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Land Use Preference for Ecosystem Services and Well-Being in Chittagong Hill Tracts of Bangladesh

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Abstract: Researchers increasingly investigate ecosystem services to assess their role in supporting livelihoods, well-being and economic value in order to inform decision-making. Many studies have explored links between ecosystem services and community-based livelihoods, with a very narrow focus on the importance of land use to well-being. We evaluated the value of ecosystem services from various land uses supporting livelihoods and the overall well-being of local communities in the Chittagong Hill Tracts (CHT) of Bangladesh. By applying a participatory habitat valuation approach with the ethnic communities from eight villages, we explored their preferences for, and perceptions of, ecosystem services and their sources in a multi-functional landscape under different land use, i.e., forest, swidden and low-land agriculture, fruit orchard and water bodies, and three land ownership contexts (state, private and mixed ownership on forest lands). Our findings revealed that community land use preference for ecosystem services supports ten different well-being needs. Among others, forests were valued land used for two-thirds of well-being needs, including the provision of shelter, nutrition, primary health care, an adequate supply of potable water, a lower level of ecological stress (i.e., protection from associated landslide soil erosion), cultural and spiritual benefits and livestock foraging. People commonly valued the food, income and nutrition contributions of all land uses. However, different forest and land ownership contexts and rights within the landscape influence people's preference for ecosystem services from land use in supporting their well-being. People with secure ownership (i.e., private and private-community) showed a broad and positive appreciation for ecosystem services to meet their well-being needs. Our study highlights that local and ethnic people's land-use preferences and ownership contexts are critical factors in assessing well-being in the context of multifunctional landscapes. We recommend that ecosystem services be considered in future decision-making related to forest and land use to support human well-being.

Keywords: valuation of ecosystem services; forest and land tenure; forest ecosystem services; landscape value; livelihoods; landscape multifunctionality

Citation: Ahammad, R.; Stacey, N.; Sunderland, T.; Sangha, K.K. Land Use Preference for Ecosystem Services and Well-Being in Chittagong Hill Tracts of Bangladesh. *Forests* **2022**, *13*, 2086. https://doi.org/10.3390/f13122086

Academic Editor: Radu-Daniel Pintilii

Received: 2 November 2022
Accepted: 5 December 2022
Published: 7 December 2022

1. Introduction

Ecosystem services (ES) are the benefits people obtain from ecosystem function [1]. Over the last four decades, the ES concept has been widely used in ecological, economic and social sciences to assess the state of ecosystem states and its various values [1–6]. The concept and its application has broadened methodological dimensions to evaluate the multiple and total values of ecosystem services. Globally the assessment of ES has been an essential tool to inform and integrate the importance of natural systems in policy for facilitating conservation, poverty reduction, food security and the overall achievement of the Sustainable Development Goals (SDGs) [1,7–11]. Despite progress in research, mainly addressing the basic livelihood needs of rural people from tangible ecosystem benefits, predominantly provisioning ES (i.e., food, fibre, energy, construction materials for shelter)

in developing countries are the focus of many studies today. By contrast, many intangible benefits, including those provided by regulation and cultural services that contribute significantly to regulating air and water quality, and various social and cultural aspects of people's well-being, are less understood [12].

Land use provides a wide range of well-being needs by making ecosystem goods and services available locally, regionally and globally. Land-use change can result in an improvement of one aspect of well-being, such as the economy, while causing a decline in several regulating, supporting and other ecosystem functions vital for sustaining community well-being [13]. A better understanding of how people's well-being is linked to ES is essential to sustainably using and managing different land resources [14,15]. With varying types of land use, ecosystem benefits differ even within rural populations, depending on people's knowledge, use and management of resources, and geographical location and context [16–21]. Although considerable research has been undertaken on land use change and ecosystem services, such studies have tended to focus on general valuations rather than understanding the differences in values attached to specific land uses within a landscape, e.g., [13,18,21].

People's utilisation of different land uses mainly relates to the ownership contexts in which they access natural resources and management [20]. Institutional processes, such as ownership rights and governance of land resources and usage, determine access for local communities, which can further impact the distribution of ecosystem services/benefits across spatial scales. Institutions related to land tenure imply the significant need for nature/ecosystem benefits in a specific social-ecological context and their roles in ecosystem management [20,21]. The context-specific perspective of the people and nature relationship often follows a different use of natural resources and knowledge systems within geographically and culturally defined settings [22,23]. Thereby incorporating ecosystem services within land use policies relies on people's ability to secure ownership. This is particularly critical for land ownership contexts in swidden agriculture-dominated landscapes where forest-based land tenure rights influence people's preferences for land use coupled with decisions for ensuring the sustainable provision of ES.

Due to over-population and an ever-growing demand for food production and settlement, Bangladesh has the long-standing challenge in sustainably managing natural resources, including forests [24,25]. By 2050, the population in Bangladesh will be 270 million, increasing challenges for the country to meet commitments towards SDGs [26]. Although forests and other land uses can contribute to achieving several SDGs related to poverty, health and food and nutrition, among others, unsustainable use and mismanagement of forest and tree-related agro-ecosystems pose a severe threat to food security. Over the past decades, forestland has decreased by 9%, barren land increased by 41.06%, settlement by 32.52%, shrubland by 21.76%, and standing waterbodies by 8.63% [27]. With increased competing contexts between forests, trees and other land uses, ecosystem service-based land management in particular offers a critical solution to meet people's well-being needs [25,28]. However, the disproportionate land ownership, social inequality, and environmental constraints associated with natural disasters influence the level of food production, especially for the rural population, in achieving a range of ecosystem benefits required for material and non-material well-being needs.

The south-eastern upland Chittagong Hill Tracts (CHT) contain a unique socio-ecological landscape inhabited by 12 different ethnic groups demonstrating a long tradition of forest and swidden agriculture land use [29]. Recent studies have highlighted the importance of forest ecosystem services and the contribution of traditional agriculture (i.e., swidden farming) to the livelihoods of local ethnic people as entirely or partly meeting their daily, basic material and non-material needs [18,28,29]. However, these studies report a limited recognition of ethnic people's rights to the forest, agricultural land (swidden farm and low-lying land use) or fruit orchards in the policies for the region and an undervaluation of the role of ecosystem services in sustaining people's well-being [18,28,29]. Lacking an understanding of the diverse ES values associated with land use generally can lead to conflict over natural resource management and the involvement of the local

ethnic population within forest management in particular. Historically, forest clearing involved in the swidden farming process was considered the driver of deforestation in the region [28]. However, ineffective forest policies primarily driven by commercial plantations with timber trees and fruit orchards replacing native vegetation have also contributed to forest loss, often more extensively. Thus, today, forest and land tenure rights assigned to the local ethnic communities have not improved their long-term ability to access land uses or meet their livelihood and well-being needs [30]. As such, the preference of ethnic peoples for forests and other land uses concerning their well-being are currently thwarted or poorly understood.

In this study, we evaluate the perceived ES value of various land uses (mainly forest, swidden and low-lying agricultural land, fruit orchards and water bodies) for their contributions to the well-being of rural ethnic communities in the CHT region. Our study addressed two questions. Firstly, do the perceived ES values differ between land use? Secondly, is the perceived value of ES from different land uses associated with forest and land ownership? By addressing these questions, this study identifies the well-being benefits rural communities derive from land uses under different forest and land tenure contexts. We consider that assessing the value attached by local ethnic communities to ecosystem services will be essential for understanding their well-being needs and their long-term interest in improved forest and land management [31].

2. Materials and Methods

2.1. Brief Description of CHT's Land Use Context

The CHT region contains 10% of the country's total land and almost 40% of the forestlands [32]: Figure 1. Forests account for just over 30% of the land use in the region, although, in the CHT, less than a quarter is natural forest. Secondary forests, mixed with natural and planted trees, sparsely distributed trees and bamboo, are widespread in the region. Throughout the 19–20th century, planted forests with teak (*Tectona grandis*) and fast-growing species such as gamar (*Gmelina arborea*) expanded across the region driven by colonial and state policy for commercial harvesting and, later, increased plantation goals. This process of plantation impacted local ethnic people by converting the agricultural lands, mainly swidden farms, into monoculture tree plots. At least twelve ethnic groups rely on forests to meet their food needs, mainly leafy vegetables and fruits, fuel wood and construction materials. Despite this forest reliance, minimal tenure rights exist within the local ethnic population to access forestland, including planted land uses across the region.

Agriculture land use in the CHT is constrained due to hilly and medium to steep slope topography over two-thirds of the land [33]. Swidden farming along the hillslopes (also referred to as shifting cultivation) is the predominant agriculture land use practice (16% of the land use) for local people. This land use was traditionally managed for annual crop cultivation followed by a fallow period of 10–15 years, but has recently declined due to limited availability of land, lower productivity and insecure land tenure. Early assessments erroneously report that swidden agriculture land use only contributes to subsistence level production, has no significant economic benefit and causes forest loss and soil erosion [29,33,34]. However, this land use provides some critical form of provisioning services for food sources managed with traditional knowledge depending on the social and ecological contexts of the rural population [30]. Besides the swidden farming practice, small low-lying lands are cultivated with rain-fed and irrigated farming systems for paddy, sugarcane, maize, tobacco and seasonal vegetable production. Despite the low availability of low-lying agricultural land use, it is often considered productive and economically viable.

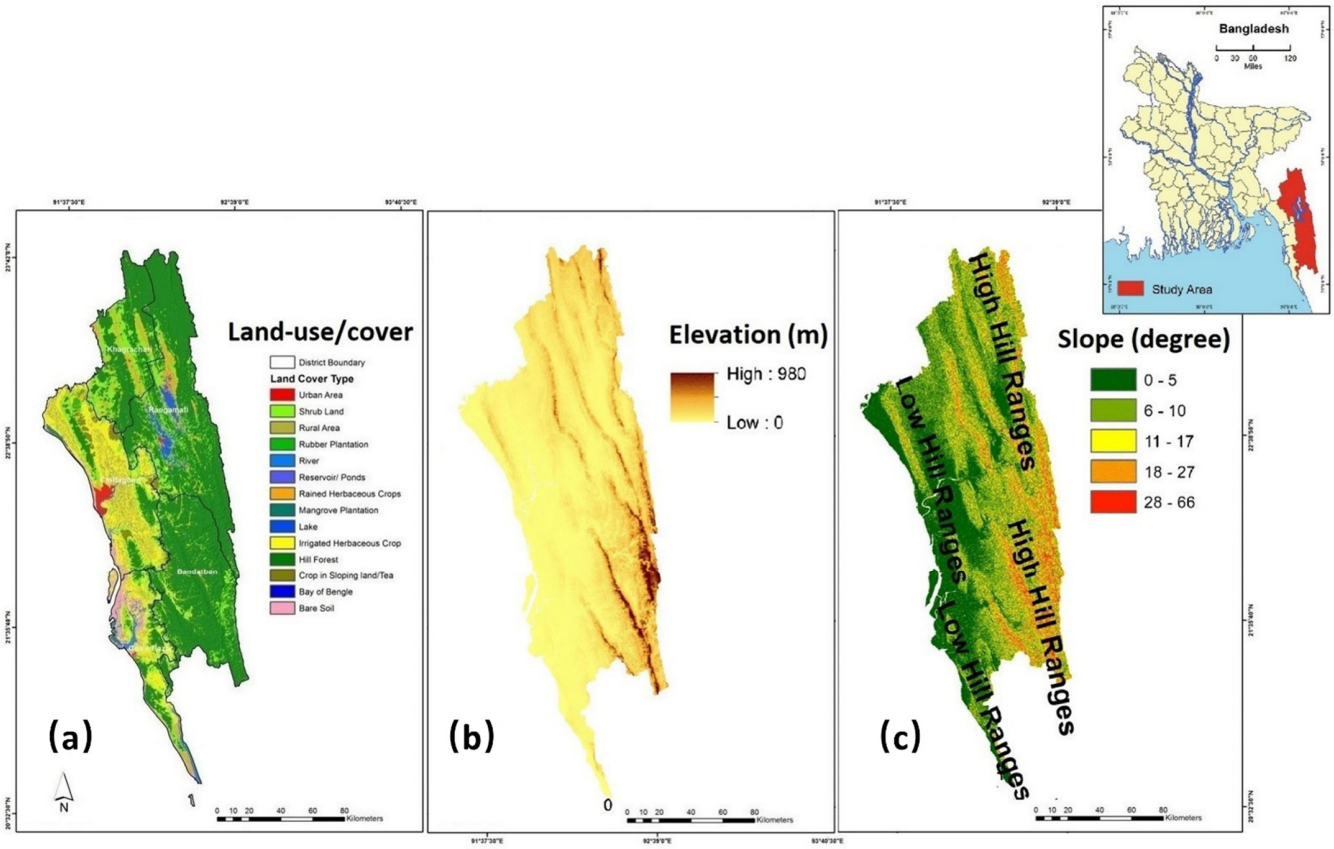

Figure 1. Land use/cover (**a**); (**b**) elevation; and (**c**) slope in the CHT.

Since the 1980s, horticulture with fruit orchard land use (i.e., tree-based agroforestry systems) has increased to improve the agriculture systems and reduce tree loss associated with swidden farming in the region. Enhancing the economic benefits, retaining tree cover on the land and limiting land degradation were the priorities of the fruit orchard based agroforestry extension. Although not extant across the region, fruit orchards with a mix of fruit trees (pineapple, orange, banana, jackfruit and mango trees) and teak plantations increased in the areas closest to markets and roads [29]. Fruit orchards with trees account for roughly 28% of the total land use [35]. However, the adoption of the fruit orchard land use is impaired by the remote locations, poor transportation, insecure market access and overall tenure situation. Notably, local ethnic people without adequate land tenure have not fully adopted fruit orchards [30,36].

Regardless of any land use for agriculture, horticulture and forestry, forest and land tenure in terms of ownership rights of the local ethnic people for natural resource management is often insecure and complicated [37]. One of the key underlying reasons is that the region's significant land (i.e., around two-thirds of the total land designated as forest, including unclassed state forests) is owned by different state departments. The local forest department regulates over 35% of the state-owned forest lands and adjacent land use with strict control on forest product collection and minimal rights for local ethnic communities (Table 1) [38]. The other 65% of forestland, especially unclassed state forests (i.e., barren lands without significant tree cover) is under the control of the local land administration. People's access to state-owned and unclassed forests is limited or partial without secure tenure rights. Customary land ownership, another form of community tenure, very often overlaps with state-designated forest-controlled areas, constraining people's access to the collection of forest and non-timber forest products, swidden farming and long-term ownership of the community-conserved regions. Only a limited extent of customary rights to lands is currently exercised, allowing people to use forest and agriculture with or without clear boundary demarcations. Customary ownership generally allows ethnic people to

access swidden farming and a small area of common forest resources. Private ownership, a secure form of land ownership through land title, is minimal in the region. The secure rights through this form of private ownership of forest and planted tree land use are generally limited within CHT's poor and marginalised ethnic communities.

Table 1. Forestlands under different management authorities in three districts of the CHT [38].

District	Forest Department Managed		District Government Controlled	
	Reserved Forests (ha)	USF Lands (ha)	USF Lands (ha)	Total Forest Land (ha) by District
Bandarban	107,095	15,646	200,151	322,892
Rangamati	248,855		309,267	558,122
Khagrachari	38,800	1702	183,837	224,339
Total forest	394,750	17,348	693,255	1,105,353
% of total forest area	35.71%	1.57%	62.72%	100%

2.2. Approaches to Data Collection and Analysis

This study applied a participatory rural appraisal tool called Pebble Distribution Method to the local ethnic population in the CHT region to quantify their preferences and the perceived value they attached to important ecosystem services about their contribution to well-being [39]. This tool was used to assess people's judgement of the relative importance of various ecosystem services derived from forests and land uses for their well-being [40,41]. Value is often associated in economics with price, quality of goods and services and willingness to pay for marketed or non-marketed ecosystem services. In this study, we used ecosystem services value, not in terms of direct monetary output, but as a reflection of the local people's perceptions of the relative importance of forest and other land use benefits required to meet their well-being needs (e.g., adequate food, gain income, safe shelter, energy, etc.). The advantages of applying this approach included capturing local well-being priorities rather than the interpretations of external researchers and avoiding the complex and financial quantification of ecosystem services for which no market existed [16,39].

Although individual interviews could offer a more detailed perspective of ecosystem services, we conducted group deliberations to establish a consensus on the value of specific land use for different ecosystem services among the participants in each workshop setting. In general, the ethnic people in the region have experienced relatively similar social and ecological challenges in terms of limited availability of low-lying plain lands and insecure ownership rights to swidden farming lands or planted tree lands. However, the recent trend of the demise of swidden farming land use followed by intensive agriculture and the establishment of monoculture tree plantations has had various impacts on the livelihoods and well-being in different areas of the region. In particular, we considered that the difference in the governance of forest and land use by state, private and community management has also influenced the preference of the participants where they are located. Focus group discussions enabled us to save time in accessing and explaining the ecosystem services to the respondents, who were from socially and ecologically dispersed communities. Through this participatory approach, we were able to explore the perceived value and importance of ecosystem services to the ethnic population's livelihoods and well-being and identify what they considered to be the benefits, their sources and their linkages to well-being.

During 2015–2016, the first author conducted a scoping survey as a part of the global agrarian change study approach (led by the third author), by undertaking an initial literature review and consulting the local government, non-government organisations and local ethnic chiefs to identify representative villages in the region [29]. The first author

selected 12 villages in consultation with the second and third authors that represented the dominant characteristics of current land use practices (e.g., swidden farming, forest and tree-based ecosystems, low-lying agricultural land, fruit orchards) in the region [42]. The distinct differences in the communities selected for the study villages were their locations, land use, forest and land ownership (Table 2). The communities in remote villages had a higher reliance on swidden farming and forests for subsistence and cash income without secure land ownership title [30]. In contrast, people with secure land ownership practised swidden farming to a lesser extent in intermediate and on-road locations. They were more engaged in low-lying agricultural cropping practices and planted tree areas with fruit orchards. Of the total of 12 villages, we randomly selected eight villages for focus group meetings, covering two-three villages from each location. Taking account of the characteristics (Table 1), we generally consider that the communities of villages within one location are more similar in land use practice and ownership than others.

Table 2. Salient features of the villages in three different locations of the CHT region, adapted from [29].

	Remote	**Intermediate**	**On-Road**
Name of villages	• Uluchari • Chainda • Marma • Pangkhua para	• Paglachara • Angadpara • Bijoypara • Suanglupara	• Khamadong • Kamalong • Jogeshkarbaripara • Bagmara Headmanpara
Ethnicity of inhabitants	• Tanchangya/Chakma • Pangkhua • Marma	• Tanchangya • Marma • Bawm	• Marma • Chakma
Population density (per sq. km.)	38	62	176
Land use types	• Swidden agriculture • Fallow land • Natural and/ secondary forests	• Swidden agriculture • Low-land agriculture • Secondary forests • Plantations • Fruit-tree garden	• Low-land agriculture • Plantations • Small fruit-tree garden
Land ownership	• State	• State • Customary • Private (land title)	• State • Private (land title)
Location (distance to sub-district/district market)	• 2–3 h travel by boat	• 0.5–1 h by motorbike	• 30 min by motorbike

With a small team of locally recruited research assistants, the first author organised eight focus group meetings with local communities in the CHT region to quantify their preferred (most important) ecosystem services of different land uses and their linkages to livelihood and well-being constituents (Figure 2). Each focus group consisted of six-eight individuals with various occupations, including forest users, swidden farmers, commercial farmers and politically elected community members from the group's village. The field team discussed the ecosystem services concept with participants in the local language to introduce its importance and scope in terms of more comprehensive benefits. We did not expect people to be familiar with the technical term. The field team presented the well-being concept by describing it as a combination of security, essential material for life, adequate food and nutrition, health, and social relations.

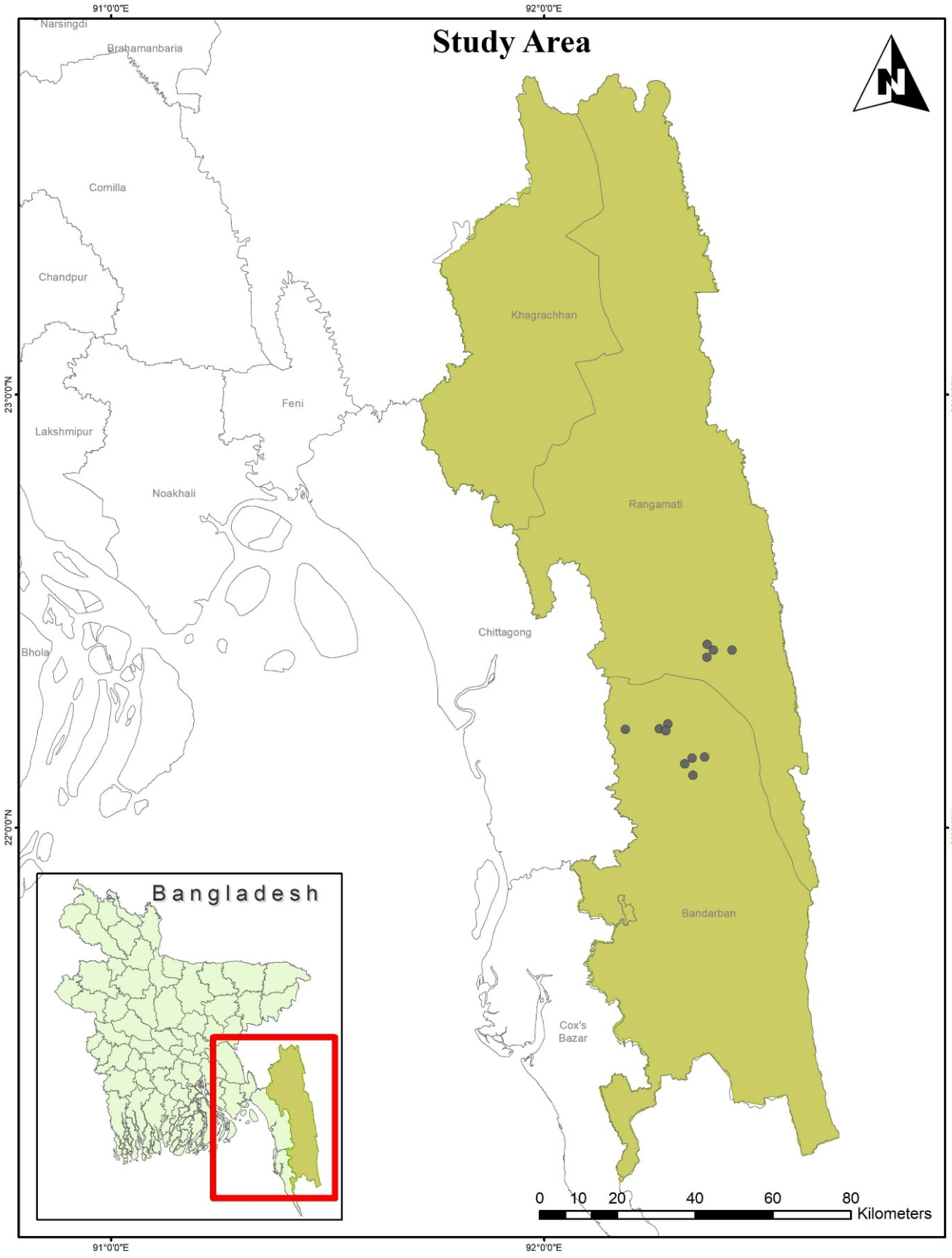

Figure 2. Study location of 8 villages in CHT region (of 12 villages) indicated on the map where focus group meeting was undertaken.

In each focus group meeting, the participants were asked two questions. The first question was: What are the most important benefits you receive from the surrounding landscape, focusing mainly on land uses? The participants were allowed to discuss the surrounding land uses and identify their valued benefits. Our study thereby identified the benefits of forests, trees and other land uses that the respondents considered most important. Occasionally, the field team introduced a list of expected benefits identified for this region related to land use [18]. Then, to determine the comparisons of land uses, we asked a second question: From where do you obtain or receive the most benefits in the landscape?

In the meeting, the participants listed the benefits they thought were important to their livelihoods and well-being. In each village, the participants discussed within the group to reach a consensus on the main forest and other landscape components/land use benefits they considered necessary for meeting their well-being. Then, the field team asked them to evaluate the benefits based on their importance and distribution across sources (land use). The participants scored the relative importance of the identified ecosystem services for the respective well-being constituents on a scale of 1–100. They evaluated the benefits more than once, according to their linkages to the livelihood and well-being requirements and sources. In so doing, they identified the main benefits of the land uses that they considered important. Once they had evaluated the important benefits for their respective well-being constituents, we discussed their reasons for choosing the benefits for the respective forest and other land uses. In this scoring part of the focus group, the participants were asked to distribute 100 counters (buttons, seeds, or pebbles) between labelled and illustrated cards in proportion to their 'importance'. We recorded the ecosystem services' values (counts) of land uses under different well-being categories in a spreadsheet.

We calculated the percentage of broad ecosystem services categories (i.e., provisioning, regulating and cultural services). Then we tested the difference among land use scores for well-being needs using Kruskal-Wallis test. We analysed the post hoc comparisons of different land-use preferred for each well-being need in R statistical programming. We also compared the well-being needs with forests and land uses and different management contexts i.e., given different forms of ownership rights of the participants in the private, private-community and state forest and land use. We obtained the ethics approval for this research through the Charles Darwin University Human Ethics Committee (ethics clearance number: H15005). We also received informed consent from all participants for our study.

2.3. Limitations of the Research

Our study was carried out via a focus group meeting rather than individual interviews or surveys. The group approach has given us a better understanding of how the majority of people in each location value ecosystem services. However, we acknowledge that the focus group may have masked individual heterogeneity on the preferences of the ecosystem services from specific land uses to meet the well-being needs, within this culturally diverse area of the country. Individual contexts of the rural ethnic population with different socio-economic characteristics, wealth conditions, ethnic backgrounds and level of land ownership may be valuable information in covering the breadth of ES value at the household level, preference of land uses and target the management interventions for improved forest and land use practices, to meet their most well-being needs.

3. Results

3.1. Preferred ES for the Well-Being

Our analysis presents reasons and people's preferences for ecosystem services regarding their importance for well-being (Table 3). Local communities identified eight of the most important ecosystem services, i.e., timber, bamboo and grass for housebuilding, protection from soil erosion, water, fuel wood, spiritual benefits, food for own uses and livestock grazing, and primary medicine (Table 3). These benefits meet their well-being needs

in a number of different ways, including nutrition and income. The valued well-being needs include the ability to obtain safe shelter, adjust to ecological stress, water, secure energy, adequate food and nutrition, food for livestock, avoid disease, to meet cultural and spiritual needs. Among the specific well-being needs, people preferred and valued safe shelter (>70 points) and the ability to protect land from soil erosion (50–70 scores) (after that, this well-being worded as reduce ecological stress) as highly important services. Overall, 75% of the ecosystem services the respondents identified were provisioning services, while those remaining were regulating and cultural ecosystem services.

Table 3. Local community's identification of ES, the reason for preference and linkage to well-being.

ES Preference	Reason for Preference	Relevance for Well-Being Components (Following MA, 2005)
Timber, bamboo and grass for housebuilding/construction	Locally available raw materials, low-cost and traditional knowledge in building housing	Safe shelter
Protection from soil erosion and fertility	Reduce soil erosion for crop production and protection from landslides	Ability to reduce ecological stress such as landslides associated with soil erosion
Water	Water only sourced from springs, creeks adjacent to forest	Adequate water for use
Fuel wood	Mainly used for cooking and boiling water	Ability to secure energy use
Spiritual benefits	Worship and peaceful living	Cultural and spiritual benefits
Food	Crops cultivated; gathered from the forest and adjacent wild environment	Adequate foodAdequate nutrition
Livestock food	Availability of food for livestock grazing	Adequate food for livestock
Primary medicine	Available plant materials and traditional knowledge associated with healing practices	Ability to avoid disease
		Access to income

3.2. Land Use Preferences for ES to Support the Well-Being

The analysis presents the association of the most preferred land use for specific ecosystem services required to meet people's basic well-being (Figure 3). The five land uses preferred by local communities for ecosystem services in the landscape were forest/planted tree land, swidden/fallow land, low-lying agricultural land, fruit orchards and waterbodies. Among those land uses, the forest was the most preferred, followed by fruit orchards, swidden/fallow, low-lying land and water bodies. Forest land was preferred for almost all the ecosystem services that the local people valued for their well-being (Figure 3). Compared to all other land uses in the landscape, the forest was the single most preferred land use with diverse options for contributing to specific well-being needs through energy, safe shelter, cultural and spiritual benefits and an enhanced local people's ability to avoid disease. Aside from forests, our analysis showed the people's preference for fruit orchards and low-lying and swidden agriculture land use for meeting safe shelter and energy needs (Figure 3).

The land use preference was significantly different for ecosystem services in attaining well-being needs ($X^2 = 77.986$, $p < 0.000$). The post hoc comparisons of land use showed that forest was valued significantly higher than other land use ($p < 0.05$) for its benefit in enhancing people's ability to avoid disease, its cultural and spiritual importance, energy use, safe shelter and supporting adequate water for use. Water bodies were the most preferred land use for adequate water ($p < 0.05$) other than forest. To secure adequate food, only low-lying agricultural land was more preferred than any other land use ($p < 0.001$). No significant difference was found in the land use preference for adequate food, nutrition, income, food for livestock and ability to reducing ecological stress such as soil erosion or landslide. Forest and low-lying agricultural land were also more preferred for adequate livestock food.

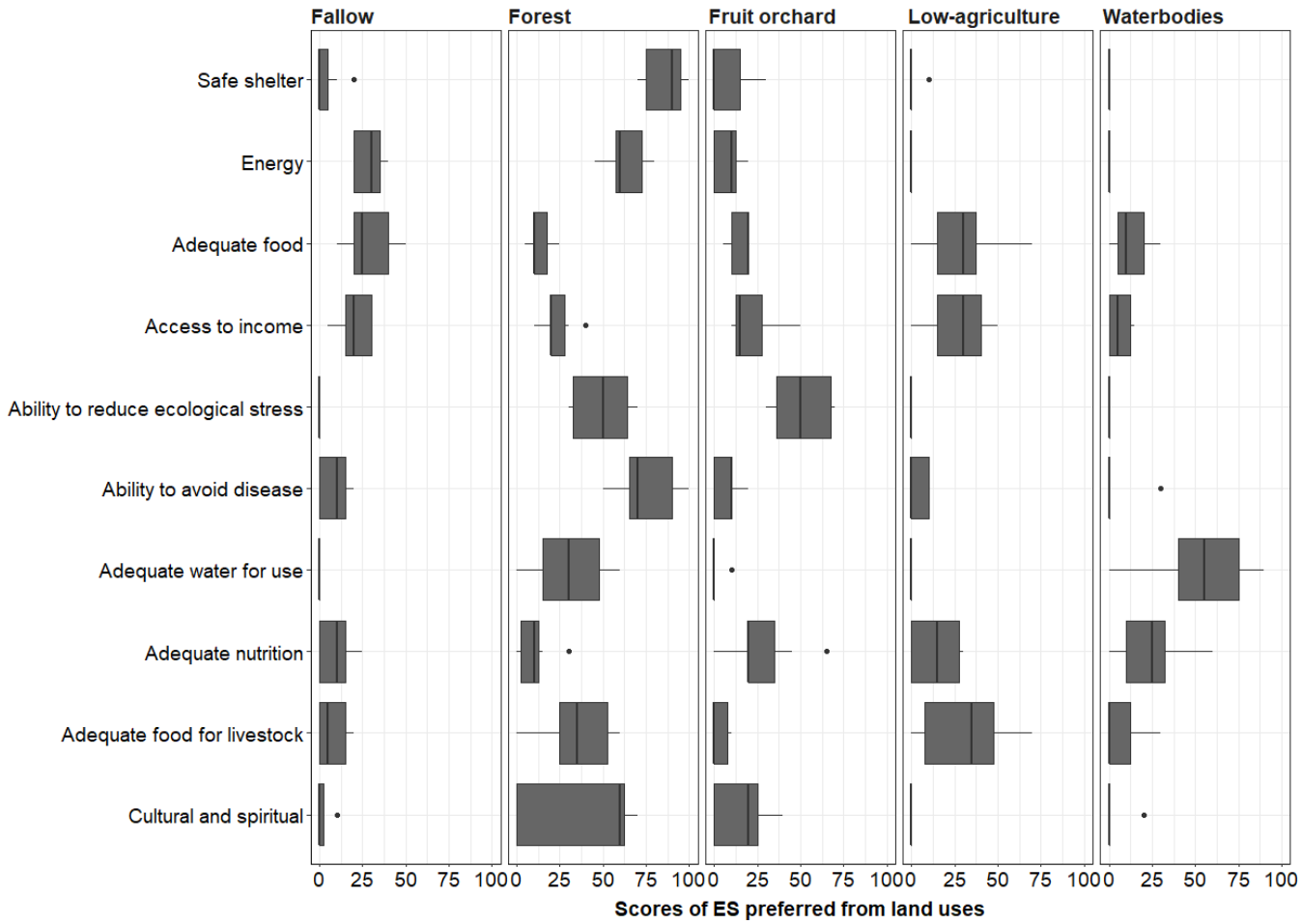

Figure 3. People's preferences for ecosystem services from different land uses to meet their well-being needs.

3.3. Land Use Preferences for ES under Different Ownership Contexts

Further analysis showed the influence of forest and land ownership contexts (state, private, private and community) on people's land use preference for specific well-being needs (Figure 4). Participants in state land-owned areas, reported forest over others for all well-being needs. Within the state and private-community land-owned areas, people showed more preferences for forestland use for the ability to avoid disease, energy and safe shelter, which is slightly higher than those in private ownership. Fruit orchard was the commonly preferred land use for adequate nutrition and ability to reduce ecological stress across all three ownership areas, with partly high perceived importance in private and private-community ownership areas. In private and state ownership contexts, people qualified the swidden agricultural practices in the maintenance of diverse well-being options, with slightly high value reported for this land use in state owned areas. Water bodies were highly valued land use by participants in the private and private-community ownership areas regarding water need compared to those in state-owned forest areas. People in state land ownership considered that waterbodies enhance their ability to avoid disease more than those in private and private-community villages.

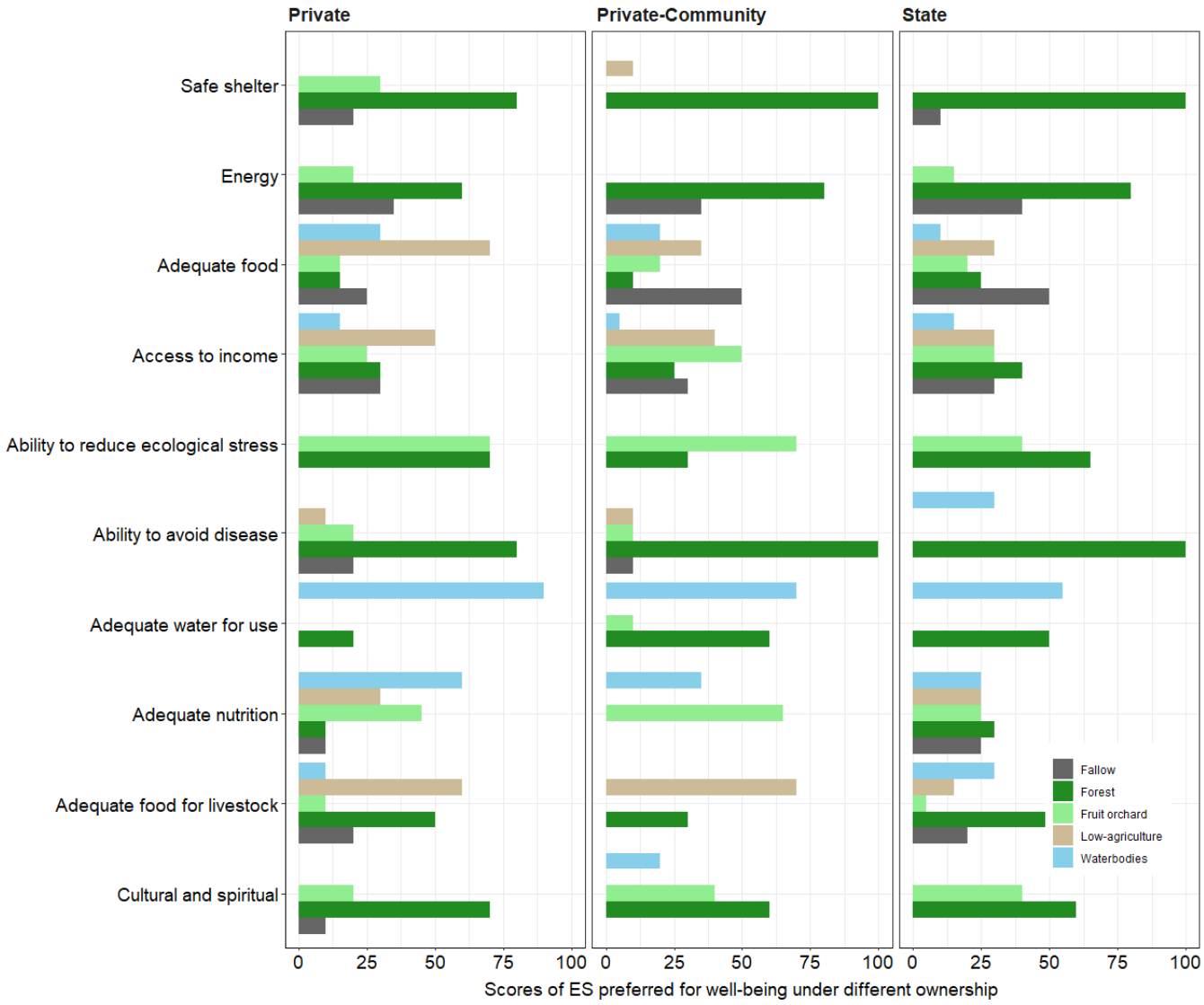

Figure 4. Variations of land use preference for ES to support well-being under different land ownership contexts. The top labels of the "x" axis show the ownership contexts. The "y" axis shows the well-being needs.

Across all the ownership contexts, participants valued swidden agricultural land as a source of adequate food and wood energy with relatively high value in a state ownership context. Among all ownership cases, the private ownership participants preferred low-lying agricultural land use. This is also observed for the swidden agricultural land use that participants generally valued for energy contribution, apart from forests, across all three ownership contexts. The participants located within private and private-ownership with secure access to land use showed a high preference for low-lying agricultural land for adequate food for livestock, compared to those in state areas.

4. Discussion

Our study revealed people's preferences for ecosystem services that supported their well-being in 10 different ways, mainly safe shelter, ecological stress reduction, disease avoidance, adequate water use, and cultural and spiritual satisfaction. Local people valued forests and land uses such as swidden farming/fallow land, low-lying agriculture, fruit orchards and waterbodies as key sources to obtain their preferred ecosystem services to support their well-being. The preferences for land use and related benefits assessed in our study reflect the different values people attached to secure their well-being [43]. The land

use and associated ecosystem services, in particular, show the varied forms of well-being impacted by different management contexts within the same landscape.

4.1. Valuing ES for Well-Being

Previous studies mention individual households' perceived ecosystem services demand without explaining how this relates to people's well-being in rural contexts [19]. Our study accounted for ecosystems' highly valued contributions to basic well-being: safe shelter, the ability to reduce ecological stress, primary energy, cultural and spiritual benefits, adequate water for use and access to traditional health care. A similar set of well-being needs reported in South Africa showed a specific pattern of ecosystem services used by households [44]. In our study, people preferred safe shelter, which identified their persistent need for construction materials, including bamboo and timber provisioning ecosystem services. This finding supports previous studies showing that changes in forest areas affect rural people's well-being owing to reduced secure access to forest resources to gather construction timber and non-timber forest products, including bamboo and the inability to maintain dietary diversity because of the lack of forest-sourced wild foods [45,46].

Aside from these benefits, which are directly related to community use-values, people's preference for ecological stress reduction (i.e., protection from soil erosion or maintaining soil fertility) reveals an indirect contribution to the ecosystem itself to maintain farm productivity and support the long-term subsistence of the population, which is directly exposed to food insecurity and must rely on its surrounding ecosystem. Soil erosion and associated fertility loss resulting in a decline in land usability and further ecosystem degradation found in our study is a common concern in swidden-dominated agro-ecosystems [47]. Our participatory valuation of ecosystem services reflects people's different levels of exposure to nature, experience and effects on improving well-being [9,43]. Local farmers experiencing a decline in farm productivity showed a positive attitude toward restoring the forest landscape in the CHT region.

People's preferences for ecosystem services for well-being needs reflect a common connection to their landscape in the CHT. For instance, specific ecosystem services, such as the ability to avoid disease through traditional healing, reflects a positive attitude toward the ecosystem in maintaining health care in all the land use practices we studied. Preferences for the cultural and spiritual benefits of ecosystems also indicate better social relationships and attachment to the landscape [48,49]. These cultural benefits and the realisation of ecosystem services are strongly linked to the values and norms of Indigenous people and local communities in many countries across the world [14,50–52].

Cultural value, in terms of a sense of place, a sacred landscape, and the role of spirituality in maintaining native vegetation and conservation of watersheds, indicates the strong connection to forest conservation that many Indigenous populations have [29]. However, driven by the global focus on carbon-based forest management, national forest policy ignores local and ethnic people's cultural value given to forest conservation or their perceptions of changing landscapes [12]. Assessing local forests' social and cultural values and the customary rules and knowledge that have persisted and been co-produced over time will be a crucial area for further research to support locally adaptive forest management in maintaining its global value. In this regard, customary management can play a critical role in maintaining the traditional knowledge of community forest protection for watersheds and rule-making in sustainable use of non-timber forest provisioning ecosystem services.

4.2. ES Value Associated with Different Land Uses

The ecosystem services preferences of local people revealed that well-being was strongly associated with different land-use configurations in a landscape [16]. Forest and tree-based ecosystems, especially, were highly valued for providing most of the benefits required to achieve well-being. Forests are mainly beneficial for safe shelter, energy, cultural and spiritual needs, ecological stress reduction, primary health care or traditional healing,

adequate water, and livestock food sources. Apart from forests, fruit orchard land use is valued for nutrition, adequate water, minimisation of ecological stress, safe shelter and cultural and spiritual benefits.

Previous studies have mentioned that the increased demand for fruit orchard land use is driven by government policy supporting agro-forest expansion to replace swidden agricultural practices in the CHT and other upland landscapes of Southeast Asia [34,53]. Although swidden farming land was considered to show low productivity agriculture practice in such studies, our study found that people's choice of this land use existed to support adequate food, income and energy sources. The social and cultural importance of this subsistence land use, i.e., swidden farming in our case, is more important than economic value. Interestingly low-lying agricultural land use was highly preferred for adequate food, nutrition, income and livestock grazing benefits. Low-lying agricultural land could be cultivated with commercially important crops (i.e., tobacco, potato, taro) on a rotational basis for more than two seasons in a single year, even though the proportion of this land use is relatively low due to the region's physiographic conditions. A positive attitude was also observed towards waterbodies because of the need for adequate food, nutrition, water and cultural and spiritual benefits. Therefore, it is evident that rural people have a wide range of social, economic and ecological values embedded in most land uses in their vicinity.

Agricultural expansion and the development of alternative land use with commercially valuable crops, including monoculture trees and fruit orchards, often limit the diversity of well-being options in a landscape [28]. Provisioning ecosystem services for food and income benefits showed a strong positive association with most land uses, except forests. Our study on the low valuation of forest-sourced food and nutrition contradicts the value of the forest for food of individual households recently reported by other studies in the region and elsewhere in the tropics [54]. Forest and tree-based foods were considered of low importance by community participants, who were more driven by their interest in land use to enhance food production and economic gains. In recent decades, there has been much interest in fruit orchards, monoculture crops, and planted land uses without considering people's differences in the capacity to access such land uses. This community-based valuation may contrast with that of individual households that might require forest-sourced foods to avoid food shortages and achieve adequate nutrition [28,54]. Future land management policy should consider this context concerning the well-being needs of those who may be unable to access fruit orchards and low-lying lands.

Furthermore, management contexts regarding people's different forest and land ownership rights to the landscape influence their ecosystem services and land use preferences in supporting their well-being. Our study findings supports similar research by others [40], which showed that ecosystem services use differs across people's well-being situations and partly relates to resource ownership in a social-ecological system. Land ownership status is a strong predictor of the distribution of ecosystem services with differing values for well-being needs [37,55,56]. For instance, people without secure land rights in the state ownership context preferred forest and swidden agricultural land for meeting several well-being needs (adequate food, income, nutrition, livestock foraging and water for use). Overall, people with fully secure land rights departed from relying on swidden farming lands and employed diverse forms of land use to support their well-being. It was evident that secure land ownership was attributed to a higher preference for forests, fruit orchards, low-lying agriculture and water bodies for multiple benefits. Especially private ownership influences the choice of water bodies for their protection to secure adequate water. From our study, the specific management contexts of the landscape that local people experienced in their daily lives strongly influenced their ecosystem services preferences to achieve well-being.

5. Conclusions and Future Directions

We assessed the value of ecosystem services' by eliciting community preferences for ecosystem services obtained from diverse land uses to support well-being. Our study findings demonstrate a comprehensive appreciation of local ethnic communities for their surrounding landscape, delivering a broad range of ecosystem services with diverse contributions to meet their well-being. By applying participatory habitat valuation approach, the local community's preferences revealed their shared aspiration to access a wide range of benefits, mainly safe shelter, traditional healing to avoid disease, energy, and cultural and spiritual benefits in their landscape. It is inevitable that a minimal set of ecosystem services will be necessary for the well-being of the ethnic population living in this landscape, but this may rarely be, if ever, sufficient given the patterns of land use and access. Overall, people perceived the role of land use to supply about two-thirds of their well-being needs. Although we observed a substantial variation in ecosystem services preferences from different land uses, the forest is found to be the most useful among all in delivering the maximum well-being benefits. The beneficial contributions of other land use such as swidden agriculture land use, fruit orchard and low-lying agriculture land use reflect the multifunctionality of the landscape and its roles in sustaining the ecosystem services required to meet various well-being needs [56].

Differences in land ownership influenced people's perceptions of the benefits and supply of ecosystem services from the land uses in the CHT region. The insecure land ownership affects people's reliance on the forest and swidden agricultural land use for meeting a wide range of needs. Swidden agriculture farming is currently regarded for its trade-offs in provisioning multiple ecosystem services although evidently the land use remains a critical source of food, income and energy options to a particular community. By contrast, our study found that preferences for fruit orchards, regardless of the ownership contexts, indicate its acceptance as a valuable land use. This specific preference of land use indicates an opportunity for engaging the swidden farmers in sustainable land management (i.e., agroforestry) by providing them secure land ownership. Indigenous people and local communities are likely to follow different land use pathways in accessing ecosystem services or to replace some with others to achieve well-being [11]. Thus, their existing situation and future well-being needs will be depended on a plethora of contextual social, ecological and institutional factors in accessing the most desired land use practices. Many of the well-being needs cannot be provided through access to ecosystem services without the proper ownership arrangement for land use that we found in a socio-ecological system [57].

To maintain the well-being of the local ethnic population relying on ecosystem services, it will be important to integrate their aspirations within the existing land management. Given the high value of forests, future land management approaches could consider achieving multiple benefits supported by ecosystem services-based policies. For instance, embedding ecosystem services within forest and other land-use-related strategies may avoid trade-offs in the provision of ecosystem services. The National Forest Policy (2016) in Bangladesh contains an objective for large-scale tree plantation programmes in degraded forest areas (i.e., unclassed state forests in the CHT region) and mentions the need to provide shared forest benefits for local communities [25]. However, there are no specific measures for understanding how forest and land use benefits are distributed and managed under different land ownership contexts. In the CHT region, land ownership will influence the types of forest and land management and the intended goals for ecosystem services. Without addressing ownership issues in forest and land use-related policies, there are potential challenges in securing a wide range of ecosystem services benefits to support local people's well-being.

Some broader recommendations can be drawn from this study. Firstly, forest and agricultural land management practices should consider the local community's preferences for ecosystem services from their desired land uses to realise their future well-being. Secondly, an integrated management approach may be undertaken with trees and fruit-based land use strategies to maximise ecosystem services values, as well-being is supported by more

than one land use practice. Ecosystem services should be placed at the heart of forest and land use-related policies to guide local and regional natural resource management. Thirdly, a strategy to support greater land ownership for local ethnic people would allow them to a secure tenure right on forests, agriculture and fruit orchard, among others. In doing so there will be a strong possibility to maintain synergistic co-existence of the land uses and thereby sustain the provision of ES in meeting multiple well-being needs in a landscape.

The results of this study could be extended through further research to broadening understanding of the role of land use preferences in addressing the breadth of ecosystem services' contributions to well-being and decision-making. We consider specific areas worth investigation in future are: (i) integrated valuation of ecosystem services to determine the synergies and trade-offs between and within ecosystem services to inform forest and land management; (ii) individual stakeholder's land use preferences on ecosystem services and well-being; (iii) underlying social, ecological and economic drivers in mediating multiple values of ecosystem services in landscape management; (iv) the links between climatic change and land use and impacts on the provisions of ecosystem services; and (v) how to address challenges and opportunities of land ownership in operationalising ecosystem services-based forest and landscape restoration.

Author Contributions: Conceptualization, R.A., N.S. and K.K.S.; methodology, R.A. and K.K.S.; formal analysis, R.A.; writing—original draft preparation, R.A.; writing—review and editing, R.A., N.S., K.K.S. and T.S.; supervision, N.S. and T.S.; project administration, R.A.; funding acquisition, T.S. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the United States Agency for International Development (USAID) and the UK's Department for International Development (DFID) through grants to Center for International Forestry Research (CIFOR). This publication is an output of the CGIAR Consortium Research Program on Forests, Trees and Agroforestry. The research was also funded by an Australian Postgraduate Award, and postgraduate research funding under the Faculty of Engineering, Health, Science and the Environment of Charles Darwin University, Australia, and a Ph.D. Dissertation Fellowship of the South Asian Network for Development and Environmental Economics (SANDEE) through the Asian Centre for Development, Bangladesh.

Data Availability Statement: Not applicable.

Acknowledgments: The authors would like to express heartfelt thanks to the people who took park in numerous focus group discussions in the study villages.

Conflicts of Interest: The authors declare no conflict of interest.

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