA); (2) socioeconomic factors (agricultural land size, type of livestock owned, different sources of household income, and number and type of crops grown); and (3) experience with wildlife-related losses (crop and asset loss, livestock depredation, and human casualties). We also derived geographic factors such as the distance of the landholding to the PA boundary using "geosphere" in RStudio 3.5.1 (Hijmans et al., 2016). Finally, to examine the potential of tourism as an additional source of income at the end of program enrollment, we asked the farmers about (1) their interest in various activities related to tourism on their land and (2) the type of support (government, skill development, and financial) they required to initiate tourism activities.

Choice Model

We assessed the aggregate preference of the landowners toward the policy options using Multinomial Logit model (MNL) analysis implemented in LIMDEP NLOGIT 5.0 (Green, 2012). An alternative specific constant (ASC) was included in the models to check if there was an inherent preference to forgo the status quo.

Assuming linear indirect utility function, utility derived by landowner i from alternative wildlife-friendly land-use j in choice set k is,

$$V_{ijk} = \alpha + \beta' x_{jk} + \lambda \left(y_i - payment_{jk} \right) + \varepsilon_{ijk} \quad (1)$$

where, α is the ASC which captures the landowner's preference to be in the status quo. The vector x_{jk} is the vector of attributes of j^{th} alternative of k^{th} choice set and β' are the corresponding parameter estimates. y_i is the investment cost of landowner i, and ε_{ijk} the random error term. The probability of landowner i choosing alternative j over alternatives h is expressed as,

$$P_{ijk} = P\left\{ \beta' x_{jk} + \lambda \left(y_i - payment_{jk} \right) + \varepsilon_{ijk} > \beta' x_{hk} + \lambda \left(y_i - payment_{hk} \right) + \varepsilon_{ihk};\ \forall\, j \neq h \right\} \quad (2)$$

However, MNL assumes homogeneous preference across the sampled population, which is less likely. Therefore, we tested for heterogeneity in terms of landowners' choices toward the attributes of wildlife-friendly land-use programs using Random Parameter Logit models (RPL). We interacted the "Land" and "Year" attributes with landowners' socioeconomic and geographic characteristics to test the relative influence of these variables on people's choices. We assumed the "Payment" attribute as fixed, and the "Land" and "Year" attributes to be normally distributed (Carlsson et al., 2003). The model estimation was done with 1000 Halton draws, and the top model

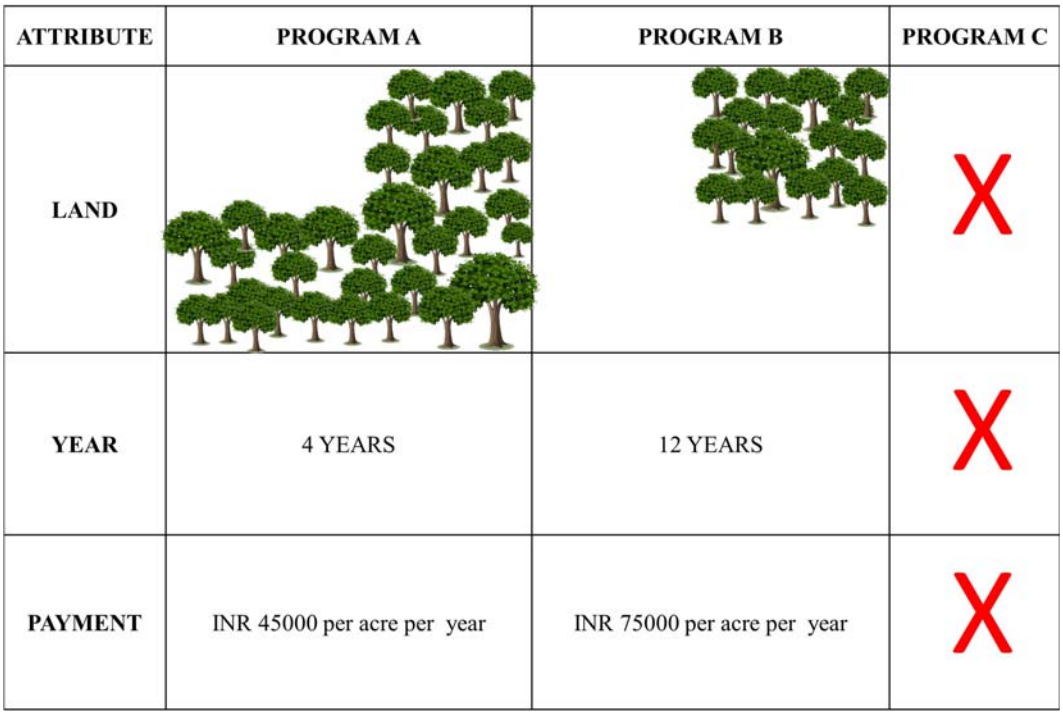

FIGURE 2 | Sample of choice card used in the choice experiment (based on study design used in Puri et al., 2021).

was identified based on Akaike's Information Criterion (AIC) values (Burnham and Anderson, 2002).

Lastly, we calculated the reservation price or the amount that would need to be paid to a landowner as a monetary incentive to enroll in the wildlife-friendly land-use program. This amount is the value at which the respondents switch from being unwilling to enroll in the program to willing. The value is derived by estimating the best fit indirect utility function (using a basic MNL model), and setting it equal to zero. The model included respondent characteristics that we assumed had direct policy relevance such as landholding size, distance to PA, experience with crop loss in the previous year, and annual agricultural income.

RESULTS

Landowner Characteristics

We surveyed 699 landowners who were responsible for making decisions concerning their respective land parcels. When long-term decisions regarding land management were discussed, women were not comfortable participating in the choice experiment. They often deferred judgment to the males of the household. Of the surveyed landowners, 98% were males and 2% were females with an average age of 47 (range: 19–93). About half of the landowners reported earning between INR (Indian rupees) 25,000 and 100,000 (US$ 357 and US$ 1428, US$ 1 = 70 INR at the time of the survey) as annual agricultural income (**Table 2**). The average household size was 5 (range: 1–15). Almost all (86%) respondents owned livestock. Most landowners (73%) were smallholders owning less than 5 acres of land. On average, these landowners grew three crops in a year (range: 0–10). Landowners grew nearly 60 varieties of crops, and the top five crops included cotton (48%), finger millet (38%), maize (32%), banana (21%), and tobacco (20%). Among these, finger millet is produced mostly for subsistence purposes, while the rest are produced primarily for commercial sale. Majority of the landowners (84%) reported facing losses due to wildlife, with crop damage (83%) being the major form of loss.

Model Estimates

Of the total surveyed landowners, 81% were interested in adopting at least one of the offered programs. Landowners opted out of the programs (i.e., rejected all offered programs) for the following reasons: (1) continue current agricultural practices (10%), (2) insufficient economic benefit (10%), (3) lack of available land to commit to the program (3%), (4) lack of faith in the institutions (2%), and (5) water scarcity (2%). We found the ASC to be significantly positive indicating that the landowners do not have an inherent preference for the status quo (i.e., they preferred to enroll in at least one of the offered programs). Across the models, we found that landowners preferred programs of shorter duration [β (SE) = −0.057 (0.008)], and enrollment of smaller parcels of land [β (SE) = −0.015 (0.001), **Table 3**]. We also found significant positive coefficient for "Payment" suggesting that farmers are more likely to choose programs with higher payment [β (SE) = 0.009 (0.001)].

TABLE 2 | Landowner characteristics.

Characteristics	Sub-characteristics	Percentage (%)
Education	Illiterate	26
	<10th grade	43
	10th grade pass	15
	12th grade pass	7
	Undergraduate	5
	Graduate	4
Number of years living next to the PA	Upto 5 years	2
	6–19 years	3
	20–49 years	14
	>50 years	81
Agricultural land size	<3 acres	28
	3–5 acres	45
	6–10 acres	18
	>10 acres	9
Crops grown	Commercial	71
	Vegetables	51
	Food grain	23
	Horticulture and others	6
Livestock owned	Cattle	84
	Sheep	20
	Goat	13
	Poultry	9
	Buffalo	1
Agricultural income	<INR 10,000 (US$ 143)	6
	INR 10,001–24,999 (US$ 143–357)	17
	INR 25,000–49,999 (US$ 357–714)	24
	INR 50,000–100,000 (US$ 714–1428)	24
	>INR 100,000 (US$ 1428)	29
Non-agricultural income	Dairy and livestock husbandry	46
	Daily wage labor	26
	Pension	25
	Service job	9
	Business	6
	Non-service job	3

Random Parameter Logit models showed that the landowners are heterogeneous in their preference for the proportion of land and number of years, represented by the statistical significance of the estimated standard deviation for "Land" and "Year" attributes, i.e., some landowners preferred enrolling larger parcels of land and for longer program duration (**Table 3**). On interacting the socioeconomic, demographic and geographic variables with the "Land" and "Year" attributes, we found that respondents who had a longer history of living next to the PA, owned larger parcels of land, and grew fewer numbers of commercial crops preferred to enroll larger parcels of land. Concurrently, respondents who grew more commercial crops preferred to enroll for longer duration (**Table 3**).

We calculated the reservation price using parameter estimates from the basic MNL model (**Supplementary Table 1**). The top model included land size, distance to PA, and number of commercial crops grown as the explanatory variables. The estimated average monetary incentive value amounted to INR 64,000 (US$ 914) per acre per year.

Tourism Potential on Wildlife-Friendly Land

We found that majority of the surveyed landowners were interested in conducting tourism activities such as guided walks and tours in the village (74%), creating accommodation facilities in their house (71%), or hosting overnight stays in their *machan*/tree house (69%) in the land set aside for the wildlife-friendly land-use program. Most (76%) landowners considered financial support in the form of interest-free loans would be necessary, 67% sought support from the government for planning and marketing, and 59% believed training and skill development would be useful.

DISCUSSION

Globally, we are witnessing rapid biodiversity loss, unsustainable land-use practices and rising climate change – collectively comprising the triad of challenges of the Anthropocene (Kremen and Merenlender, 2018). Finding conservation solutions to this triad of interlinked challenges requires a consolidated approach that takes social, ecological, and economic perspectives into consideration. India is among the few developing nations predicted to be most vulnerable to climate change, and this will likely exacerbate the existing food insecurity, poverty, inequality, and undernutrition (IPCC, 2014; Mendelsohn, 2014). In addition to the sociological challenges, wildlife habitats are shrinking within and outside PAs and intensive land-use change has affected animal movement and biodiversity (Jayadevan et al., 2020; Nayak et al., 2020). Land management practices that aim to expand habitat for biodiversity beyond PAs through the participation of local stakeholders are needed to address the conservation issues being faced.

Through our study, we assessed the willingness of landowners living in the buffer of two premiere Indian PAs to participate in a voluntary, incentive-based wildlife-friendly land-use program. We examined how socioeconomic, demographic, and geographic factors influenced the willingness of landowners to participate in such programs. Our results highlight the importance of incorporating local willingness and the need for policy makers to integrate heterogeneity in preferences to make feasible conservation options.

We found that there is a high willingness among landowners to modify their ongoing agricultural practices and adopt more wildlife-friendly land-use. Most rural livelihoods around Bandipur and Nagarahole depend upon agro-pastoral farming for their primary source of income (Karanth et al., 2013; Margulies and Karanth, 2018). However, there is an increasing dependency on non-farming sectors for income in rural India, including the study landscape (Pingali et al., 2019; Li et al., 2020). The lower contribution of agriculture toward household income in the landscape due to high input costs, increasing levels of uncertainty in agricultural yields, and high-interest rates on agricultural credit have prompted farmers to adopt low-risk

TABLE 3 | Results of the Multinomial Logit (MNL) and Random Parameter Mixed Logit (RPL), estimations, standard errors in parentheses.

	MNL model	RPL model		RPL model with interactions	
Attributes and interaction	**Coefficient (SE)**	**Coefficient (SE)**	**Coeff.Std. (SE)**	**Coefficient (SE)**	**Coeff.Std. (SE)**
ASC	1.012*** (0.141)	5.006*** (0.588)	6.931*** (0.718)	3.297*** (0.249)	
Land	−0.015*** (0.001)	−0.022*** (0.002)	0.026*** (0.004)	−0.084*** (0.018)	0.043*** (0.004)
Year	−0.057*** (0.008)	−0.081*** (0.014)	0.140*** (0.026)	−0.229** (0.114)	0.297*** (0.026)
Payment	0.009*** (0.001)	0.013*** (0.002)	–	0.012*** (0.002)	–
Land × family size	–	–	–	−0.0006 (0.001)	–
Land × Edu	–	–	–	0.001 (0.002)	–
Land × land size	–	–	–	0.008*** (0.003)	–
Land × years living	–	–	–	0.010** (0.004)	–
Land × Dist PA	–	–	–	0.001 (0.001)	–
Land × HH div				−0.0006 (0.002)	–
Land × Comm	–	–	–	−0.006** (0.002)	–
Year × family size	–	–	–	−0.0002 (0.008)	–
Year × Edu	–	–	–	0.004 (0.012)	–
Year × land size	–	–	–	0.008 (0.018)	–
Year × years living	–	–	–	0.008 (0.025)	–
Year × Dist PA	–	–	–	−0.003 (0.008)	–
Year × HH div	–	–	–	−0.014 (0.015)	–
Year × Comm	–	–	–	0.029* (0.016)	–
Log-likelihood	−2168.96	−1733.08		−1847.69	
AIC/N	2.072	1.66		1.78	
N (observations)	2097	2097		2097	

Estimates are from the best-fit model based on AIC.
ASC, alternative specific constant; HH div, household income diversity; Comm, number of commercial crops grown; Dist PA, distance to protected area from the survey location; Edu, education of the landowner; years living, number of years living next to the protected area.
$^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$; Coeff.Std., coefficients of standard deviation.

farming strategies as well as seek opportunities to supplement cash incomes (Margulies and Karanth, 2018; Pingali et al., 2019; Li et al., 2020). These results mirror the willingness of farmers in Pakistan who were inclined toward growing trees on their land. Farmers attribute multiple benefits to trees, compared with traditional cropping where they face various constraints, including inadequate access to credit, natural calamities, and limited support from local authorities (Mahmood and Zubair, 2020). This shift in the rural agricultural economy highlights the opportunity for private land conservation through capacity building and skill development of rural landowners.

We found that landowners preferred short-term programs, although there was heterogeneity in their preferences. This can be attributed to a faster turnover of benefits, and the uncertainty associated with signing long-term contracts. Creating wildlife-friendly land-use as proposed in this study can take many years; practitioners should include growing native trees and fruiting tree species that require a shorter growth period and yield quicker economic returns. We also found that people prefer to enroll smaller parcels of land (with heterogeneous preferences) pointing to the risks and uncertainties associated with land conversion. Since the agricultural lands around these PAs are usually small and highly productive, it makes it harder to opt for alternative forms of land-use as seen in a "greening" program proposed to German farmers (Schulz et al., 2013). Preference for shorter programs and reluctance to enroll larger land parcels can be attributed to loss aversion from adopting programs with unknown returns (Moon and Cocklin, 2011; Haile et al., 2019). Another potential reason could be the absence of similar programs in the study landscape or country. Higher payment amounts tend to attract landowners toward programs like wildlife-friendly land-use, which is in accordance with other studies that showed that landowners who are dependent on farming income tend to go for higher compensation (Broch and Vedel, 2012; Schulz et al., 2013). Some landowners also suggested that even if the profit is less in the initial stages of the program, the profit margin will rise in the subsequent years as they will have to invest only in the upkeep.

Large landholders were more likely to choose programs that required enrolling larger parcels of land. This corroborates the results of Haile et al. (2019) who also found that large landholders had a stronger preference for alternative land-use programs rather than remaining in the status quo. Our results suggest that landowners who had a long history of living next to the PA also chose programs that required enrolling larger land parcels. This could be due to the ecological value they associate with living adjacent to a forest. During field surveys, about half of the landowners reported that the forests regulate climate and rainfall, improve quality of life and provide livelihoods. Farmers in Pakistan have also been found to attribute environmental benefits such as reduced pollution and soil erosion to increased tree cover (Zubair and Garforth, 2006). We also found that landowners who grew more commercial crops are less likely to

participate in programs that require enrolling large pieces of land. While our results also suggest that landowners who grew more commercial crops are more likely to choose programs with longer contract periods, the association is weak.

Conservation interventions can be constrained due to lack of resources, lack of faith in institutions, and limited economic benefits (Rasul and Thapa, 2006; Dhakal and Rai, 2020; Dhyani et al., 2021). The offered payment amounts in the programs were, at times, insufficient to gain farmer interest, as continuing with ongoing agricultural practices was perceived to be more beneficial. Unfamiliarity with a program coupled with a perception about the capacity of small landholdings to generate insufficient returns through wildlife-friendly land-use can lead to lower participation levels in conservation programs. Program participation can be augmented through outreach and extension activities including awareness campaigns, knowledge sharing, and capacity building.

The average monetary incentive of INR 64,000 (US$ 914) per acre per year derived from our study is higher than the average annual income from cultivation (US$ 537) across Indian states (NABARD, 2018). Previous studies from India have estimated the monetary value to be paid to the landowners for leaving land uncultivated (US$ 1429 per acre per year), or for the services derived from farmland (US$ 970 per acre per year) (Devi et al., 2017; Badola et al., 2021). The monetary amount offered may vary across the country given variation in local socio-economic contexts, agricultural incomes and land productivity. As such, we recommend that funds from CAMPA (Compensatory Afforestation Fund Management and Planning Authority), an afforestation program under the central government of India that procures compensation from forest diversion activities, can be utilized for incentivizing rural landowners and encouraging wildlife-friendly land-use adoption. In the year 2019–2020, CAMPA released INR 13.5 billion (US$ 192.91 million) to the state of Karnataka where the study landscape is located (MoEFCC/GOI, 2020). Beyond government subsidies and incentives, there is also scope for public-private partnerships, which mobilizes private finance in landscape initiatives to leverage private sector investment (Clarvis, 2014).

Sustaining Wildlife-Friendly Land Through Tourism

Wildlife-friendly land-use can expand conservation efforts beyond PAs by securing habitat for wildlife and creating alternative livelihood opportunities for local landowners through market-based instruments such as tourism. Currently, in India, PAs listed as Tiger Reserves practice a safari-based tourism model while non-Tiger Reserves conduct safaris and other activities such as nature walks, boating, trekking, and camping (Karanth and DeFries, 2011; Puri et al., 2018). Across India, the need to expand tourism beyond core PAs and integrate buffer areas is being recognized. This would help offset the pressure of a high number of tourists restricted within 10–20% of PA. The existing ecotourism policy in India defines ecotourism as "responsible travel to natural areas that conserves the environment and improves the well-being of local people" (MoEFCC, 2018). This establishes local communities as the principal stakeholders in ecotourism ventures. It suggests that buffer areas, private lands, revenue lands, and Reserved Forests around PAs with high-quality wildlife habitat be developed for ecotourism to reduce pressure on sensitive "core" areas of reserves. This will simultaneously increase benefits to local communities. However, current ecotourism practices benefit private tourism enterprises and government agencies, with local communities reduced to mere bystanders (Karanth and DeFries, 2011; Rastogi et al., 2015). There is little participation of local communities, and those that benefit from tourism either live close to safari gates or belong to socially elite classes (Rastogi et al., 2015). While most of the interviewed landowners expressed positive interest in bringing tourism into the wildlife-friendly land developed through our proposed program, financial support continues to be a key catalyst in undertaking such initiatives. Communities should also be provided with essential training and skill development for hosting tourists, better communication and management skills. More inclusive ecotourism ventures will involve and benefit marginalized communities, simultaneously paving the route for sustainable, long-term ecotourism on private lands surrounding PAs.

In a rapidly growing economy where exclusive reliance on agriculture is challenging, our approach suggests a way of designing incentive-based mechanisms that incorporate the needs of key stakeholders while moving conservation beyond current PA networks. Our approach can be used to assess the feasibility of alternative conservation actions outside PAs based on the site-specific preferences identified in collaboration with local landowners. Future efforts to encourage landowners to engage in conservation practices on land adjoining PAs will facilitate the expansion of critical wildlife habitats and strengthen PA connectivity, which is currently poor (Ward et al., 2020). Finally, our research provides information for landscape-scale policy development and equips us with a baseline understanding of the long-term sustainability of conservation efforts derived through modification of land-use and tourism.

DATA AVAILABILITY STATEMENT

The datasets presented in this article are not readily available because it includes information that could compromise the privacy of the research participants. Data supporting the findings of this study are available on request from the corresponding author. Requests to access the datasets should be directed to DM, dincy.mariyam@cwsindia.org.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved (dated 24.12.2018) by the Human Subjects Review Board of the Centre for Wildlife Studies, Bengaluru, India.

Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

DM: data curation, formal analysis, investigation, methodology, project administration, software, visualization, and writing – original draft. MP: conceptualization, formal analysis, methodology, software, and visualization. AH: formal analysis. KK: conceptualization, funding acquisition, project administration, resources, supervision, and validation. All authors contributed to manuscript revision, read and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fevo.2021.663043/full#supplementary-material

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