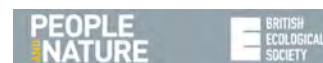


RESEARCH ARTICLE



Lost in transition? Capturing the impacts of conservation and development interventions on relational values and human wellbeing in the forested tropics

Mixed impacts of protected areas and a cash crop boom on human well-being in North-Eastern Madagascar

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Abstract

1. Tropical forest frontier areas support the well-being of local populations in myriad ways. Not only do they provide the material basis for people's livelihoods, they also sustain socio-cultural foundations through relational values. They host some of the most biodiverse ecosystems and largest carbon stocks on the planet, and are thus a focus of global conservation efforts. They are also a prime location for the production of many global agricultural commodities. These dynamics—often intertwined—may trap local populations between powerful interests, with the potential to affect their well-being.
2. We conducted 100 structured interviews in four biodiversity-rich landscapes of north-eastern Madagascar to investigate how multi-dimensional human well-being is affected by the recent establishment of protected areas and surge in cash crop prices. We asked households about their satisfaction—and changes in satisfaction—with locally relevant well-being components, mapping their answers through Nussbaum's Central Capabilities approach. We also investigated the cultural significance of key natural resources beyond the material benefits they provide. All issues were explored along four variables: site, main source of rice, gender and household land use portfolio.
3. Our findings are as follows: first, human capabilities are interconnected and mutually interdependent, with relational values linking many of them. Second, subjective accounts of well-being are influenced by cognitive biases, such as treadmill effects, adaptive preferences and recency bias. Third, while households perceived a positive influence of protected areas, those most reliant on forest land and products held a more negative view of conservation interventions. And

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fourth, while households more engaged in commercial agriculture may be benefitting economically from the recent increase in cash crop prices, these very dynamics might be leading to trade-offs between capabilities. This is most notably so for the *Bodily Health* capability (e.g. greater spending on housing) and *Affiliation* and *Bodily Integrity* (i.e. worsening social relations and security).

4. These insights highlight the importance of addressing the multiple dimensions of well-being when assessing the impacts of conservation and economic dynamics in forest frontier populations. Particular attention should be paid to the relational values ascribed to the natural resources the communities rely on.

KEYWORDS

biodiversity conservation, capabilities approach, cultural ecosystem services, export cash crops, relational values, shifting cultivation, subjective well-being, sustainable development

1 | INTRODUCTION

Tropical forest frontier landscapes support the well-being of millions of residents in myriad ways (Erbaugh & Oldekop, 2018; Vedeld et al., 2007). Most visibly, these landscapes contribute to food security and provide the material basis for local lives and livelihoods: Forest bushmeat is an important source of protein (Milner-Gulland & Bennett, 2003) and forest may represent a reserve of agricultural land for present and future generations (Chomitz, 2007). No less important are the essential ecosystem services tropical forests provide to sustain agricultural livelihoods at the forest frontier, such as hydrological cycle regulation or crop pollination (Louman et al., 2009; van Meerveld et al., 2021), with forests also representing a central foundation for social practices and cultural identity and continuity (Gould et al., 2014). In parallel, tropical forests are the world's most biodiverse terrestrial ecosystem (Gardner et al., 2009; Gibson et al., 2011) and constitute some of the largest carbon stocks on Earth (Mitchard, 2018). Adding complexity to the picture, the tropical forest frontier provides prime conditions for the production of many globally traded agricultural commodities, through large-scale agriculture, cattle raising (Pendrill et al., 2019) and smallholder farming of export crops (Byerlee & Rueda, 2015).

The multiple benefits tropical forest landscapes can deliver make these regions collision sites of diverging interests. Stakeholders range from economic actors pursuing the monetary value of agricultural commodities (le Polain de Waroux et al., 2018); national and transnational conservation actors focusing on existence or scientific value among others (Sandbrook et al., 2019); to local communities who rely on the landscapes for their subsistence, identity and autonomy (Fritz-Vietta, 2016). Given the relatively disenfranchised position of local communities vis-à-vis more powerful actors (Palmer Fry et al., 2015), the needs of local populations are often trapped between competing global demands for land-based resources and services (Niewöhner et al., 2016), with deep implications for local well-being (Brockington & Wilkie, 2015; Ulrich, 2014). On the one hand, the ongoing and expected expansion of protected areas (PAs) (Dinerstein et al., 2019) has the potential to negatively affect millions

of forest frontier communities (Schleicher et al., 2019). On the other hand, the chase after maximal economic profit from agricultural commodities produced in tropical forest frontier landscapes (Folke et al., 2019) links local producers to the inherent uncertainties of the global economy (Jha & Yeros, 2019).

In this study, we explore how the multi-dimensional well-being of forest frontier communities is evolving in a context of conservation interventions and export cash crop production in north-eastern Madagascar. The region is of global conservation and development concern (Borgerson et al., 2019; Kremen et al., 2008). It is also linked to the world economy through the production and trade of vanilla and clove, two of the most sought-after agricultural export commodities (Danthu et al., 2014; Neimark, Osterhoudt, Alter, & Gradinar, 2019).

1.1 | Multidimensional human well-being and capabilities

Understanding human well-being in conservation contexts is essential for practical and ethical reasons, as interventions adapted to local realities may achieve broader legitimacy and they may be more likely to succeed (Milner-Gulland et al., 2014). It may be especially important to take into account local perspectives in conservation target areas that are also sites of cash crop production, to avoid compound negative impacts on the local populations (Clements & Milner-Gulland, 2015). To be meaningful for conservation and development practice, investigation of these intertwined dynamics requires a contextualized, locally rooted understanding of well-being (Loveridge et al., 2020). Human well-being is increasingly understood in a multi-dimensional manner, with three interacting dimensions: material, relational and subjective (McGregor & Sumner, 2010; Woodhouse et al., 2015). The material dimension encompasses the objective components people need to build their livelihoods and achieve a minimum standard of living, such as productive assets, housing or income (Travers & Richardson, 1995). The relational dimension acknowledges the social embeddedness of the material

conditions (McGregor et al., 2015). It encompasses the social interactions that people engage in to produce and reproduce their well-being, including the institutional relations enabling people to make use of their assets (Woodhouse et al., 2015) and the relations to the natural resources they rely on (Chan et al., 2012). The subjective dimension comprises the cognitive and affective evaluations of a person about their quality of life, including emotional reactions to experiences (Diener et al., 2009).

Many of the frameworks and methods used to investigate human development and well-being in the Global South in a comprehensive, context-sensitive and globally relevant way build on the idea of *capabilities*, first proposed by economist Amartya Sen (Sen, 1979). Examples of such frameworks and methods are the Sustainable Livelihoods Framework (DfID, 2001), the Global Person Generated Index (Camfield & Ruta, 2007) and the Wellbeing in Developing Countries approach (Gough et al., 2006). Capabilities are the freedoms people have *to do* and *to be* with the resources they have at hand (Sen, 1999), or in other words, the freedom people have to achieve well-being (Robeyns, 2017). This materializes into valuable doings and beings, referred to as *functionings* in the capabilities terminology (Alkire, 2005). A capabilities standpoint might grant privileged access to explore the three dimensions of well-being of rural communities with high reliance on the natural environment. First, for the material dimension, thinking in terms of capabilities—that is, what people can do with the resources they rely on (Sen, 1999)—can help to unveil the many ways in which natural resources contribute to well-being beyond strictly material benefits, and how people perceive that these benefits relate to other life domains (Travers & Richardson, 1995).

Second, regarding the relational dimension, capabilities are relational in essence (Loveridge et al., 2020), in the sense that they are framed and actualized in a permanently evolving social context (Robeyns, 2005), and in that they frequently require collective action to translate into achieved functionings (Evans, 2002). This provides a vantage point to unearth the values people assign to and hold regarding their natural environment and their interactions with it, and their relations with other people (Chan et al., 2011). Thinking in terms of such relational values might help expand the analytical arena beyond the dichotomy between assigned values that are instrumental and intrinsic (Himes & Muraca, 2018). It can also help to unveil the collective cultural underpinnings of socio-ecological relations at the core of current environmental concerns (Chan et al., 2018). Revealing the multiplicity of values local actors might hold is particularly important in understanding the intangible benefits that people derive from nature beyond the strictly material or use value (Chan et al., 2012), also known as cultural ecosystem services. Such contributions might emerge not only through human-to-nature relations (De Vos et al., 2018), but also through the human-to-human relations that interaction with nature enables (Chan et al., 2016), rooted either in use or non-use values (Chan et al., 2011). This has been shown in regard to the cultural heritage and social identity support provided by interactions with forest land (Gould et al., 2014), agricultural landscapes (Tilliger et al., 2015), marine ecosystems (Oleson

et al., 2015) or certain species (Klain et al., 2014)—or in regard to the benefits provided by place attachments (Cundill et al., 2017; Dawson et al., 2021 [in this Special Issue]).

And third, in terms of the subjective dimension, implicit to the idea of capabilities is the assumption that subjective accounts of people's interpretations of their life circumstances are essential to capturing what matters for their well-being (Comim, 2005). Consequently, a capabilities approach can facilitate a holistic, more dynamic understanding of people's motivations and aspirations (Camfield & Skevington, 2008), and therefore an understanding of why they act as they do (Diener et al., 1999). Exploring subjective well-being is becoming more common in research on human well-being in the rural Global South (Gough et al., 2006; Reyes-García et al., 2016). Furthermore, the subjective dimension is also becoming more frequently investigated in conservation contexts, both in the Global South (Beauchamp et al., 2018) and North (Jones et al., 2020), despite until recently lagging behind other well-being domains more readily amenable to evaluation (McKinnon et al., 2016).

1.2 | Building on Nussbaum's central capabilities to explore multi-dimensional well-being at the forest frontier

To structure our investigation of multi-dimensional well-being at the forest frontier, we build on Nussbaum's 10 Central Capabilities (Nussbaum, 2000) of *Life, Bodily Health, Bodily Integrity, Sense, Imagination and Thought, Emotions, Practical Reason, Affiliation, Other Species, Play and Control over one's environment* (see Supporting Information 1 for definitions). The list can be thought of as an objective, universal list of well-being domains required to enjoy a life of minimal dignity (McGregor et al., 2015; Schleicher et al., 2018). Relying on such an *objective* list, and as suggested by Binder (2014), we captured the *subjective* dimension of human well-being by asking respondents about their current satisfaction with aspects considered necessary to have a good life in our study villages (Llopis et al., 2020), which we define as well-being components.

We also asked about *changes* in satisfaction, for two reasons. First, to obtain insights into the factors influencing such satisfaction, and thus to understand how people adapt over time to the new conditions brought about by conservation interventions or fluctuating commodity markets and how well-being consequently changes (St John et al., 2013). And second, to try and illuminate some of the inherent operational difficulties in handling subjective personal evaluations of how well people are doing, particularly due to the dynamic nature of human aspirations and the influence of social comparison on these (Robeyns, 2017). Many of these difficulties stem from cognitive biases, such as 'treadmill effects', which may emerge when people adjust their aspirations upwards as their material circumstances improve (O'Neill, 2008), or 'adaptive preferences', when people adapt their expectations downwards to meet their current material possibilities and those of their peers (Crettaz & Suter, 2013).

We pay particular attention to the Central Capability of *Other Species* for two reasons. First, the approach has been criticized for including the role of nature in supporting well-being under only one capability, *Other Species*, understood as '[b]eing able to live with concern for and in relation to animals, plants, and the world of nature' (Nussbaum, 2000, p. 80). This can be considered insufficient (Holland, 2008), particularly in rural Global South contexts where most capabilities, and well-being more generally, are arguably more directly supported by the environment (Dasgupta, 2001; Fedele et al., 2021). And second, to try to overcome some of the difficulties inherent in operationalizing this capability to meaningfully elicit the relevance of the natural environment for well-being (Wolff & de-Shalit, 2007). For this reason, we employ the capability of *Other Species* to explore the many ways in which nature contributes to people's prosperity through cultural ecosystem services that go beyond the strictly material (Fish et al., 2016), which can, in turn, support a number of other capabilities (De Vos et al., 2018). Furthermore, we also disaggregate our exploration of well-being along characteristics considered key in mediating human well-being. This is particularly appropriate given that not all members in a community achieve the same well-being outcomes even with the same set of material assets or access to social resources, with inequalities running along gender or ethnicity lines, among others (Daw et al., 2016; Dawson & Martin, 2015).

This approach differs slightly from other ways of operationalizing the capabilities approach. Some scholars, for example, view the cultural contributions of ecosystems to identity and experiences as separate from capabilities (Fish et al., 2016). Also, other studies have mapped out well-being components directly onto the material, relational and subjective dimensions of well-being (Lapointe et al., 2021; Mbaru et al., 2021; Woodhouse & McCabe, 2018), which the Central Capabilities list would also allow. However, in this study, our intention is not to define material, relational or subjective well-being components per se, but rather to investigate the multiplicity of ways in which components considered necessary to have a good life in this context contribute to well-being in ways other than the most obvious.

Our ultimate aim is therefore to investigate how local residents of four forest frontier villages in north-eastern Madagascar perceive the implications of the recent establishment of PAs and the increases in cash crop prices on their multi-dimensional well-being, differentiated by households according to characteristics widely considered to mediate the influences on human well-being. We disaggregate this overall aim into three concrete objectives. First, we investigate the current level of household satisfaction with locally defined well-being components and changes in satisfaction. Second, we explore the significance of the natural resources and cultural keystone species people in these villages depend on for their well-being in ways that do not necessarily have material value. And third, we investigate how local respondents perceive the effects of the recent establishment of PAs and the surge in cash crop prices on their well-being. Across these three objectives, we explore differences in household

responses along location characteristics (i.e. village), household land use portfolio, main source of rice, and gender.

2 | CASE STUDY AREAS

Madagascar's biodiversity and endemic species are globally renowned, with forests being their main habitat (Goodman & Benstead, 2005; Martin et al., 2022). The island has long been labelled one of the hottest biodiversity hotspots on the planet (Myers et al., 2000), due to the severe pressures its biodiversity-rich forests face. Efforts to retain this biodiversity has prompted the expansion of the country's PA system by more than 400% in the last 15 years (Gardner et al., 2018), with the main objective of curbing the expansion of subsistence shifting cultivation, which, based on the evidence to date, is the main threat to the island's forests (Zaehring et al., 2015). However, in a country that ranks among the lowest in the world in the Human Development Index (UNDP, 2018) and the Food Security Index (EIU, 2019), conservation interventions can end up further undermining the already precarious situation of rural populations (Corson, 2011). For example, it is becoming increasingly clear that local communities in conservation contexts in Madagascar are suffering high economic losses (Neudert et al., 2016; Poudyal et al., 2018). And given the role shifting cultivation plays in enabling social cohesion and cultural continuity across generations (Keller, 2008), the socio-cultural losses associated with conservation forest use restrictions might be just as important (Llopis et al., 2021), something the scientific literature has barely touched upon.

In addition, Madagascar is a major producer of two of the most sought-after agricultural commodities in the world, vanilla and clove, which, amid a history of highly volatile prices, have surged in economic value in recent years (Danthu et al., 2014; Zhu, 2018). Both crops are grown along the north-eastern region, which has been particularly targeted by recent conservation interventions (Zaehring et al., 2016). Despite remarkable advances in understanding the effects of community forest management on economic well-being (Rasolofoson et al., 2017) or of conservation interventions on subjective well-being (Rasolofoson et al., 2018) in Madagascar, the full picture of the intertwined impacts of conservation initiatives and export crop price fluctuations on multi-dimensional human well-being remains unclear.

Our four study villages are located in north-eastern Madagascar (Figure 1), where several large PAs were established in recent decades to curb the expansion of shifting cultivation into old-growth forests (Zaehring et al., 2015) and stem the pressures this expansion poses on biodiversity (Morelli et al., 2019). In this study, we focus on Masoala National Park, established in 1997, and Makira National Park, granted definitive protection in 2012 (Table 1). The region is also key for the production of vanilla and clove, increasingly valued on the global market in recent years, which, combined with the creation of the PAs, has led to rapid land use changes in the past decades (Llopis et al., 2019).

The study villages were selected based on differences in the overall share of land uses present in the landscape, population size and density, degree of remoteness and conservation history (Table 1), differences that might help to explain diverging well-being outcomes. The main common characteristics across villages are the populations' almost exclusive reliance on agricultural activities to meet their subsistence and income needs, and the Betsimisaraka ethnicity of most households. The main subsistence crop is rice (*Oryza sativa*), which is cultivated in two distinct systems. Irrigated paddy fields occur in valley bottoms with flat terrain and enough water and means of irrigation. A rain-fed shifting cultivation system occurs in the uplands and, in a first stage, requires the clearing of old-growth forest. In addition to being the main staple food crop, rice plays a key role in local culture and traditions throughout Madagascar (Linton, 1927). The main income source for local populations is the cultivation and sale of vanilla and clove for export (Hänke and Fairtrade International, 2019; Mariel et al., 2021). Zebu cattle (*Bos indicus*), a species central to Malagasy cultural life (Klein et al., 2008), are also raised in the area, depending on the availability of pasture, or brought in from other regions for special occasions.

3 | METHODS

3.1 | Structured household-level interviews

Following preliminary field visits in 2016, data collection took place between September and November 2017 through 100 household-level interviews across our four study villages, following a structured format with all questions formulated in the same way on each occasion. We also used follow-up questions to explore further aspects relevant to this study, gathered information on each household's socio-economic characteristics and wrapped up the interviews by asking respondents to state the three well-being aspects they found the most satisfying and the three most difficult to achieve (Supporting Information 4). To capture the maximum difference possible in land use portfolio across households, we followed a stratified sampling strategy, based on local land use estimates from previous studies in the region (Zaehringer et al., 2016). This strategy was also aimed at having respondents from different age groups, as well as a similar number of female and male respondents. Interviews lasted 80 min on average and

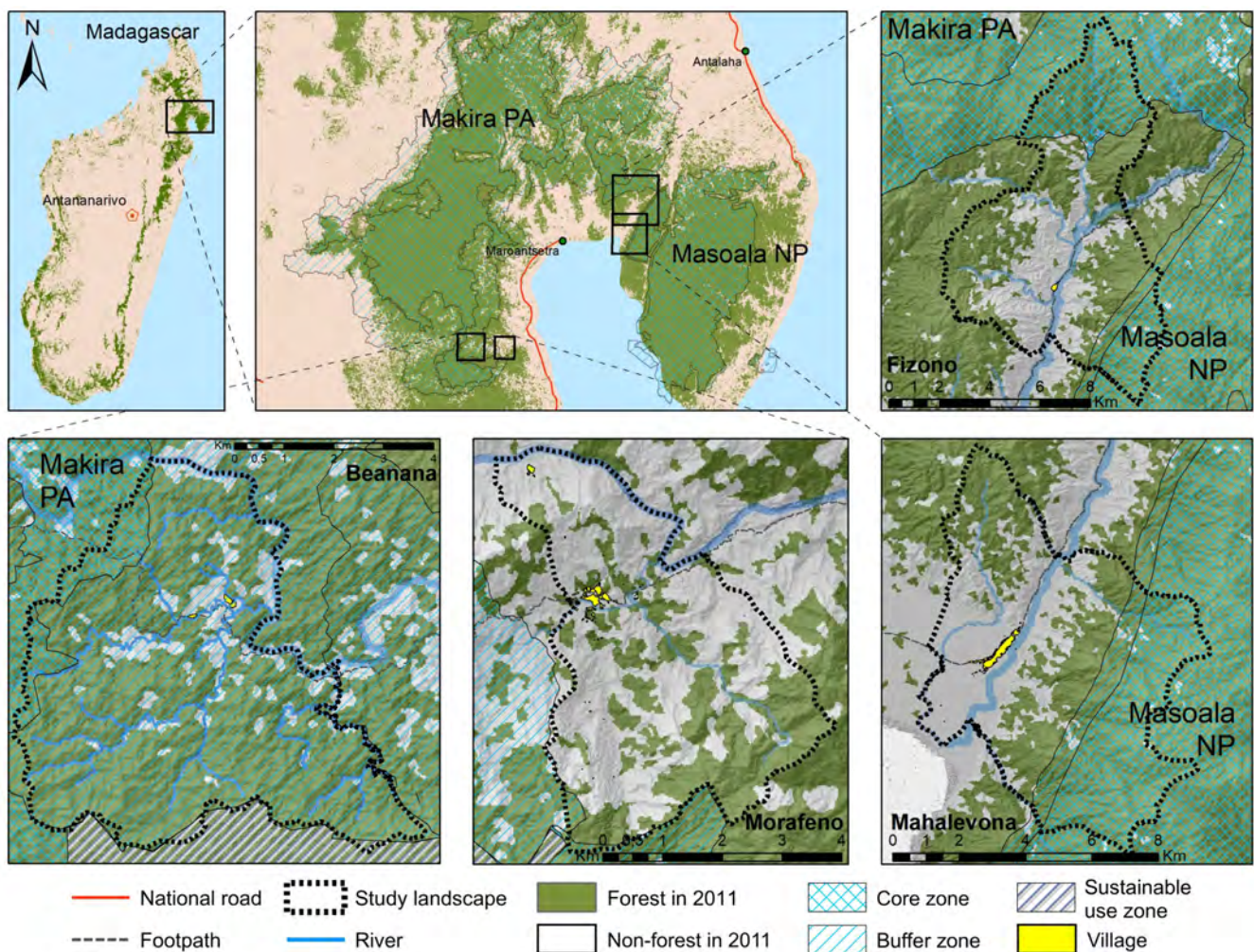


FIGURE 1 Location of study villages. Data sources: Forest cover from (ONE et al., 2013); protected area boundaries from (MNP, 2017) and (WCS, 2017); digital elevation model from (DLR, 2017). Figure source: Adapted from Llopis et al. (2020).

TABLE 1 Characteristics of study villages.

	Village			
	Beanana	Morafeno	Fizono	Mahalevona
General characteristics				
Population (2015) ^a	721 (19)	1889 (94)	3851 (50)	9834 (169)
Travel time to district capital (hours)	11	6	7	3.5
Protected area (PA) establishment year	2012	2012	1997	1997
Village land within PA's core/buffer zone (%)	7/93	0/1.4	27.8/3.5	28.6/7.9
Land uses ^b				
Irrigated rice (%)	55	36	92	97
Shifting cultivation rice (%)	100	64	38	0
Vanilla (%)	70	84	92	74
Clove (%)	75	96	63	68
Zebu-pasture land (%)	20	12	48	37
Forest-based economic activities				
Collection of forest products (%)	100	83	96	77
Selling of forest products (%)	40	12	10	0
Main source of self-consumption rice ^c				
Irrigated (%)	15	20	67	97
Shifting cultivation (%)	75	60	25	0
Irrigated and shifting cultivation equal (%)	10	8	4	0
No rice cultivation (%)	0	12	4	3
Households interviewed by village (n)	20	25	24	31

^aPopulation density in inhabitants/km² in brackets.

^bPercentage of interviewed households that resort to these land uses.

^cPercentage of interviewed households for which the respective source of subsistence rice is the most important in terms of annual production.

were conducted in the local Malagasy dialect, later being translated for analysis. The interviews were conducted in parallel with a series of focus group discussions that served to elicit locally relevant well-being components at village level and whose results are presented in Llopis et al. (2020).

Before starting the interview, we explained to respondents the purpose of the study, requested consent to conduct and record the interview, informed them they could refuse to answer any question they did not feel comfortable with, that they could abandon the interview at any time (which none did), and that all responses would be anonymized for analysis. All participants gave informed consent verbally, which was considered appropriate given the high illiteracy rate in the area. We obtained permission to conduct this research from the General Directorate of Forests of Madagascar.

3.2 | Methods used to address the study objectives

We addressed our first objective by investigating human well-being using Nussbaum's Central Capabilities. The list served two goals. First, it provided a heuristic approach to elicit as many locally relevant well-being components as possible to be discussed in the interviews, given that asking only open-ended questions could fail to trigger

reflection on important aspects that might be taken for granted by respondents (Abunge et al., 2013). Second, using this structured approach enabled us to embed our findings in the wider debate on human well-being in conservation contexts, increasing the relevance of this research for other, comparable contexts in the Global South.

We further asked about perceptions of recent changes in satisfaction with these well-being components over the last two decades. This provided insights into factors influencing local well-being and shed light on some of the pitfalls of assessing subjective well-being, such as the influence of adaptive preferences or treadmill effects on people's accounts of their life satisfaction. In Supporting Information 1, we provide Nussbaum's definition of each Central Capability and the well-being components connected to them. Supporting Information 2 contains the interview protocol in local Malagasy dialect and Supporting Information 3 contains the English translation.

We address our second objective, investigating the cultural significance of the natural resources local populations most strongly rely on for their material well-being, by inquiring about the *non-material* or *non-nutritional* values that respondents assign, respectively, to eco- and agrosystems (i.e. forest and agricultural land) and to the cultural keystone species of rice and zebu. Keystone species are those that, in addition to their nutritional or economic value, are central to socio-cultural practices (Garibaldi & Turner, 2004). We

address our third objective, investigating the influence of PAs and recent cash crop price increases on human well-being, in three ways. First, by inquiring directly whether the respondents considered that the PA in their vicinity had influenced their lives, and if so, in what way. Second, by exploring the ways respondents explain their satisfaction and change in satisfaction with well-being components that are explicitly connected with cash crops. And third, by asking interviewees whether they would consider giving up rice cultivation if they could obtain the rice they needed from other sources (e.g. buying it), particularly taking into account the context of recent PA creation and cash crop price increases.

3.3 | Differentiation according to household characteristics

For all three objectives, we investigated whether the households' responses differed in terms of four variables. First, geographical location (or site, i.e. village), which is key to determining different well-being outcomes (Beauchamp et al., 2018), particularly in regard to differences in remoteness or proximity to and history of conservation schemes (Jones et al., 2020). Second, the respondent's gender, known to influence well-being dynamics (Abunge et al., 2013), especially in terms of social capital and possibilities for participation in local decision-making. Third, the household's land use portfolio, which might prove key to understanding differences in the material basis that households have available to support their well-being (Dawson & Martin, 2015). And fourth, the main production system of rice grown for household consumption (i.e. irrigated, shifting cultivation, both equally important or no rice production). This can help to identify which households are more dependent on forest land to meet their food security needs and are therefore likely to experience a wider range of impacts of conservation restrictions on their well-being (Brockington & Wilkie, 2015).

Using Fisher's exact test of independence, we investigated whether these four variables explained differences across households' current and changes in satisfaction with well-being components, non-material value assigned to natural resources, perceived influence of PAs on their lives and the household's readiness to give up rice cultivation. We also computed the odds ratios (Szumilas, 2010) between the four predictor variables and household responses, to explore the likelihood of interviewees responding in one direction or another. We conducted all analyses using the *stats* package of R software version 3.6.3 (R Core Team, 2020).

3.4 | Household land use portfolio cluster analysis

For site, gender and main source of rice, we used information on individual and household characteristics collected directly in the interviews. To elaborate a typology of households based on their land use portfolio, we conducted a hierarchical cluster analysis, clustered using Ward's minimum variance method. We included in the analysis

the household's land uses, out of the five most important land uses present in these villages: vanilla, clove, shifting cultivation rice, irrigated rice and pasture land, using for the latter whether the household raised zebu as an indicator.

4 | RESULTS

In this section, we first provide the results of the cluster analysis, and then dedicate one subsection for each of our three objectives, namely, first, current satisfaction with well-being components and changes in satisfaction along the list of Central Capabilities; second, cultural significance of natural resources (used to explore the capability of *Other Species*); and third, influence of PAs and cash crop price dynamics on well-being. We explore the four variables considered (household land use type, site, main method of rice production and gender) showing statistical significance to help explain differences between respondents across all three objectives.

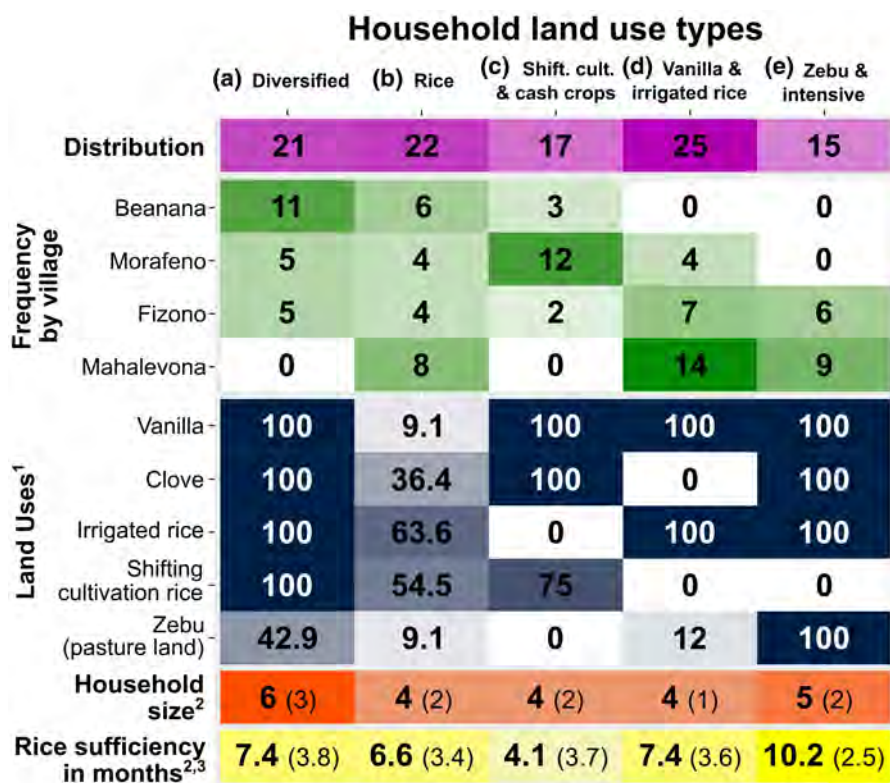
4.1 | Household land use portfolio typology

The cluster analysis resulted in five household land use types, referred to as types A to E. Each type is relatively equal in size, with the distribution per village broadly following the respective share of land uses in each village (see Figure 2 and Zaehring et al., 2016). Differences across household types for rice self-sufficiency, measured by the months a year households can consume their own production, and a key indicator of material well-being, were strongly significant (based on Kruskal–Wallis test).

All households in Type A, *diversified* farmers, cultivate all crops considered in this study. They are the largest households of all types and some 40% raise zebu. Half of households in Type B, *rice* farmers, carry out shifting cultivation, two-thirds practise irrigated rice production, a third cultivate clove, while hardly any grow vanilla or raise zebu. In Type C, *shifting cultivation and cash crop* farmers, all households produce both cash crops, three-quarters practise shifting cultivation, and none have irrigated rice or zebu. They are the least rice self-sufficient and most of the households are located in Morafeno. In Type D, *vanilla and irrigated rice* farmers, all households cultivate vanilla and irrigated rice, none are engaged in clove or shifting cultivation, and only 12% have zebu. Finally, all households in Type E, *zebu and intensive* farmers, cultivate what is considered intensive in this context, namely both cash crops and irrigated paddy rice, and raise zebu. They are by far the most self-sufficient in rice, and only comprise households from Fizonon and Mahalevona.

4.2 | Current satisfaction with well-being components and change in conditions

Households held a variety of views towards *Life* and *Bodily Health* well-being components, which relate to supporting a long, healthy



1: Percentage of households in each type having a given land use at present time

2: Standard deviation between parentheses

3: Kruskal-Wallis test p-value: < 0.001

FIGURE 2 Household land use portfolio typology ($n = 100$) based on a cluster analysis. The darker the heatmap colour in each row, the higher the value.

life, with access to healthcare, food, drinking water and shelter. While most respondents were satisfied with their access to health services (Figure 3), perceptions towards changes in access to healthcare varied, with strong differences by site. Nearly all households in Mahalevona were not satisfied with changes in access to healthcare, while a range of views were present in other villages. Regarding housing, an overwhelming majority of households were not satisfied with current conditions, but when asked about changes in such conditions, including electricity, virtually all respondents perceived an improvement. Concerning food, most people were satisfied with the variety they could access, but not with the overall quality, with many stating that they would have preferred more meat consumption. Furthermore, a majority reported a decrease in their rice self-sufficiency. Responses differed by site, with nearly all households in Morafeno reporting that their rice self-sufficiency had declined, with a more mixed spread of perceptions elsewhere. Regarding drinking water, most households were satisfied with the quantity available but not with the quality. This was due to concerns over the cleanliness of their main water source, the river, and most perceived a worsening trend in both quantity and quality.

We explored *Bodily integrity*, first, in relation to current security in the villages, where views were varied, and in relation to changes in this situation, with most people perceiving a worsening trend. Site explains differences in satisfaction with current security, with households in Mahalevona five times more likely to hold negative views than in other villages. And second, we explored *Bodily integrity*

with the possibilities of moving around, with which most households were satisfied and also perceived improvements. Again, site explains differences, with households in the most remote village, Beanana, not satisfied with the current situation, and Fizono, where the road was recently repaired, with the largest share of respondents considering the situation improved. For *Senses, imagination and thought* we asked respondents about their satisfaction with their level of education, with which nearly all respondents were not satisfied, and also about the education opportunities for children in their village, where views were more mixed. Although most people were not satisfied with current education opportunities in their village, a majority perceived improvements.

For the *Emotions* capability, we first asked respondents about their satisfaction with the amount of land they have to bequeath to their descendants, critical for raising children and in turn key to articulating socio-cultural and economic life across rural Madagascar. Although the majority of households were not satisfied with the amount of land to be left to their children, this view varied by household type. Nearly all Type B households (those relying almost exclusively on rice cultivation with barely any cash crops) were not satisfied, while Type D and E households (the least reliant on shifting cultivation and with the largest share of intensive land uses) holding a more even distribution of positive and negative views. The second question we used to explore this capability related to the respondents' perception of their ability to take care of other people, where all but one person were satisfied. A large majority were also satisfied

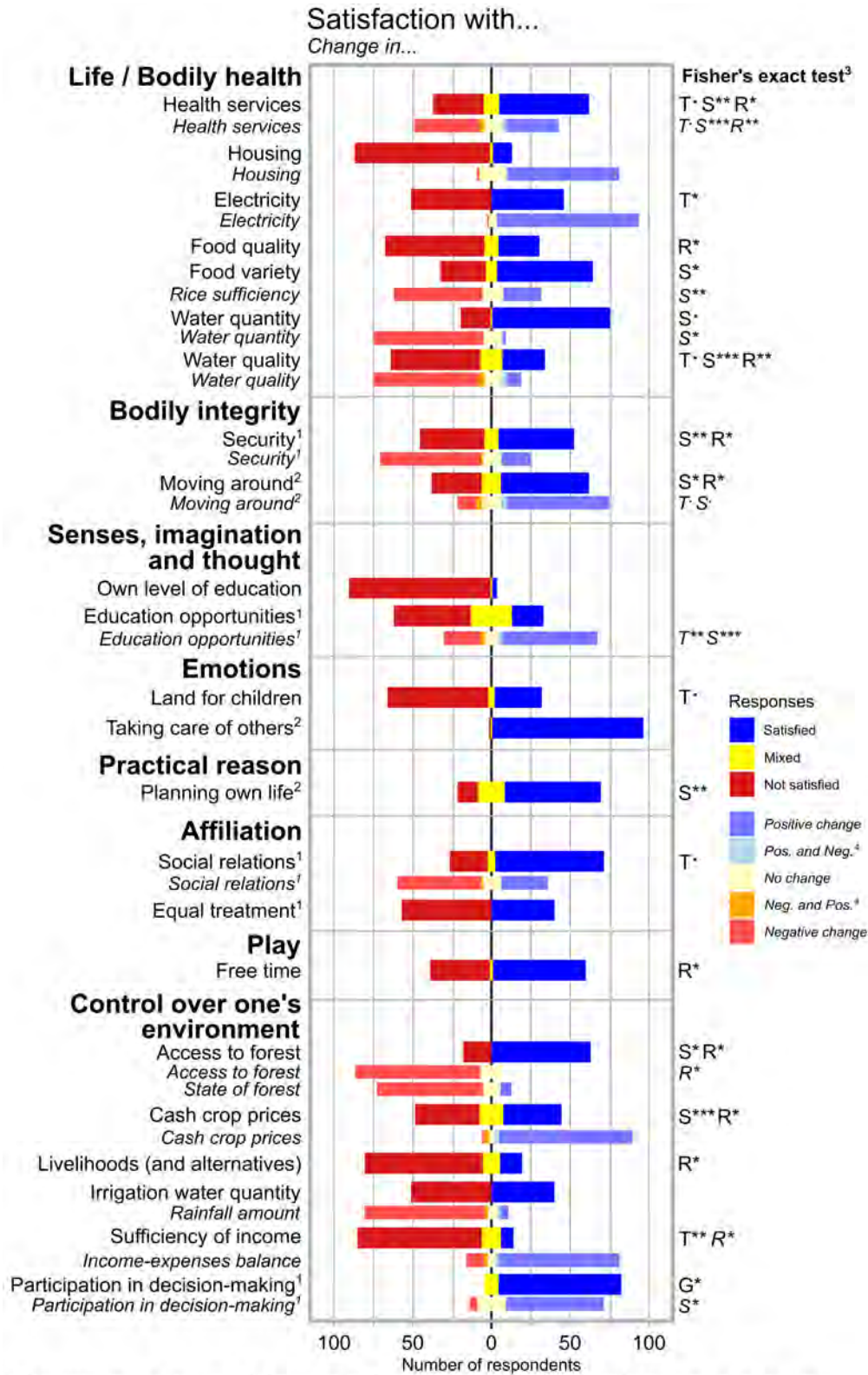


FIGURE 3 Household responses on current satisfaction with well-being components and changes in this satisfaction, along the central capabilities they most relate to. Note that the 'other species' capability is discussed in detail in Section 4.2.

with the possibilities they have to plan their life, which we used to operationalize the capability of *Practical reason*. This view differed by site, with virtually all respondents in all villages satisfied with their possibilities except in Beanana, where negative and positive responses were equally distributed.

Regarding the *Affiliation* capability, the first aspect we enquired about was social relations in the village, with a large majority satisfied with the current situation (Figure 3). However, when asked about the change in social relations, most households perceived a worsening trend. The second question we used to look into *Affiliation* related to equal treatment of people in their villages. Most households were not satisfied with the situation, in most cases mentioning differences between poor and well-off households. To obtain insights about the capability of *Play*, we asked respondents whether they were satisfied with their amount of free time, with a majority replying positively. However, responses differed depending on the household's main source of rice, with those mostly relying on shifting cultivation being three times more likely to be unsatisfied than other households.

Finally, we explored the capability of *Control over one's environment* by asking households about well-being aspects needed to support their livelihoods, and about possibilities to engage in decision-making processes in their village. While most households were satisfied with their current access to forest, most perceived a change towards less access or no change, with none holding a positive view. This was similar to perceptions on the state of forests, with most perceiving a worsening trend. Satisfaction with current cash crop prices was mixed, with both positive and negative views, although virtually all respondents perceived an improvement. A vast majority of respondents were not satisfied with either their livelihoods or available alternatives, or with current income sufficiency, although views differed by the household's main method of rice production. Nearly all households reliant on shifting cultivation were not satisfied with either component, compared with a more balanced view by those who mostly produced irrigated rice. Lastly, although almost all respondents were satisfied with their possibilities of participating in decisions taken in their villages and perceived an improvement in these opportunities, there were some differences by gender: Six female respondents but no male respondents stated that they listened to the discussions but did not participate.

4.3 | Other species: Non-material value of forest, zebu, agricultural land and rice

For the *Other species* capability, we investigated the value households assign to forest, agricultural land, rice and zebu that is neither strictly material nor nutritional. Nearly all households assigned non-material, non-extractive value to forest land (Figure 4). Most responses referred to regulation and maintenance ecosystem services delivered by the forest, such as provision of water, rain, or clean air, habitat for wildlife, and temperature regulation, with fewer seeing cultural services, such as existence (i.e. attraction for tourists) or

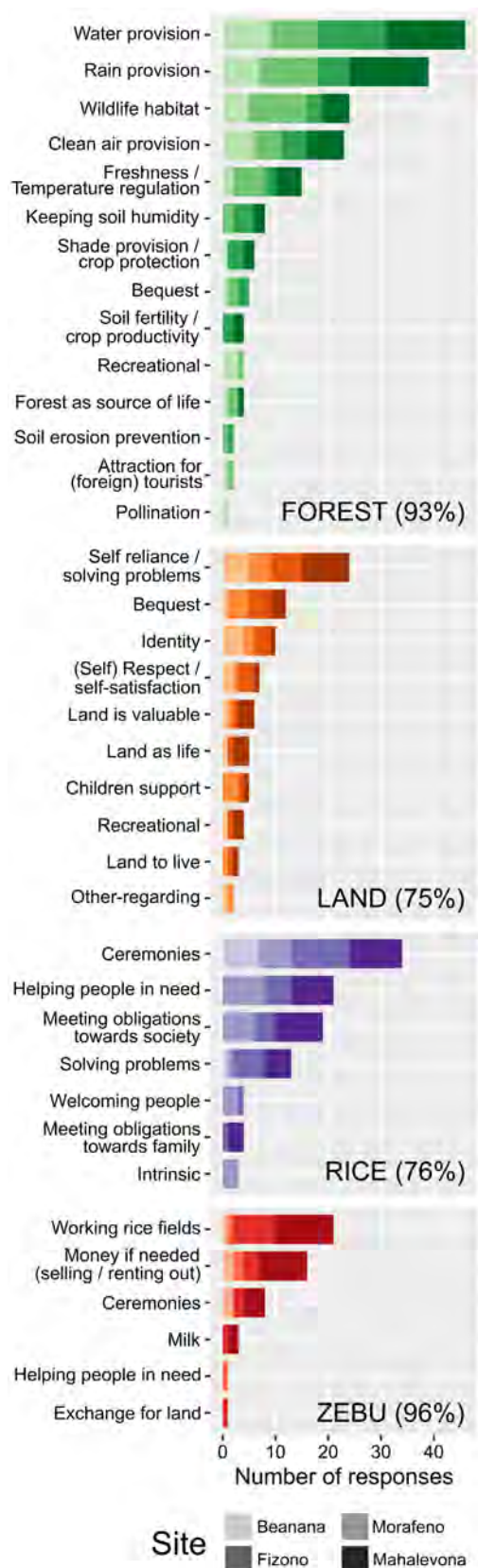
recreational value. Three-quarters of households considered that agricultural land had non-material value, in that having land allowed them to be self-reliant and respected in the village, that they needed land to bequeath to their children, or that land was a symbol of identity.

A majority of respondents also considered that rice had value beyond its nutritional role, the most cited being its value in ceremonies. People also mentioned *other-regarding* values such as helping people in need, or that rice was needed to meet obligations towards their local society and (extended) family, and to solve problems by selling part of the harvest. Finally, most of the households who raise zebu, around a third of all interviewed, considered the animals to have value that went beyond the nutritional. These mostly referred to the value of zebu in working the irrigated rice fields and as savings to resort to if needed (by selling or renting them out); only a few respondents mentioned relational values, such as the role of zebu in ceremonies.

4.4 | Protected area establishment and cash crop price increases

We asked respondents whether they considered that the establishment of the PA in their vicinity had influenced their lives. Around a third said that it had, with significant differences in responses across sites. In Beanana, where households most strongly depend on shifting cultivation and on collection and sale of forest products (Table 1), a majority of respondents felt the PA had influenced their lives, with households about four times more likely to hold that view than across all other villages. When asked whether the influence was negative or positive, answers differed depending on the main source of rice. Those engaged in shifting cultivation as the main source of rice were more than three times more likely to report a negative influence than those growing irrigated rice, the majority of whom perceived a positive influence of the park on their lives. For the 45% of households who stated that the PA had not directly influenced their lives, the large majority nonetheless mentioned positive aspects related to the existence of the PA ($n = 33$), compared with fewer reporting negative ($n = 6$) or both positive and negative aspects at the same time ($n = 6$). See Supporting Information 5 for a complete overview of responses.

Most respondents explained the improvement in the balance between income and expenses by the increase in cash crop prices ($n = 35$), the household's recent uptake of cash crop production ($n = 30$) or the household's cultivation expansion (allowing them to grow more cash crops) ($n = 14$). However, a number of respondents also stated a negative change in this balance, connected to the increase in prices of basic goods accompanying the cash crop price boom ($n = 5$). Households also linked the worsening security situation with the recent cash crop price increases, due to a higher incidence of thefts ($n = 17$), in particular of cash crops ($n = 13$). Households in Mahalevona, the village with the greatest extent of cash crop production, were nearly twice as likely to hold negative views towards the security situation than respondents in all other



villages. Similarly, most of the households that perceived a worsening of social relations pointed to less collaboration or solidarity between households than before ($n = 14$), and to the need to pay people for help that was previously offered for free ($n = 8$).

FIGURE 4 Household responses on the significance of forest and land beyond the material value, and of rice and zebu beyond the nutritional value, which served to explore the capability *other species*. The figure displayed is the percentage of respondents considering that these items had value that went beyond the strictly material or nutritional.

Finally, we asked respondents whether they would consider giving up rice cultivation, to which nearly two-thirds answered affirmatively. Responses differed depending on main type of rice production, with nearly 80% of respondents whose primary rice source was shifting cultivation stating that they would cultivate only cash crops if they could ($n = 10$), and that rice cultivation was too difficult or tiring ($n = 7$).

5 | DISCUSSION

5.1 | Central capabilities and dynamic perceptions on multi-dimensional well-being

Our investigation of current satisfaction with well-being components and changes in these dynamics structured along Nussbaum's Central Capabilities revealed issues that an exclusive focus on the material dimension of well-being would likely not have. Specifically, the study revealed four major insights.

A first insight is that, even though we presented the results on well-being components as separate entities, many of these components are strongly interconnected and mutually interdependent, and by extension also the capabilities they support (Horrell et al., 2020; Iversen, 2003). Agricultural land is a good example: Besides being an essential asset to produce food and thus support the *Bodily health* capability, people assign a bequest value to land (the *Emotions* capability) and consider it important to have land to feel respected in local society (the *Affiliation* capability). This is consistent with findings from other assessments of multi-dimensional well-being where material components appeared to contribute to more than one dimension (Beauchamp et al., 2018; Woodhouse & McCabe, 2018).

A second insight is the prominent influence of treadmill effects when investigating subjective accounts of well-being (O'Neill, 2008), which our combination of asking about current satisfaction with well-being components as well as changes in this satisfaction helped to unveil. Treadmill effects appeared most obvious with housing conditions, with which hardly any respondent was satisfied even though most mentioned substantial and recent improvements. This phenomenon can also be related to the fact that houses can be thought of as 'positional goods' (O'Neill, 2006), that is, whose perceived value is affected by how other people consider them. The increasing purchasing power of households that are benefiting most from the current cash crop boom, many of them investing in better and larger houses (Supporting Information 6), might encourage others to also consider doing so, not least because of the social status value of having what is considered locally as a good house (Llopis et al., 2020).

A third insight is the effect adaptive preferences have on how people reflect upon the state of their life and the circumstances shaping it (Crettaz & Suter, 2013). An example is the case of access to forest, with which most people were satisfied, even though most perceived a negative change in access.

A fourth insight is that events that happened more recently affect how people perceive their life situation and satisfaction with components of their well-being, referred to as recency bias (Garbinsky et al., 2014), when recollections of the past are dominated by recent events. In our case, this surfaced in the answers on 'moving around' in Fizonon, which most perceived as improved shortly after the road to the village was repaired, or the case of a new hospital being built in Beanana, which might have led residents there to have a more pronounced positive view on changes in access to healthcare.

5.2 | Other species

Exploring the non-material value local people assign to eco- and agrosystems and cultural keystone species, we illuminated the multiple contributions of nature to well-being in this context. These are increasingly understood as critical for grasping the full complexity of human well-being (Betley et al., 2021 [in this Special Issue]), and are otherwise difficult to unveil in broader assessments of nature's contributions to local residents in terms of income or provisioning and regulating services (Angelsen et al., 2014; Fedele et al., 2021).

In a first finding, we revealed the relational values people assign to agricultural land and rice. Land plays a central role for two main reasons. On the one hand, it is critical in allowing households to contribute to the autonomy of future generations, especially in regard to food security. On the other, it is key to ensuring that children can continue the traditions embedded in agricultural practices, thus enabling the social reproduction of these communities, particularly given the value agricultural land has in supporting a farmer's identity (Figure 4), also found recently in other contexts (Lliso et al., 2021 [in this Special Issue]). Concerns for both cross-generational food security and cultural continuity have been found to be of central importance for shifting cultivators in other contexts (Carmen et al., 2021; Kenter et al., 2011), and might help to partly explain the prevalence of this agricultural system in our study region (Laney & Turner, 2015). In the case of rice, the shared, societal values (Kenter et al., 2015) respondents expressed might be crucial in allowing individuals to feel as valuable and functional members of their communities (Fish et al., 2016). Furthermore, we have also revealed the key altruistic or 'other-regarding' value (Kenter et al., 2015) that people assign to land, and especially to rice, particularly in its enabling role for households to help other people, or to welcome visitors. This might, in turn, contrast with findings from nearby Malagasy areas where people appeared more reluctant to share rice, at least rice that was produced through shifting cultivation (Laney & Turner, 2015).

Second, we revealed the role natural resources play in sustaining people's autonomy. This is expressed by respondents in

regard to the value of land, rice and zebu in helping them to 'solve problems', enabling them to have the freedom to conduct their life in the way they want, or even the need for 'having land to live'. While this resonates with findings from other conservation contexts (Beauchamp et al., 2018), it points directly to the value that subsistence activities have for individuals beyond the strictly economic (Chan et al., 2011), including in our study region (Laney & Turner, 2015; Martin et al., 2022). Such benefits might include, for example, allowing people to live a life of dignity and autonomy, thus providing the basis for self-respect, an issue found to be important across the rural tropics (Markussen et al., 2018; Woodhouse & McCabe, 2018), and a central tenet of the capabilities idea (Nussbaum, 2000).

Third, we revealed the intrinsic value many people assigned to forest, agricultural land and rice, referred to as inherently valuable, 'forest as a source of life', 'land as life' or 'rice as having value in itself'. The multifaceted relational and intrinsic value people assign to the resources they rely on hints at the irreplaceable nature of these resources in the local socio-cultural panorama (Himes & Muraca, 2018), and further shows that cultural ecosystem services might provide several benefits at the same time (Chan et al., 2011), in turn supporting capabilities that might open the possibility of accessing further benefits (De Vos et al., 2018).

5.3 | Influence of protected areas on well-being

The first major insight regarding the influence of the PAs on local well-being is that most local residents perceived as positive the conservation intervention around their villages. This was because the conservation scheme was seen to be successfully preserving the regulation and maintenance services delivered by forests, such as providing water and clean air (Supporting Information 5), perceptions also found in the proximity of Mahalevona and Fizonon shortly after the PA was established there (Marcus, 2001; Ormsby & Kaplin, 2005). However, in these earlier studies, positive views were strongly connected with the small development projects delivered by the Integrated Conservation and Development project which initiated the conservation initiative there, which resonates with other conservation contexts in Eastern Madagascar (Rasolofoson et al., 2018), and also with our case (Supporting Information 5). This points to the expectations local residents might have in terms of compensation for restricted access to and use of forest land.

Nonetheless, a second finding is that such views were not balanced between communities, with those respondents most reliant on forest land for shifting cultivation and forest products, such as in Beanana (Table 1), perceiving the intervention more negatively. This is likely because they are more severely affected by conservation restrictions, which again echoes findings from eastern Madagascar that the most marginalized households face the highest costs (Rasolofoson et al., 2018). However, the fact that in Fizonon, the other village with a large area affected by conservation restrictions

while being strongly reliant on shifting cultivation and the collection of forest products (Table 1), households mostly held a positive view on the PA might be the result of adaptive preferences or a recency bias, as the conservation scheme was implemented much earlier here than in Beanana.

5.4 | Cash crop price boom and well-being

The first finding related to the recent surge in cash crop prices is the improvement in balance between expenses and income most respondents reported in connection with these dynamics. Despite the volatile spending attitudes found in nearby areas in relation with the vanilla price boom (Andriamparany et al., 2021; Zhu, 2018), and anecdotal observations while we were conducting fieldwork, our study did not capture this behaviour as a widespread phenomenon in our study villages (Supporting Information 6). Rather, much of the economic gain was invested in expanding the Bodily Health capability basis of households (e.g. housing, electricity) or on alternative livelihoods such as commerce, as well as on relational components such as children's education, aimed at expanding the capability basis of future generations (Otto & Ziegler, 2006).

The second finding however is that the dramatic rise in cash crop prices was driving up the cost of basic necessities and consumer goods. This was mentioned specifically by several interviewees, particularly affecting those not yet engaged in cash crop cultivation but living in the vanilla-producing areas of north-eastern Madagascar (Hänke and Fairtrade International, 2019). Furthermore, the rise in prices might help to explain the worsening security situation perceived by a majority of respondents in Mahalevona, the largest village and a cash crop hub, and also stressed in the other two villages with sizable cash crop production, Morafeno and Fizonon. This is in line with the findings from other nearby regions involved in vanilla production (Neimark, Osterhoudt, Blum, & Healy, 2019; Osterhoudt, 2020). Taken together, these insights could point to the emergence of trade-offs between well-being components, and likely, between capabilities, both within and across households.

A final finding likely connected to recent cash crop price dynamics, and potentially to the influence of PAs, is that most people acknowledged they would stop rice cultivation if it turned out they could rely on cash crop production and instead purchase the rice they need for consumption. This view was much more pronounced among those who produced rice mainly through shifting cultivation, citing the hardships involved in this practice, lack of free time and little satisfaction with livelihood alternatives. This suggests a latent motivation to move away from this agricultural system if other options to assure food security and support life improvement aspirations were available. This has also recently been found in the same area (Andriatsitohaina et al., 2020) and in other shifting cultivation contexts across the tropics (Fantini et al., 2017), although it somehow contradicts the findings from nearby areas in Madagascar (Laney & Turner, 2015).

5.5 | Limitations and outlook

Our approach also had some limitations. One was the difficulty we encountered when trying to separate the treatment of the 'Life' and 'Bodily Health' capabilities, due to overlaps that have also been found by other scholars (Horrell et al., 2020). Furthermore, while we were expecting to elicit more cultural values held on forest land—such as a sense of place, which is critical in conservation contexts (Hausmann et al., 2015)—these did not emerge in our discussions. This is likely due to the limited time we had in our approach as we attempted to cover *all* components important for well-being; fully exploring these specific forest-related aspects would have needed much more dedication (Gould et al., 2015). A related point is that we unintentionally collected material values when trying to elicit exclusively non-material ones on rice and zebu, which likely points to difficulties of unambiguously conveying the objective of these questions to respondents (Chan et al., 2011). Finally, our approach of asking respondents directly about how they *perceived* that the respective PAs had influenced their lives might have been unable to solidly pin-point how the conservation schemes had *actually* affected their broader well-being, a common caveat in using perceptions to explore conservation impacts (Bennett, 2016). This adds to the contradictory perceptions the same respondents might have on PAs (Martin et al., 2018), likely as a consequence of recency or other biases (Durayappah, 2011), and the issue that many benefits (and dis-benefits) from conservation interventions might go unnoticed (Barua et al., 2013), even when attempting to explicitly prompt for them.

In terms of outlook, we suggest that future research investigates the implications of our findings for conservation and development practice. One interesting avenue would be to examine the social and cultural factors that could enable households to transition away from shifting cultivation if they so wish, which has been investigated in the past from another angle, for example, through factors explaining the prevalence of this agricultural system (Laney & Turner, 2015). This could now be complemented with recent insights on biophysical factors that are locally perceived to constrain rice farming in eastern Madagascar (Dröge et al., 2022), or with perspectives highlighting the role that relational values may play in underpinning environmentally detrimental practices (Hoelle et al., 2021 [in this Special Issue]). Furthermore, in-depth investigation of the influence of the recency bias we observed on views towards the PA, and how this plays out in the longer run, can provide insights on the psychological factors enabling or preventing acceptance of conservation interventions in forest frontier communities (St John et al., 2013). This could, in turn, help to illuminate some of the social and cultural underpinnings of how local communities perceive the legitimacy (or otherwise) of conservation interventions (Keller, 2015). It would also shed light on the likelihood of non-compliance with PA regulations in the early years of conservation interventions (Solomon et al., 2015), or even during the establishment process, as with the case of the

pre-emptive forest clearing behaviour observed in the case of both PAs investigated in the present study (Llopis et al., 2019).

6 | CONCLUSION

Our study of disaggregated multi-dimensional well-being in a tropical forest frontier region in a context of recently established protected areas and a boom in cash crop prices revealed four main insights. First, the interconnected nature of human capabilities, with many of the well-being components needed to support them providing several benefits at the same time. Second, the difficulties inherent in exploring subjective well-being, like the effect of dynamic aspirations, particularly in relation to changing material conditions in a context of inter-peer evaluation and self-evaluation, and the influence of (e.g. recency) biases. Third, the multifaceted value—beyond the strictly economic or material—that local residents assign to the natural resources and species they most rely on. And fourth, the complexity of impacts that conservation interventions and sharp increases in the prices fetched by export cash crops might have on multi-dimensional human well-being at the forest frontier, likely leading to trade-offs between capabilities.

These findings highlight the need for—and the difficulties of—mainstreaming multi-dimensional accounts of human well-being into the design and implementation of conservation and development interventions. They also stress the need to pay particular attention to the (often hidden) cultural benefits local populations derive from the interactions with the natural resources they most rely on.

AUTHORS' CONTRIBUTIONS

J.C.L., C.L.D., F.S., P.M. and J.G.Z. developed the idea of the study; J.C.L., C.L.D., F.S., P.C.H. and J.G.Z. elaborated the interview protocol; J.C.L., C.L.D., P.C.H. and J.G.Z. conducted the data collection; J.C.L. and C.L.D. analysed the data; J.C.L. drafted the manuscript; all other authors contributed to it and agreed on the final version.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data this study builds on is deposited in Zenodo with DOI [10.5281/zenodo.6411477](https://doi.org/10.5281/zenodo.6411477), and URL <https://zenodo.org/deposit/6411477>.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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