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Re-Building Communities: Voluntary Resettlement From Protected Areas in India

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Exclusion of people from wilderness to minimize anthropogenic threats to wildlife forms the historical basis for the establishment of some protected areas. Conservation efforts to resettle people from protected areas remain controversial as they often fail to address people's expectations and rebuild lives, especially in Africa and South Asia. Resettlement projects are especially challenging for the Indian government, with an estimated 4.3 million people sharing spaces with megafauna such as tigers and elephants within protected areas. Current Indian government policies focus on cash-based or a combined cash-land compensation package for families voluntarily relocating. We surveyed 592 households from four Indian protected areas and evaluated people's decisions to move relative to government policy provisions. Many (89%) households wanted to move for better education, healthcare, roads, agriculture, less human-wildlife conflict, and the government-aid package. Wage-labor dependent households chose to move due to high human-wildlife conflict, poorer small landholders for better agricultural opportunities, and larger households to avail government package benefits. Current government policies place heavy emphasis on agriculture-based livelihoods, poorly support other developmental needs or provide for alternative livelihoods. We call for greater transparency and participation of beneficiaries in the process, policy expansion to diversify skills and vocational training, accompanied by independent long-term monitoring post-resettlement.

Keywords: relocation, tiger, voluntary, wildlife, India, healthcare, education, protected areas

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INTRODUCTION

Over 20 million km^2 of the planet are covered by protected areas (PAs) that harbor extraordinary biodiversity while home to millions of people (Juffe-Bignoli et al., 2014). Much of world's biodiversity is concentrated in areas where dense human populations have grown by 15% between 2000 and 2010 (Williams, 2011). The existing PA network would need to expand from 12 to 17% of the planet to achieve conservation targets for terrestrial vertebrates alone, and even more if other species were to be included (Visconti et al., 2016). While multiple categories of legal protection are recognized by the IUCN, PAs devoid of people (IUCN management category II) remain essential for conservation of species such as the tiger (*Panthera tigris*) and the Asian elephant (*Elephas maximus*), which require large, undisturbed areas for maintaining viable populations (Watson et al., 2014).

Well-managed PAs are a cost-effective approach to achieve improved ecological outcomes such as increase in wildlife abundance, recovery of endangered populations and reduction of habitat loss (Rodrigues et al., 2004; Geldmann et al., 2013; Watson et al., 2014). PAs provide people with better ecosystem services such as clean water, climate regulation, and unfettered access to wood, fodder, non-timber forest products, and wild meat (Dudley, 2008). However, PA management rules and regulations may lead to diminished human well-being owing to restricted access to natural resources, reduced livelihood strategies, lower social capital, high human-wildlife conflict and declining health (Pullin et al., 2013; Ferraro and Hanauer, 2015; Oldekop et al., 2016; Vedeld et al., 2016). Establishment of PAs may lead to inward migration for agricultural land and ecosystem services (Ferraro and Hanauer, 2015; Hanauer and Canavire-Bacarreza, 2015), or outward migration due to restricted access to resources, better employment opportunities, and increased damage by wildlife (Wittemyer et al., 2008; Salerno et al., 2014; Ferraro and Hanauer, 2015). This movement of people into, and out of PAs has significant implications for conservation and land management (Salerno et al., 2014). Agencies are faced with balancing growing human populations and aspirations, in conjunction with new opportunities emerging from greater connectivity and mobility for people with the increasing isolation or degradation of PAs (Defries et al., 2005; Parry et al., 2010; Geldmann et al., 2014; Harihar et al., 2015).

Exclusion of people from nature stems from the idea of "pristine wilderness areas" and has been shaped by national and international conservation movements (Rangarajan and Shahabuddin, 2006; West et al., 2006). The history of relocation has frequently involved displacement or eviction i.e., involuntary physical removal of people. This has drawn criticism due to imposition of unequal costs upon poor and impoverished communities (Agrawal and Redford, 2007; Witter and Satterfield, 2014). The voluntary resettlement of families living within PAs, where people are provided financial and social welfare incentives to transfer property rights to PA management, is now a mandate of both governments and funding agencies (World Bank, 2001; Asian Development Bank (ADB), 2012) and is implemented in many PAs globally.

The debate over relocation has been particularly fractious in India where 602 PAs cover <5% of total land area (comprising IUCN management categories II-VI). These small PAs (average size = 210 km^2) are critical to protecting endangered megafauna such as tigers and elephants, whose fast-shrinking ranges have contracted by 40–60% in the past century (Karanth et al., 2010; Goodrich et al., 2015). Voluntary relocation is a central component of government policy in India and well-executed relocation projects can result in improved habitat connectivity and wildlife recovery (Hall et al., 2014) with positive social outcomes (Karanth, 2007; Harihar et al., 2015). People choosing to resettle from Indian PAs have done so due to, in no specific order, high human-wildlife conflict, for improved access to infrastructure, amenities, schooling, healthcare, the pull of urbanization and a fundamental desire to integrate with mainstream society (Karanth, 2007; Harihar et al., 2014, 2015; Sekar, 2016). In some PAs, forced evictions have led to impoverishment and marginalization owing to poor quality of land and inadequate facilities, and lack of post-relocation support (Narain et al., 2005; Kabra, 2009; Shahabuddin and Bhamidipati, 2014; Brockington and Wilkie, 2015). Post-relocation challenges include economic difficulties, erosion of culture and traditions, changing power relationships, inequity and non-settlement of rights under India's FRA (2006) (Brockington and Igoe, 2006). Mismanagement and delays by implementing agencies have increased frustration and resentment due to inflation of land prices, inability to cope with new livelihoods and increased gender disparity (Kabra, 2009; Shahabuddin and Bhamidipati, 2014; Sekar, 2016). In contrast, successful resettlement projects are known to be voluntary, participatory, and involve long-term monitoring by independent NGOs (Karanth, 2007; Karanth and Karanth, 2007; Dhakal et al., 2011).

The Indian Government has a history of relocating people for multiple reasons including mega dams, infrastructure and industrial projects (Agrawal and Redford, 2007; Lasgorceix and Kothari, 2009). Almost 60 million people may have been moved from 25 million ha of land during 1974–2000 (Government of India (GOI), 2013). In this ongoing mass migration of people, conservation-related resettlements from PAs constitute a small fraction (Lasgorceix and Kothari, 2009). The current resettlement policy was formulated partly in response to the local extinction of tigers from Sariska Tiger Reserve, and the subsequent observation that people preferred to return to "live illegal and wretched lives" within the PA due to failures of past official government-led relocation (Narain et al., 2005).

Overall, ∼2% of the estimated 4.3 million people living within Indian PAs have moved out in the past 30 years, highlighting the immense need for resources, and coordinated efforts by responsible agencies (Narain et al., 2005). At present there are tens of thousands of people seeking to be relocated from multiple PAs, yet many requests remain unfulfilled (Narain et al., 2005; Karanth and Karanth, 2007). In some PAs government-led initiatives are unfolding with wide variations in quality of effort, documentation, transparency, and participation of people (Lasgorceix and Kothari, 2009; Shahabuddin and Bhamidipati, 2014). Given this context, we focused on understanding why people chose to relocate from four Indian PAs where the state governments are implementing resettlement. We conducted a *post-hoc* evaluation to determine if demographics, economics, education, health, and awareness of post-relocation facilities were associated with the decision to relocate (**Supplementary Material I**). Since the government package focuses on either complete monetary compensation or establishing agricultural livelihoods, we expected agriculture-dependent small landholders would be more likely to relocate. We expected households vulnerable to wildlife related losses or with greater awareness about post-relocation provisions to be more willing to move (Karanth et al., 2012; Harihar et al., 2014). We also examined how current hardships and anticipated benefits would determine households' decision to move for improved infrastructure (roads, schools, healthcare, Harihar et al., 2015). We identified key concerns and implementation issues relevant to improving ongoing and future resettlement

efforts as well as guide resettlement policy and conservation practice.

MATERIALS AND METHODS

We selected four PAs—Tadoba-Andhari (Tadoba), Kawal, Nagarahole, and Wayanad where there are ongoing Indian government led voluntary resettlement efforts (**Figure 1**, **Table 1**). These initiatives offer a unique opportunity to examine how diverse geographies, ecological, historical, and socio-political-economic contexts influence people's decision to voluntarily resettle from a PA.

Typically, multiple institutions are involved in the relocation of people from PAs in India. Relocation from Critical Tiger Habitats i.e., core areas of Tiger Reserves [as identified by the Wildlife Protection Act (WLPA) 1972] is done by the state government in consultation with an expert committee also comprising of wildlife and social scientists. On the other hand, relocation from Critical Wildlife Habitats [as identified by the Forest Rights Act (FRA) 2006] is carried out only after obtaining the consent of the Gram Sabha (i.e., village governing body) and affected stakeholders. In the latter case, other models of co-existence need to be explored prior to recommending relocation (Narain et al., 2005; National Tiger Conservation Authority (NTCA), 2012). The Scheduled Tribes and Other Traditional Forest Dwellers Act (2006) allows resettlement of forest dwellers only if their representative body provides free and informed consent, passes a resolution seeking relocation, and directs that relocation packages provide "secure livelihoods" to people (Government of India (GOI), 2006). Three of the four PAs in the study are Critical Tiger Habitats (Tadoba, Nagarahole, Kawal) and one (Wayanad) is a Critical Wildlife Habitat.

India's National Tiger Conservation Authority (NTCA) resettlement policy mandates that families wishing to relocate (each adult family member over 18 years as a unit) from a PA can either receive an amount of INR 1 million (US$ 15,517, 1 US$ = INR 67 in 2018), or a land-based package (National Tiger Conservation Authority (NTCA), 2012). In

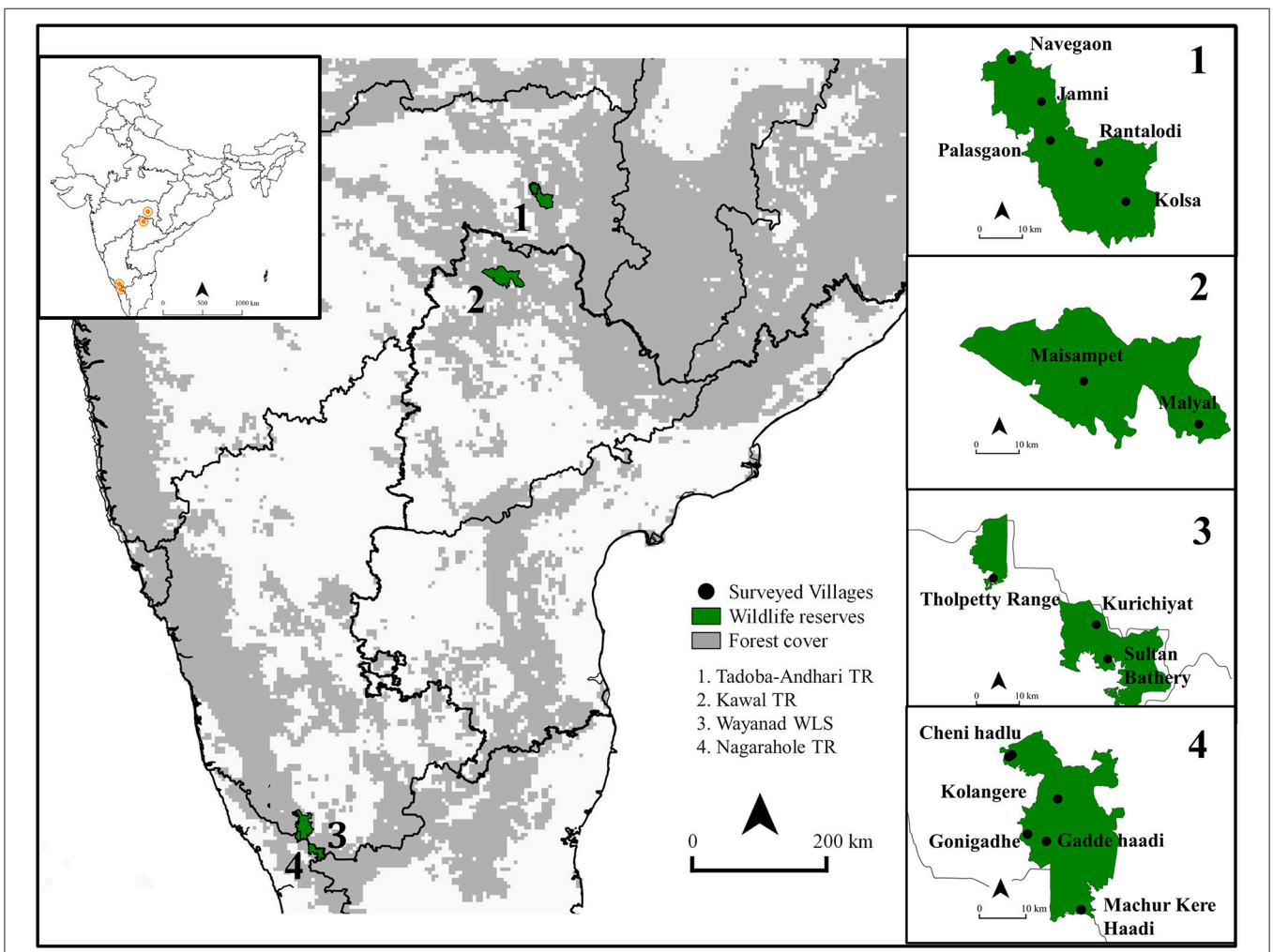

FIGURE 1 | Location of villages and PAs that were surveyed during the study. TR, Tiger Reserve; WLS, Wildlife Sanctuary.

TABLE 1 | Top-ranked models (cumulative weight > 0.95) and beta estimates of fixed, and random effects for predicting the likelihood that households want to relocate, and top-ranked reasons for relocation i.e., better agricultural opportunities, to minimize losses to human-wildlife conflict, and for improved education facilities at Tadoba-Andhari Tiger Reserve.

	Do you want to move		**Agriculture**	**Human-wildlife conflict**		**Education**		
Model name	**Ag* + D†**	**Ag**	**Ec‡ + As§ + Aw¶**	**EV** + DV††**	**EV**	**C‡‡**	**A§§**	**C + A**
ΔAICc¶¶	0	4.28	0	0	0.25	0	2.62	3.40
AIC weight	0.89	0.11	0.96	0.51	0.45	0.69	0.19	0.13
(Intercept)	3.4 (2.46)	4.37 (3.09)	−4.04 (0.99)***	−2.55 (0.84)	−1.44 (0.71)	−1.01 (0.15)	−1.17 (0.22)	−1.08 (0.23)
Household size	1.66 (1.98)		1.28 (0.80)	−1.34 (0.72)†††				
Number of children	1.79 (2.53)						0.24 (0.23)	0.20 (0.24)
Percent of adult males				−0.18 (0.35)				
Mean household adult education	−0.74 (1.06)					*0.51 (0.23)*	*0.54 (0.23)*	*0.49 (0.24)*
Annual household income [US $232–US $7760)	1.6 (1.42)	1.31 (1.27)	*−1.87 (0.48)*	*0.83 (0.34)*	*0.67 (0.32)*	−0.25 (0.18)	−0.24 (0.18)	−0.24 (0.18)
Expenditure on education						0.88 (0.72)		0.77 (0.7)
%contribution of agriculture to annual income	0.67 (1.12)	0.48 (1.05)	*2.28 (0.63)*	*−0.90 (0.41)*	*−0.90 (0.40)*			
Agricultural land size	−0.28 (1.08)	−0.21 (1.08)	*−1.90 (0.83)*					
Livestock lost to carnivores in past decade				0.76 (0.41)	*0.79 (0.40)*			
Ownership of agricultural assets			−0.09 (0.53)					
Buy fertilizers from market			−0.78 (0.62)					
Awareness of post-relocation land provisions	1.61 (1.13)	1.22 (1.02)	*2.30 (0.80)*	1.00 (0.59)				
Awareness of post-relocation education amenities							−0.07 (0.23)	−0.07 (0.23)
Marginal r-squared (global)	0.07	0.47	0.12		0.23			
Conditional r-squared (global)	0.91	0.59	0.40		0.23			
RANDOM EFFECTS								
Kolsa	*−9.94 (1.71)*	*−8.2 (1.54)*						
Jamni	0.39 (1.01)	0.4 (0.98)	−0.34 (0.37)	1.07 (0.29)	1.00 (0.28)			
Navegaon	2.15 (3.08)	1.67 (2.77)	*−1.29 (0.68)*	*1.17 (0.43)*	*1.58 (0.42)*			
New Jamni	1.28 (3.62)	1.27 (3.01)	0.89 (0.51)	−0.51 (0.53)	−0.35 (0.53)			
Palasgaon	−0.1 (1.01)	0.11 (0.99)	−0.04 (0.42)	0.32 (0.36)	0.13 (0.36)			
Rantalodi	−0.47 (0.74)	−0.26 (0.72)	*0.95 (0.35)*	*−1.83 (0.61)*	*−2.12 (0.63)*			

**Agricultural, and †demographic variables associated with a household's decision to move, ‡Economic, §agricultural assets, and ¶awareness about post-relocation provisions that determine the likelihood of agriculture being the top-ranked response, **Economic, and ††demographic factors that contribute to a household's vulnerability to human-wildlife conflict, Models representing ‡‡current difficulties faced by respondents within PA, and §§anticipation of future benefits post-relocation, ¶¶Δ AICc is the difference between model and top model AICc values. ***Standard errors in brackets below beta coefficients, †††Predictors with a significant effect on response are italicized (p < 0.1).*

the latter case, funds are to be divided into agricultural land purchase (35%), rights settlement (30% i.e., compensation for forest dwellers' rights recognized under WLPA, 1972 and FRA, 2006), house construction (20%), community facilities such as road, electricity, and sanitation (10%), and incentives (5%). These recommendations are generally followed with not much room for local improvisation of benefits and procedures.

Trained assistants surveyed 592 adult household members from two to five villages per PA in 2012–2014 (**Supplementary Material II**). Villages were selected randomly from those that had applied for relocation. We attempted to survey all households in selected villages. Structured questionnaire surveys were administered at Tadoba, Kawal, and Wayanad prior to relocation, and at Nagarahole within a year after relocation. Questions covered (i) household composition in terms of age, gender, and education, (ii) economic profile including average annual income of households, contribution of income from agriculture, wage labor, non-timber forest produce (NTFP) collection etc., expenditure on health care and education services, and (iii) awareness of post-relocation provisions

made by the government (**Supplementary Material IV**). We questioned respondents if they wanted to voluntarily relocate (except at Nagarahole where respondents had already moved out) to list their reasons and rank the top three reasons. We also asked respondents if they had changed their decision and why. We modeled the likelihood that a household wanted to move out of Tadoba, but not at Kawal and Wayanad where > 95% households wanted to relocate (**Supplementary Material I**). We then examined the relative importance of different reasons listed by households that wanted to relocate. We modeled the likelihood of PA-wise primary reasons (>10% of households ranked reason as first) including improved access to health care; better road infrastructure; improved education facilities; losses due to human-wildlife interactions; better agricultural opportunities, and provisions of the NTCA policy. We fit a random intercept model with villages incorporated as random effects. Binomial logistic regression models were used to assess the relationship between each of the six responses and predictors.

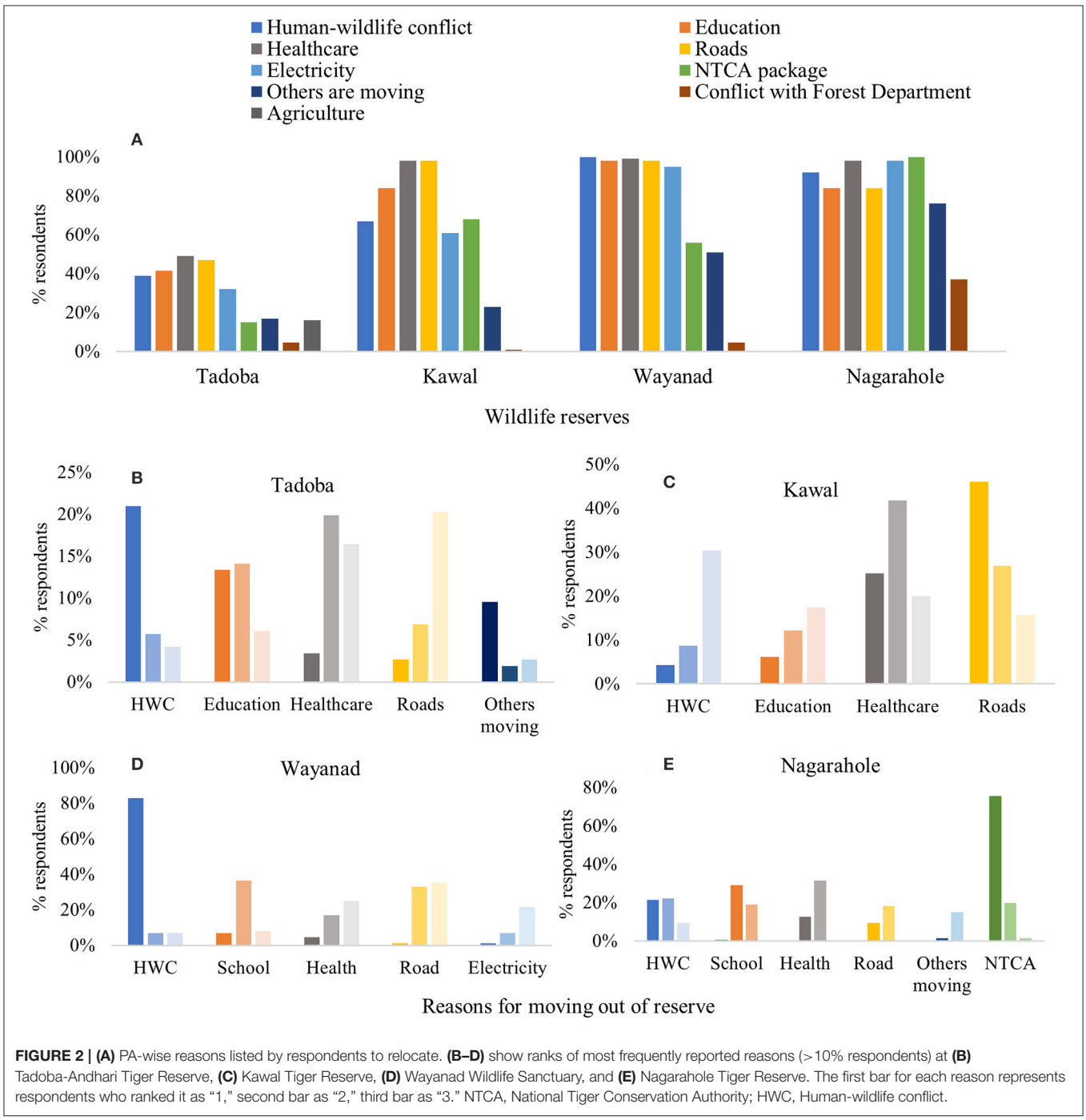

FIGURE 2 | (A) PA-wise reasons listed by respondents to relocate. **(B–D)** show ranks of most frequently reported reasons (>10% respondents) at **(B)** Tadoba-Andhari Tiger Reserve, **(C)** Kawal Tiger Reserve, **(D)** Wayanad Wildlife Sanctuary, and **(E)** Nagarahole Tiger Reserve. The first bar for each reason represents respondents who ranked it as "1," second bar as "2," third bar as "3." NTCA, National Tiger Conservation Authority; HWC, Human-wildlife conflict.

We tested two to four models (**Supplementary Material I**) and used corrected Akaike's Information Criteria (AICc) for ranking models (Burnham and Anderson, 2002). We chose one to three top models for each reason (cumulative AIC weight > 0.95). To supplement information collected from the villages, we also conducted interviews with NGOs who partnered with the government in the resettlement process.

RESULTS

Household Characteristics

We surveyed 592 households from 16 villages across four PAs. Agricultural land ownership averaged 54%, with average land holdings of 3.29 acres (ranging from 0.31 acres in Nagarahole to 5 acres at Kawal, **Supplementary Material III**). Top income sources included wage labor (56%, in Wayanad and Nagarahole), agriculture (39%, in Tadoba), and non-timber forest product (NTFP) collection (17%, in Kawal). Additional PA, village and households details are in **Supplementary Materials II–III**.

Reasons for Resettlement

Of the 402 households relocating, 89% stated it was voluntary (ranging from 81% at Tadoba to 100% at Wayanad). Households listed nine reasons for resettlement and top-ranked reasons were healthcare (77%), roads (73%), schools (67%), human-wildlife conflict related losses (66%), and benefits of the NTCA package (61%, **Figure 2A**).

In Tadoba, people's decision to relocate was strongly associated with their village, with Kolsa villagers least likely to relocate (**Table 1**). Improved agricultural opportunities (25%), human-wildlife conflict (21%), and education (13%) were the primary reasons for relocation (**Figure 2B**). Improved agricultural opportunities was the primary reason for poor, small land holders, with high agricultural dependence, and awareness about post-relocation land provisions (**Table 1**). Human-wildlife conflict was likely to be the top reason for wealthier households, with low dependence upon agriculture (i.e., wage laborers, pearson's $r = -0.85$), and had lost livestock in the past decade. Better education facilities were likely to be associated with more educated households, but the results should be interpreted with caution due to poor model fit (conditional r-squared = 0.23, **Table 1**).

At Kawal, 99% of households wanted to move out of the PA. Better roads (46%), and improved healthcare (25%) were the top-ranked reasons for relocation (**Figure 2C**). Better roads were likely to be the primary reason for households dependent upon NTFP incomes (**Table 2**). Improved healthcare was the top reason for wealthy households. However, global models for healthcare (conditional r-squared = 0.23), and roads (conditional r-squared = 0.13) had low fit and should be interpreted with caution. Some (24%) households had changed their decision to move out primarily due to poor facilities and resources (**Supplementary Material III**).

In Wayanad, 100% of households wanted to relocate, and 81% ranked human-wildlife conflict as the primary reason

TABLE 2 | Top-ranked models (cumulative weight > 0.95) and beta estimates of fixed effects for predicting the likelihood that households want to relocate for better access to roads, and healthcare facilities at Kawal Tiger Reserve.

	Roads			Healthcare	
Model name	**A***	**C†**	**A + C**	**C**	**A**
Δ AICc‡	0	0.36	2.54	0	1.15
AICc weight	0.47	0.40	0.13	0.64	0.36
(Intercept)	0.02 (0.17)§		−0.12 (0.24)	−0.36 (0.20)	
Household size	0.17 (0.21)		0.26 (0.22)		
Number of children				0.19 (0.28)	0.20 (0.27)
Percent of adult males				−0.07 (0.36)	−0.08 (0.36)
Mean household adult education	0.31 (0.38)		0.42 (0.4)		
Expenditure on education		0.75 (0.91)	0.36 (0.91)		
Expenditure on illness		*−1.39 (0.73)*¶	−1.69 (0.78)	1.02 (0.76)	
Number of sick days in last year				−0.11 (0.33)	
Annual household income [US $776–US $1552)		−0.03 (0.25)	−0.13 (0.26)	−0.30 (0.28)	−0.12 (0.26)
Annual household income [US $1552–US $7760)		0.13 (0.20)	0.09 (0.20)	*0.44 (0.24)*	*0.41 (0.23)*
Percent contribution of NTFP to annual income		*0.34 (0.18)*	*0.34 (0.18)*	*−0.58 (0.23)*	
Marginal r-squared		0.148		0.232	
Conditional r-squared		0.148		0.232	

Models representing current difficulties faced by respondents within PA, and †anticipation of future benefits post-relocation, ‡ΔAICc is the difference between model and top model AICc values, §Standard errors in brackets below beta coefficients (raw log odds), ¶ Predictors with a significant effect on response are italicized ($p < 0.1$).

TABLE 3 | Top-ranked models (cumulative weight >0.95) and beta estimates of fixed, and random effects for predicting the likelihood that households want to relocate to minimize losses from human-wildlife conflict, at Wayanad Wildlife Sanctuary.

	Human-wildlife conflict		
Model name	**EV***	**DV†**	**EV + DV**
ΔAICc‡	0	0.75	3.70
AICc weight	0.54	0.37	0.09
(Intercept)	2.25 (0.89)§	1.85 (0.82)	2.16 (0.91)
Household size		*1.40 (0.75)*	0.70 (0.79)
Percent of adult males		1.14 (1.07)	0.83 (1.18)
Percent contribution of agriculture to annual income	*−2.22 (1.09)*		−1.80 (1.15)
Annual household income [$776–US $7760)	*1.67 (0.83)*		1.39 (0.86)
Livestock lost to carnivore attack in the past decade	0.42 (0.87)		0.29 (0.9)
Marginal r-squared	0.224		
Conditional r-squared	0.413		
RANDOM EFFECTS			
Kurichiyat settlement	0.37 (0.51)	0.31 (0.52)	0.38 (0.52)
Sultan Batthery settlement	*−1.20 (0.39)*	*−1.21 (0.37)*	*−1.19 (0.39)*
Tholpetty settlement	0.64 (0.82)	0.7 (0.81)	0.62 (0.82)

**Economic, and †demographic factors that contribute to a household's vulnerability to human-wildlife conflict. ‡Δ AICc is the difference between model and top model AICc values. §Standard errors in brackets below beta coefficients (raw log odds), ¶Predictors with a significant effect on response are italicized ($p < 0.1$).*

(**Figure 2D**). Wealthy households, with low dependence on agricultural incomes (i.e., wage laborers, Pearson's $r = -0.76$) were most likely to move out due to high wildlife-related damage (**Table 3**). Households reported changing their decision to move out from no to yes primarily due to anticipated benefits of the NTCA package, hardships due to poor resources, and due to government pressure (**Supplementary Material III**).

At Nagarahole, NTCA package (76%), and human-wildlife conflict (21%) were the top-ranked reasons for people's decision to move (**Figure 2E**). NTCA package was most likely to be chosen by households with more children, with significant village-level differences (**Table 4**). Human-wildlife conflict was most likely to be chosen by smaller households.

DISCUSSION

Government supported voluntary resettlement from four Indian PAs provided a valuable opportunity to understand people's motivations to relocate and evaluate the process in different contexts. Across PAs, 89% of households wanted to relocate for varied reasons: agriculture, human-wildlife conflict, and education in Tadoba; healthcare and roads in Kawal; human-wildlife conflict in Wayanad; government policy and human-wildlife conflict in Nagarahole.

Past relocation history played a role in people's decisions in Tadoba. In 2003, 49 families from Kolsa had moved outside the PA. Families complained about poor land and housing quality, and inadequate irrigation facilities (Nagendra et al., 2010). The remaining families were apprehensive a decade after this experience. Poor implementation, lack of continual engagement with relocating people, and few mechanisms to address emerging grievances post-relocation have had long-term repercussions in Tadoba (Shahabuddin and Bhamidipati, 2014). This is similar to Kuno where poorly executed relocations eroded people's good will and faith in the process (Kabra, 2009). In contrast, benefits shared by people who moved earlier created a positive feedback cycle encouraging other villages to move at Melghat, a PA in the same state (Sekar, 2016).

Improved agricultural opportunities was the top reason for poor, landless or small land holders to move from Tadoba similar to Kuno, Melghat, and Bhadra (Karanth, 2007; Kabra, 2009; Sekar, 2016). Larger landowners may hesitate to relocate if they feel inadequately compensated, perceive a reduction in social status or may receive less land outside if their land within PA was illegally encroached (Karanth, 2007; Dhakal et al., 2011). Increased fragmentation of agricultural land has resulted in 45% of agricultural land in India being distributed into small 1.15 hectares holdings (Government of India (GOI), 2016b). In contrast, the NTCA policy often provides at least 2 hectares of land per family along with improved infrastructure and school-health care amenities. Going forward, providing suitable agricultural land remains a major challenge for the government as more families apply to relocate.

Human-wildlife conflict was a top-ranked reason for relocation from Tadoba, Wayanad, and Nagarahole. Wage laborer households less dependent on agriculture were more willing to move due to high wildlife damage (crop, property, and livestock loss as well as human injury or death). People engaged in farming, grazing livestock, or collecting NTFPs reported fearing for their lives inside these PAs with high densities of elephants, tigers, leopards etc. (Karanth et al., 2012; Dhanwatey et al., 2013; Karanth pers obs). Post-relocation new sites must be carefully selected to avoid high wildlife conflict zones adjacent to PAs (Karanth and Kudalkar, 2017). This must be complemented with access to effective mitigation measures and compensation schemes to avoid further impacts upon livelihoods (Karanth et al., 2018).

The provisions of the NTCA policy were the top-ranked reason for larger families to relocate at Nagarahole. Many (86%) wage-labor and hunter-gatherer families were able to transition to agriculture-based livelihoods unlike the *Baigas* in Kanha (Rangarajan and Shahabuddin, 2006) and *Sahariyas* in Kuno (Kabra, 2009). These households were surveyed within a year of relocation, and therefore possibly were better able to settle down and perceive all the benefits of the NTCA package.

The Indian government's current policy allocates 10% of funding toward improving social amenities with wide local and state-level variations in implementation (National Tiger Conservation Authority (NTCA), 2012). Access to infrastructure diversifies people's livelihood options and can raise their living standards to levels comparable to neighboring communities (Clements et al., 2014; Sekar, 2016). Among these PAs

TABLE 4 | Top-ranked models (cumulative weight >0.95) and beta estimates of fixed, and random effects for predicting the likelihood that households want to relocate to avail the benefits of the government resettlement (NTCA) package, and to minimize losses from human-wildlife conflict at Nagarahole.

	NTCA Package		Human-wildlife conflict		
Model name	**D* + A†**	**D + E‡ + A**	**EV§ + DV¶**	**DV**	**EV**
Δ AICc**	0	5.55	0	1.68	2.19
AICc weight	0.92	0.06	0.57	0.24	0.19
(Intercept)	1.17 (0.65)††	0.83 (0.82)	−2.27 (0.80)	−1.60 (0.65)	−2.08 (0.73)
Household size			*−1.46 (0.61)*	*−0.92 (0.53)*	
Number of children	*1.07 (0.47)*‡‡	*1.30 (0.52)*			
Percent of adult men			−0.44 (0.82)	0.25 (0.68)	
Mean household adult education	0.72 (0.57)	0.75 (0.58)			
Agricultural land size		−1.90 (1.51)			
Annual household income [US $1552–US $7760)		−0.41 (0.44)	*1.06 (0.58)*		0.55 (0.47)
Expenditure on education		−0.79 (3.91)			
Expenditure on illness		−1.06 (1.74)			
Livestock lost to carnivores in the past decade			1.74 (1.13)		1.47 (1.07)
Awareness about post-relocation facilities	0.04 (0.51)	−0.05 (0.53)			
Marginal r-squared (global)	0.157			0.152	
Conditional r-squared (global)	0.369			0.466	
RANDOM EFFECTS§§					
Cheni hadlu	−0.15 (0.62)	0.24 (0.65)			
Gadde haadi	−0.54 (0.58)	−0.39 (0.61)			
Gonigaddhe	*−1.37 (0.34)*	*−1.56 (0.35)*			
Kolangere	0.57 (0.76)	0.47 (0.81)			
Macchur Kere Haadi	1.23 (0.64)	1.01 (0.68)			

**Demographic, †awareness of post-relocation provisions, and ‡economic variables that determine the likelihood of NTCA package being the top-ranked response, §Economic, and ¶demographic factors that contribute to a household's vulnerability to human-wildlife conflict. ** Δ AICc is the difference between model and top model AICc values. †† Standard errors in brackets below beta coefficients (raw log odds), ‡‡Predictors with a significant effect on response are italicized ($p < 0.1$). §§ Includes villages that the respondent originated from, excludes villages with <10 respondents.*

improved education, healthcare, and roads were desired by households from Tadoba and Kawal, similar to Rajaji (Harihar et al., 2014), and Bhadra (Karanth, 2007). These findings mirror aspirations of a young India (552 million people are under the age of 25 years), where employment (61%) and education (24%) are the top reasons for migration (Government of India (GOI), 2011). Estimates across India suggest that post-migration employment opportunities rise from 23 to 36% in the general population due to diverse livelihood opportunities (Government of India (GOI), 2010). Therefore, post resettlement monitoring of people will provide insights into how forest-dependent people diversify their economic and educational opportunities and trans-generational impacts that follow these.

Understanding livelihood dependence on PA resources and replacement by suitable alternatives (for example, gas or solar instead of fuelwood) will better equip people with effective coping strategies post-relocation (Rangarajan and Shahabuddin, 2006). Households heavily dependent on the PA for NTFP or hunting often find it hardest to adjust outside compared to agricultural families (Karanth, 2007; Karanth and Karanth, 2007; Kabra, 2009; Lasgorceix and Kothari, 2009). Kawal families may find it more difficult to establish their livelihoods post-relocation without significant support from local agencies. The current "one size fits all" NTCA package needs to be restructured so that focus expands from primarily agricultural livelihoods to providing people with jobs and skills training suited to living in and integrating with rural and urban India. Moreover, the policy sometimes excludes women, except for Maharashtra (Tadoba), where only adult men were eligible for the package. Such state-level exclusions must be fixed to ensure long term well-being of all people (Lasgorceix and Kothari, 2009; Sekar, 2016).

Across PAs, multiple regional, cultural, socio-economic, and political forces influence people's decision to move or not to move. Prior to relocation, it is essential that underlying motivations and expectations are understood to offer pragmatic packages and societally relevant opportunities. Successful relocation also requires political and bureaucratic will for conservation that can considerably improve transparency and public support for such efforts. In Wayanad and Kawal many people changed their decisions once all of the NTCA package benefits became clear. Meeting other resettled families motivated Kawal families similar to Melghat, while some Wayanad respondents reported experiencing pressure by the government. It is necessary that relocation projects remain entirely free of governmental coercion, intimidation or

manipulation, that violate the UN principle of free, informed and prior consent (Sekar, 2016). Independent monitoring by NGOs and external agencies is critical to providing pre-relocation support through a participatory process (Agrawal and Redford, 2007; Karanth, 2007). Long-term follow-up by independent agencies can reduce financial mismanagement from a sudden rise in annual earnings among relocated people and monitor how people rebuild their lives post-resettlement (Kabra, 2009; Rantala et al., 2013; Sekar, 2016).

India is currently witnessing high rates of internal migration with 26% rural and 35% urban population classified as migrants (Government of India (GOI), 2010). Concurrently, there has been a decline in contribution of agriculture both in terms of workforce, and economic contribution to the GDP (Government of India (GOI), 2016a). These trends are significant in a country where PAs protecting endangered megafauna are surrounded by some of the most populated and most rapidly urbanizing areas in the world (densities of 382 persons/km^2) and land management decisions will need to balance people's and conservation needs (Government of India (GOI), 2011; McCauley et al., 2013). Our study highlights that people living within PAs are no longer isolated but are continually acted upon and engage with a complex suite of economic, environmental, social, and political forces (Davidar et al., 2010; McCauley et al., 2013; Hunter et al., 2015). In this scenario, advocating coexistence without accounting for people's aspirations can lead to continued impoverishment, isolation of communities from social and economic development, and increased fragmentation of natural spaces (Watson et al., 2015). On the other hand, well-planned resettlement projects can improve people's lives and simultaneously aid recovery of wildlife and wild places (Bamford et al., 2014; Hall et al., 2014; Li et al., 2015).

ETHICS STATEMENT

This study was carried out in accordance with the recommendations of the Human Subjects Ethics Committee at the Centre for Wildlife Studies. The protocol was approved by the Human Subjects Ethics Committee at the Centre for Wildlife Studies. Since the study was carried out at sites with low literacy rates, oral informed consent was obtained from subjects prior to administration of the survey.

AUTHOR CONTRIBUTIONS

KK conceived and designed the study, and collected the data. KK, SK, and SJ analyzed the data. KK and SK wrote the manuscript.

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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.2018.00183/full#supplementary-material

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