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## Re-reading Nepalese landscapes: labour, water, farming patches and trees

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### ABSTRACT

In this paper we use a patches approach to study changes in local land-use practices in response to constraints of labour and the increasing effects of climate change. Drawing on a mix of different participatory exercises and in-depth interviews we describe five categories of land use patches in two contrasting study areas in Nepal. We examine how decreasing access to land, labour and water generate socially differentiated local landscapes. Our findings point toward adaptive land-use responses that secure a subsistence production, encourage close integration between crop and tree land practices, but are supported by a remittance economy. This logic of local land use is not recognised by either agricultural or forestry institutions. We argue that an ongoing debate on land abandonment in Nepal is an example of how narrow sectoral understandings fail to comprehend adaptation practices in a complex landscape system.

### KEYWORDS

Abandoned land; smallholder landscapes; land use; climate change; intensification; subsistence

## Introduction

The stories told about the environmental state of Nepalese mountains have swung from pessimism with the Himalayan environmental crisis narrative in the 1970s and 1980s (Ives and Messerli 1989) to hope in the 2000s with the return of forest cover in the mid-hills as a result of the community forest programme (Gautam et al. 2003; Niraula et al. 2013). Now there is a new story emerging of abandoned agricultural land and an underutilisation narrative that sees an increasing problem in that ‘agricultural land is being abandoned or underutilised’ (Ojha et al. 2017, 157). Added to this have been concerns over degradation associated with the uncultivated land, *bajho jagga* (Jaquet et al. 2019).

Central to these narratives has been the state of Nepal’s forests, and the notion of dependence on forest resources of fodder and browse in particular, to support labor-intensive subsistence farming systems (Schroeder 1985). As forest resources declined, organic input availability decreased and the labour time rose to collect what was available to support farm productivity (Blaikie and Coppard 1998), underpinning an environmental pessimism. But as tree cover through the community forest programme recovered, restrictions on forest use for livestock, in particular, has led to a gradual uncoupling of forest–agricultural interlinkages. The gradual increase in restrictions on forest use rights by the forest department has further contributed to this (Khatri et al. 2017). While the forests still

provide benefits (Paudel 2016) in kind and in cash the notion of rural people's strong forest dependence has lived on. However, the evidence (Marquardt et al. 2016) points more to reduced direct use of forests and increasingly self-contained ecosystem service flows within agricultural areas with on-farm trees used for fodder and intensified livestock systems supporting a slowly commercialising agriculture.

However, the limits to the ability of the mountain farming systems to support a growing population has been a constant element in people's lives. And when the possibilities run out people have moved (Sugden et al. 2018). More recently and to greater effect on Nepal's agrarian economy there has been major labour movement to the Middle East. Now some one-third of rural population has one or more members working abroad and sending remittances home (Sunam and McCarthy 2016). This growth of a remittance economy has averted an agrarian crisis that was anticipated in the 1980s (Blaikie et al. 1980). But it has not resolved the underlying structural constraints to the agrarian economy of shrinking farm sizes and deep social inequalities. As Sugden et al. (2018) indicate given the terms of employment in the labour migration economy, for many the level and reliability of remittances may not be a route to either permanently escape or transform agriculture, and subsistence remains a cornerstone of the rural economy.

But the level of outmigration has induced a labour shortage leading to a retreat of the cultivation boundary. This has generated its own environmental story, the *bajho jagga* debate. It echoes a wider global debate about land abandonment which captures both shifts in land use as well the giving up of land for any form of use (Quiroz et al. 2014). But should we believe this story any more than some of the earlier accounts of crises and junctures that have failed to be consequential? Certainly labour has played a crucial role in providing conditions for long-term landscape investments (so-called *landesque capital*, see Blaikie and Brookfield 1987) in irrigation, terracing, community forest recovery and so forth to maintain landscape integrity. But does less labour lead to things falling apart – a sort of reversal of the 'More People Less Erosion narrative' (Tiffen et al. 1994)? Much depends on 'where', 'how' and at 'whom' you look.

With respect to the 'where' if there is one thing that has been learned about Nepal's landscape is the significance of site specificity (Marquardt et al. 2016) and the importance of the ecology of local knowledge (Blaikie and Coppard 1998). The 'where' is also related to the 'how' you look. Though individual professionals might be more sensitive to the complexity of rural landscapes, sectoral institutional perspectives tend to be more dogmatic and do not take an integrated view on land use and vegetation. Rather, their sectorial lenses that divide forest from agriculture fails to appreciate the trees in agricultural landscapes (Marquardt et al. 2016). For forestry institutions they are not part of the forest, for the agricultural sector the spread of trees is not really relevant to the fields' production and more of an encroachment on the farming territory. The agricultural landscape can also be viewed through land use categories and taxation classes (Regmi 1977) distinguishing between irrigated paddy land (*khet*), dryland (*bari*) and un-ploughed farm land (*kharbari*, *pakho* etc). This production based perspective introduces its own biases of what is and is not seen.

But if we are to think of site specificity neither the sectoral lens nor production-based land classes operate at a sufficiently fine scale to capture the micro-management of landscapes that are evident in farmer practice. Rather, a more ecological approach is required that responds to what Jodha (1992) conceptualised as mountain specificities and in particular of heterogeneity, niche and human adaptation mechanisms. In earlier research

(Marquardt et al. 2016), field observations indicated that practices of land use were present that were not appreciated with existing land use categories. These included divisions of land use within the dryland (*bari*), land where more distant and marginal sections were managed for fodder and grazing and other tree products supporting more intensive production in higher potential areas of the *bari*. However, access to these various resources is not evenly distributed between village households and these practices have to be understood in terms of who has access to what. It is the findings from an enquiry into the socially differentiated nature of actual land-use practices as forms of localised intensification in response to constraints and pressures that this paper addresses.

The paper uses the concept of patches drawing from Jodha's idea of niche to capture specific biophysical units, distinct topographies, soil types and vegetation cover. But we add to the bio-physical aspect of patches recognition of their social origins in that they have been formed by specific social group management practices that shape spatially diverse land uses (Sinare et al. 2016; Scoones et al. 2017). The patches, discussed in this paper often overlap with existing land use categories. They are the irrigated fields (*khet*), rain-fed areas (*bari*), different locations of extensively managed fodder areas (*kharbari*, *khar pakho*, *gas baan* and *kanlo*), the homestead and forest areas. These categories coincide with the terms used by villagers when they talk about their land management practices. This integrated spatially diverse land use has been well described in older Nepalese literature (Schroeder 1985). But more recent Nepalese livelihood and land use studies almost exclusively focus on *khet*, *bari* and community forests. Land use outside these three 'principal' categories, such as fodder areas and the homestead, are scarcely acknowledged although as the data will show, these 'invisible' areas provide significant contributions to the household economy.

This patches approach is used to explore changes in land use and management as responses to labour constraints but also the effects of climate change in two contrasting landscapes. We elaborate a micro-level understanding of these by exploring how people in juggling with their various resources draw on the potential of different land use patches. In doing so, spatially diverse but interlinked forms of intensification become visible. This understanding offers a rethinking of landscape categories and rationales of land use. However, access to these patches is not equally distributed within the villages and there are differences between the poorest and the better-off households. The inquiry has been framed by three research questions.

- What land-use patches are present in the local landscape, how are they managed and what benefits do different groups of people derive from them?
- How does the use of these different patches vary in relation to environmental and socio-economic constraints?
- What are the implications of a patches approach to the understanding of land use management practices and adaptation responses to labour availability changes and climate change in particular?

The paper starts with a brief review of the patches method and the findings explore the significance of place to integrated landscape use practices and how these differ between social groups within the villages. The paper concludes with a discussion of the contribution that a patches approach makes to understanding landscapes management practices and their implications for adaptation to changing demographics and climate change.

## Methods

Ramechhap district (in the Mid Hills) and Sindhuli district (in the Chure<sup>1</sup> mountain range), both in the south-eastern Nepal, were selected as field sites due to their contrasts in climate, topography, land-use history, and processes of socio-economic change.

In each district, three villages were selected, in Ramechhap to capture contrasts in levels of water stress and in Sindhuli differences in community forest use and management approaches. Detailed villages studies were carried out during August to December 2017. The analysis focuses on two of the case villages, Rampur (in Ramechhap) and Silame Sakhajor (in Sindhuli). Where appropriate these are contrasted with the other study villages to emphasise the variability and trends within and between contexts. Rampur can be seen as a “typical” Mid-hill village, socially mixed with meagre forest resources, struggling with drought and high levels of out-migration (Table 1, Figure 1a and b). Silame Sakhajor has rich forest resources, farm lands that are both productive and increasingly commercial oriented due to close connectivity with an urban centre, see (Table 1, Figure 2a and b). The term ‘study village’ is used to refer to the residential area linked to a Community Forest User Group (CFUG) as there can be more than one CFUG per village.

In each study village we followed a five-step methodology. This drew on Sinare et al.’s (2016) method for assessing the local use of ecosystem services and the agro-ecological variability of land use. An assessment of the socially differentiated nature of access to different land resources and ecosystem services was added.

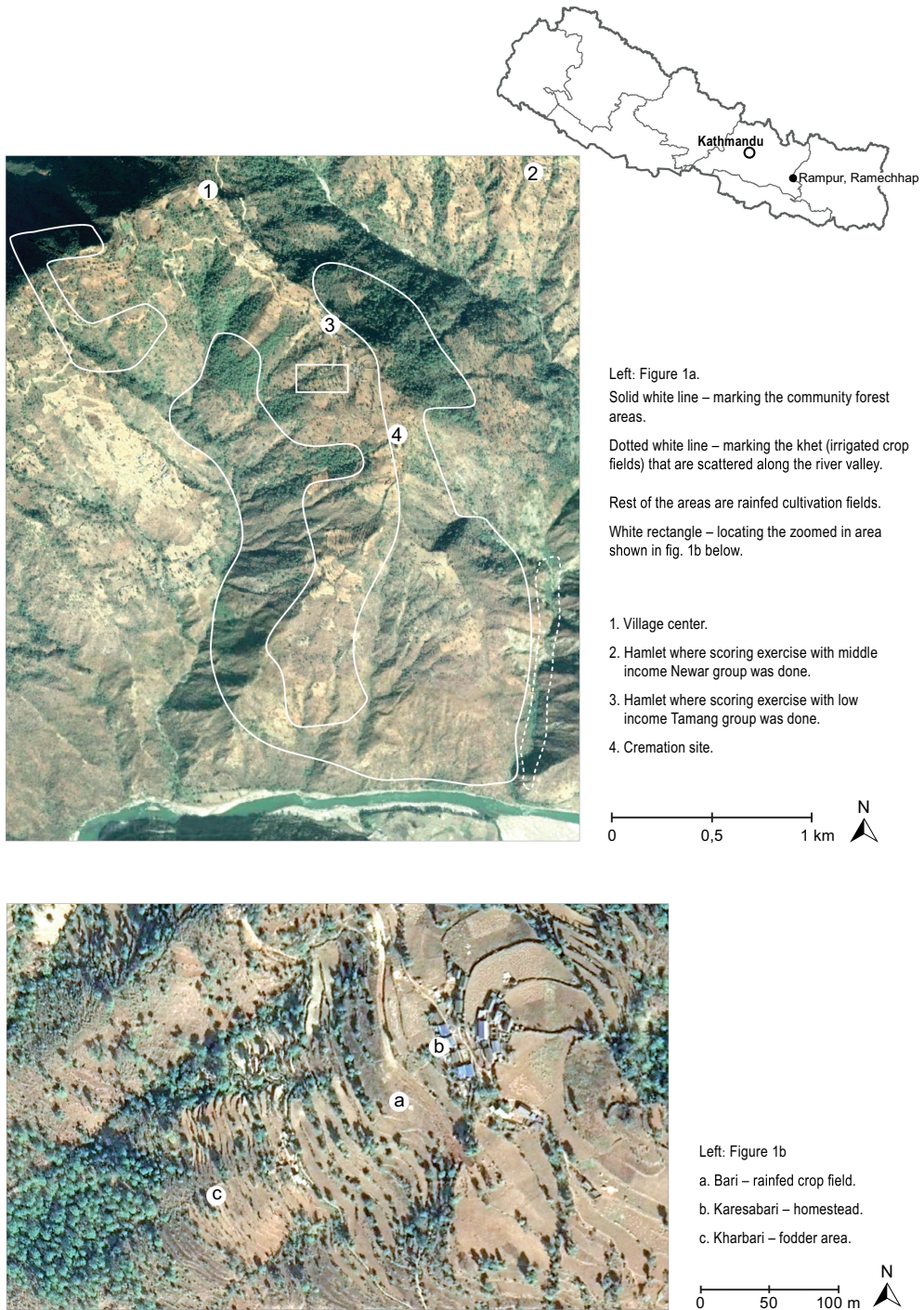
First a group discussion was held where the CFUG executive committee explained the village history and features and how life had changed. This was followed by a group discussion on trends in forest use, agricultural productivity and water access. A village resource map was drawn identifying the location of settlements, forest areas, farm areas, fallow areas, abandoned farm land, water sources and other key features. A seasonal calendar explaining the work in the fields and forest throughout the year was developed. All discussion activities and interviews were made in Nepali.<sup>2</sup>

In the second step a transect walk through the different land-use types was undertaken with a group of villagers. This ground truthed the resource map and built understanding of the landscape use and interests of different social groups. These first two steps helped

**Table 1.** Description of case study villages.

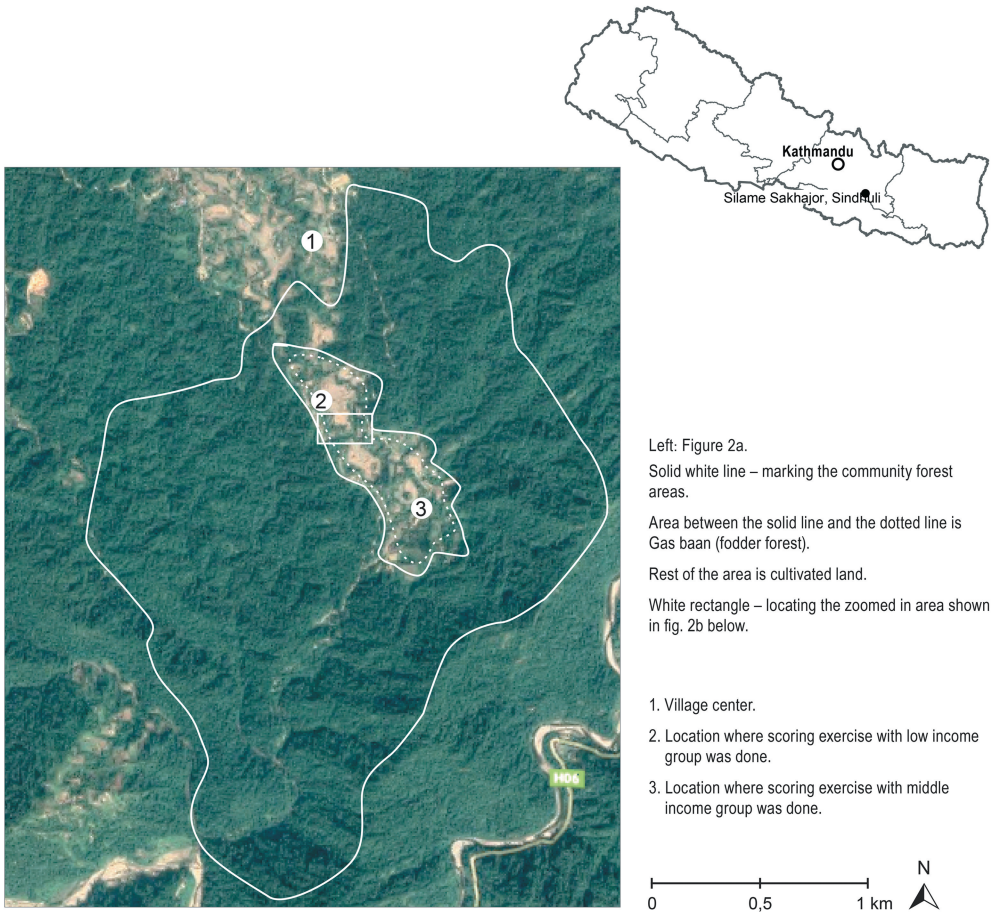
|  | Altitude<br>(range)     | Climate  | Natural<br>vegetation  | Nr of HH  | CF size   |
|--|-------------------------|--|--|---|-----------|
| <b>Rampur village</b><br>(Kaijal CFUG)<br>Ramechhap<br>municipality, ward<br>no 5, Ramechhap                   | 500 to<br>1300<br>masl. | Within the rain shadow of the<br>Mahabharat mountain range<br>and relatively<br>dry, rainfall 800 m/year | Sparse chir<br>pine ( <i>Pinus</i><br><i>roxburghii</i> )<br>forests | 185 HH<br>Tamang and Newar<br>HH with smaller<br>groups of Magar and<br>Dalit HH. | 372.50 ha |
| <b>Silame Sakhajor<br/>village</b><br>(Sarashwoti<br>CFUG*), Kamalamai<br>municipality, ward<br>no 5, Sindhuli | Below<br>300<br>masl.   | In the Dune Valley part of the<br>Chure area, semi-tropical<br>climate. Rainfall 1800 mm/<br>year.       | Rich broad-leaf<br>vegetation  | 201 HH<br>Mainly<br>Newar HH and few<br>Tamang HH.                                | 399.27 ha |

CFUG – community forest user group, CF – community forest, HH – Household



**Figure 1.** Study area in Rampur, Ramechhap. Maps: Google Earth.com

identify local landscape units or “patches”, and understand the use and flows of certain ecosystem services (e.g. water, soil nutrients, etc.).



**Figure 2.** Study area in Silame Sakhajor, Sindhuli. Maps: Google Earth.com

In the third step we elaborated a land-use matrix with two different groups of smallholders, one of poorer farmers and a second of middle-income farmers. The identification of the members of each group was based on a household wealth ranking of its members by the CFUG steering groups. In Ramechhap this built on an exercise undertaken about 10 years earlier by a Swiss forestry project (Hobley and Jha 2012). The CFUGs in Sindhuli had not gone through this process, so the CFUGs were asked to identify very poor/poor and middle-income households. Drawing on the developed resource map, a discussion was held on what each group considered as the main land use patches that they used.

The fourth step was a scoring exercise concentrating on what kind of products households obtained from the different patches they identified. The two wealth groups identified in step three then discussed what food products were grown and where this was done. For each food category (e.g. rice, maize, cereals, legumes, etc.) the participants distributed 20 beans between the different patches showing the relative importance of the different land use patches for specific crops. This exercise was then repeated for the various sources of animal feed and 'forest' products.

In step five semi-structured in-depth household interviews were held. In addition to households from the two wealth groups, we also purposefully included interviews from households who drew on specific landscape resources (e.g. blacksmith, bamboo basket maker, fuelwood seller). The interviews focused on the particular household's use of their land and larger landscape. They were asked about patterns of change within their household. This included household size and composition, land holdings, productivity, labour availability, fuel wood use, food security, forest use and land value now and 20 years ago. These interviews contributed to our understanding and analysis of the wide heterogeneity and the micro-management of niches in mountain farming systems and land uses changes over time. Thirteen household interviews were made in Ramechhap and sixteen in Sindhuli. In addition, outside perspectives on forest use and changes from interviews with seven key informants in the District Forest Office (DFO) and Federation of Community Forest Users, Nepal (FECOFUN) were collected.

Five categories of land use patches were found in the two villages (Table 2). Most households work within several or all these patches and the different patches are scattered across the landscape (Figure 1 and 2).

## Results

### *Walking the two study landscapes: seeing the patches*







#### *Rampur*

If one stands in Rampur's village centre and looks down the valley two features are clear (see Figure 1). First all the land is downslope from the village and everything has to be carried upslope. Second all this land is used. The mountain side is subdivided by terraces, ridges and stone walls with a gradation of different vegetation densities. At first sight the mountain side appears to be covered with *bari* fields. But walking through the landscape different patches of land use become visible.

Walking downslope, the land closest to the village is covered by numerous well-kept *bari* fields. They are very small so that it can be difficult to turn a plough around. These narrow belts of land are supported by stone terraces. They are planted with different combinations of intensively managed grains (mainly maize and millet), legumes, tubers, vegetables and



**Table 2.** Description of patches identified in Rampur and Silame Sakhajor. Categories in order of an assessed over all importance.

|   | Patch   | Description   | Contribution to HH economy  |
|---|---|---|---|
| 1 | <br><b>Private land</b><br><i>Khet</i><br>Irrigated cultivated land                    | Irrigated crop land, paddy fields on relatively gentle slopes or flat lands   | Food crops, fodder (crop residue)   |
| 2 | <br><i>Bari</i><br>Non irrigated cultivated land                                       | Rain fed crop land, terraced fields in slopes with different level gradients  | Food crops, fodder, forest products   |
| 3 | <br><i>Kharbari/ Kharpakho</i><br>Land where you produce thatching material and fodder | Less productive slope areas or <i>bari</i> land managed for grass for thatching and fodder and fuel wood  | Fodder, fuel-wood   |
| 4 | <br><i>Karesabari/ghuran</i><br>Homestead  | Intensively managed area around houses and stables  | Food crops (vegetables), fruits, spices, medicinal plants, fodder           |
| 5 | <br><b>Public land</b><br><i>Gas baan</i><br>Slopy border land of community forests  | Literally meaning fodder forest. Community forest edge areas, managed by individual households for fodder production, a combination kharbari and slopes with bamboo and trees (practiced in Sindhuli) | Fodder, forest products   |
| 6 | <br><i>Baan</i><br>Forest  | Community forest areas managed by community forest user group   | Fodder, fuel-wood, timber and minor collection of food and medicinal plants |

\* Photo on line 1, 4 and 5 have been taken in Silame Sakhajor and photo and 2 and 6 in Rampur.

spices. But the fields also often support a sparse line on the borders of various fodder and timber tree species. The grass growing on the ridges between the fields is used as animal fodder.

As the path continues around the farm houses there are more fodder trees such as khanyu (*Ficus semicordata*), kutmiro (*Litsea polyantha*), ipil-ipil (*Leucaena leucocephala*), dumri (*Ficus racemose*) and fruit trees such as banana, papaya and sugar apple supporting perennial climbers. These form a boundary between the *bari* fields and the homestead (*kareshabari*). The court yard is the heart of the homestead; here tethered animals eat the collected fodder, and a variety of plants for daily needs such as chili, coriander, ginger, leaf vegetables (mustard greens), vegetables, medicinal herbs, etc., are growing in small areas.

Beyond the homesteads, less well-maintained *bari* land and areas of leafy vegetation start to appear. These contain stands of grass, bushes and trees used for fodder and construction material such as bamboo and timber trees i.e. *kharbari* land. This perennial *kharbari* vegetation may be long-standing traditional *kharbari* areas, but *kharbari* is increasingly found on what used to be *bari* land, a previous land use indicated by the terraces. The reasons for the abandonment were often cited as being due to the field's poor soil conditions, or disadvantageous location (e.g. on a north slope, in a shadow, distance), or high harvest losses to wildlife as these areas are next to the community forest. *Kharbari* can also be a thicket of vegetation on the driest and most distant fields from the household or a grove of grass covered terraces in-between food producing *bari* fields. The distinction between *kharbari*, *bari* in transition to become *kharbari*, and private forest can be blurred. One sees land that might have aspects of all three but the *bajho jagga* (abandoned land) discussion treats them as all the same. They may be extensively managed but they are not abandoned in Rampur.

The most productive farm land, irrigated *khet*, is found at the bottom of the hillside, about 60 minutes' walk from the village centre in a thin belt on both sides of the river. These are valuable as they have an almost continuous year-round production of food crops, principally rice but legumes, vegetables, and grain are also grown. There are few trees on this land. Only about 30% of the villagers, mainly of Newari ethnicity, have *khet* land in the valley, the rest rely on their *bari* and *kharbari* land higher up the slope.

### **Silame Sakhajor**

Whereas the walk through the Rampur landscape is steeply downhill, in Silame Sakhajor it is flat in a more lush landscape (Figure 2). The village centre is next to a road, but most villagers live and farm in an area that is surrounded by the community forest (*baan*). This is a dense broadleaf forest, rich in saal (*Shorea robusta*) trees and orchids on both sides of the dirt road which leads into a mosaic farming landscape.

The forest on the right side of the road is different from the thick vegetation on the left side. On the right, between the road and the fields there is a strip of fodder trees such as kutmiro, khasreto (*Ficus hispida*) badahar (*Artocarpus lakoocha*) khanayo (*Ficus cunia*), timber trees mainly saal, asna (*Terminalia alata*) and karma (*Adina cordifolia*) and bamboo, indicating active management. This is the outer belt of the community forest, an area the villagers have transformed into a 'fodder forest', the *gas baan* patch. The *gas baan* provides a convenient 'larder' of fodder, fuel wood and construction material. The surrounding forest is used for additional forest products and livestock grazing.

A path that cuts through the *gas baan*, leads to an open agricultural zone covered with *khet* fields. A small stream winds through the valley bottom, irrigating through channels the paddy fields. All villagers have at least one small piece of *khet* land which produces three annual harvests of food crops such as rice, grain, vegetables, legumes and spices. Few if any trees grow on the *khet* land, but the ridges that mark property boundaries provide some grass for animal fodder.

The productive *khet* land is too valuable to construct on, so the homestead (*karesha-bari*) are located on the higher points in the landscape. Walking up from the flat *khet* land towards the homestead, the path passes through a belt of *bari* fields. These are terraced to stabilise the slope and grow grain, legumes and vegetables. They support many trees, particularly fruit trees such as mango, banana, papaya and jackfruit on the field borders.

Reaching the top of the hill, there is a cluster of buildings around the homestead. As in Rampur, the homestead buildings are surrounded by a line of lopped trees (see above) and fruits trees such as mango, banana and papaya. Useful plants such as vegetables, tubers and spices are planted around the houses to secure their harvest. The wildlife in the adjacent forest feed on many of the crops and cause large losses to the farmers.

In sum the different land use patches in both locations show how land management is fine-tuned to location. Moreover, given the social differentiation in these villages there is also a social patterning of the landscape – who does what and where – that should be looked for.

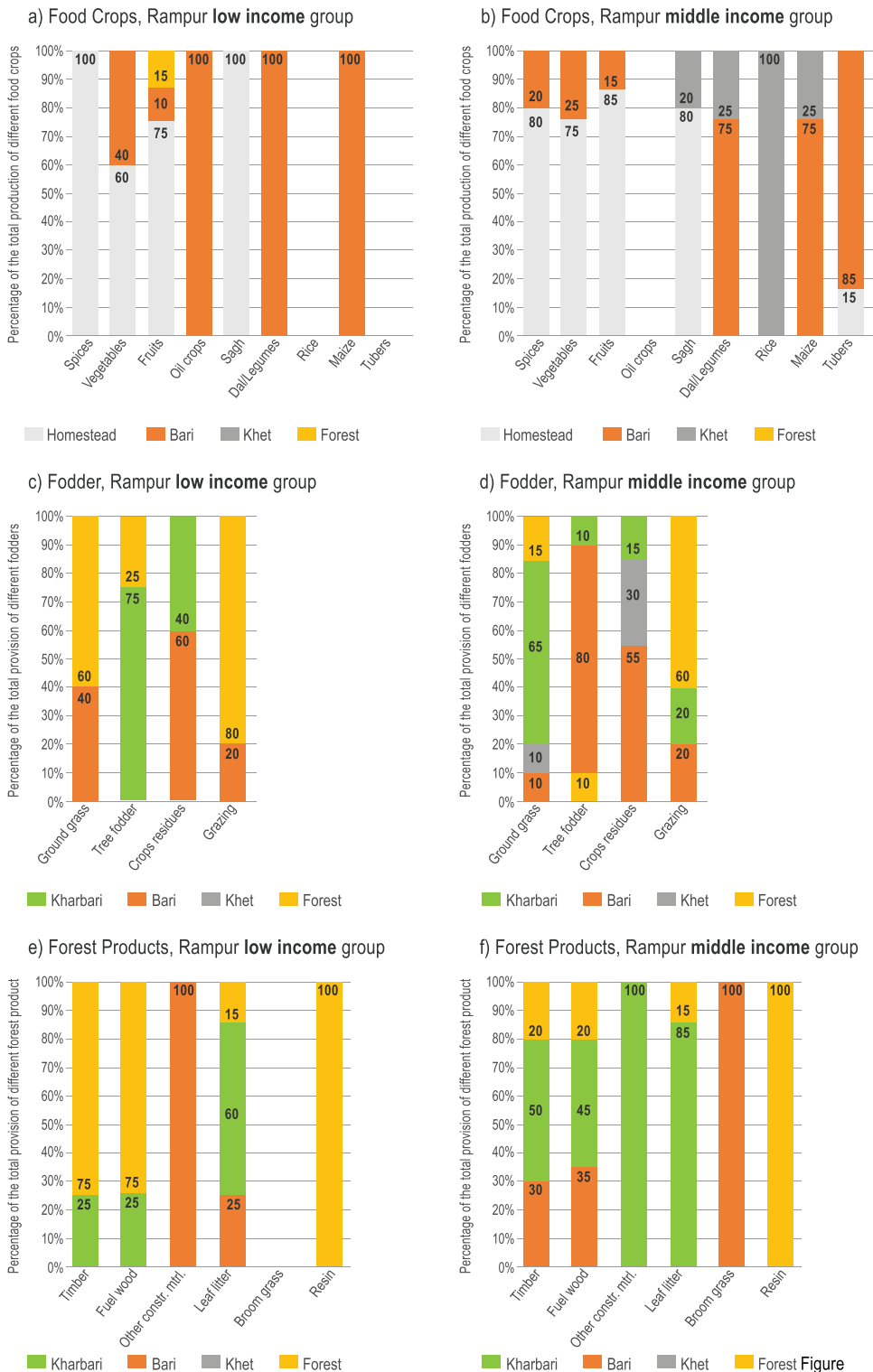
### ***The use of different patches in the landscape***

In the scoring exercise, the production of each crop harvested from the different patches was estimated. The relative contribution from the different patch types to the provision of food, fodder and forest products differs not only between the two study areas but also between social groups and patch locations within the landscape. Figure 3 and 4 show the different uses and relative importance of specific landscape patches by two income groups in Rampur and Silame Sakhajor, respectively. They also show the multipurpose uses of different patches.

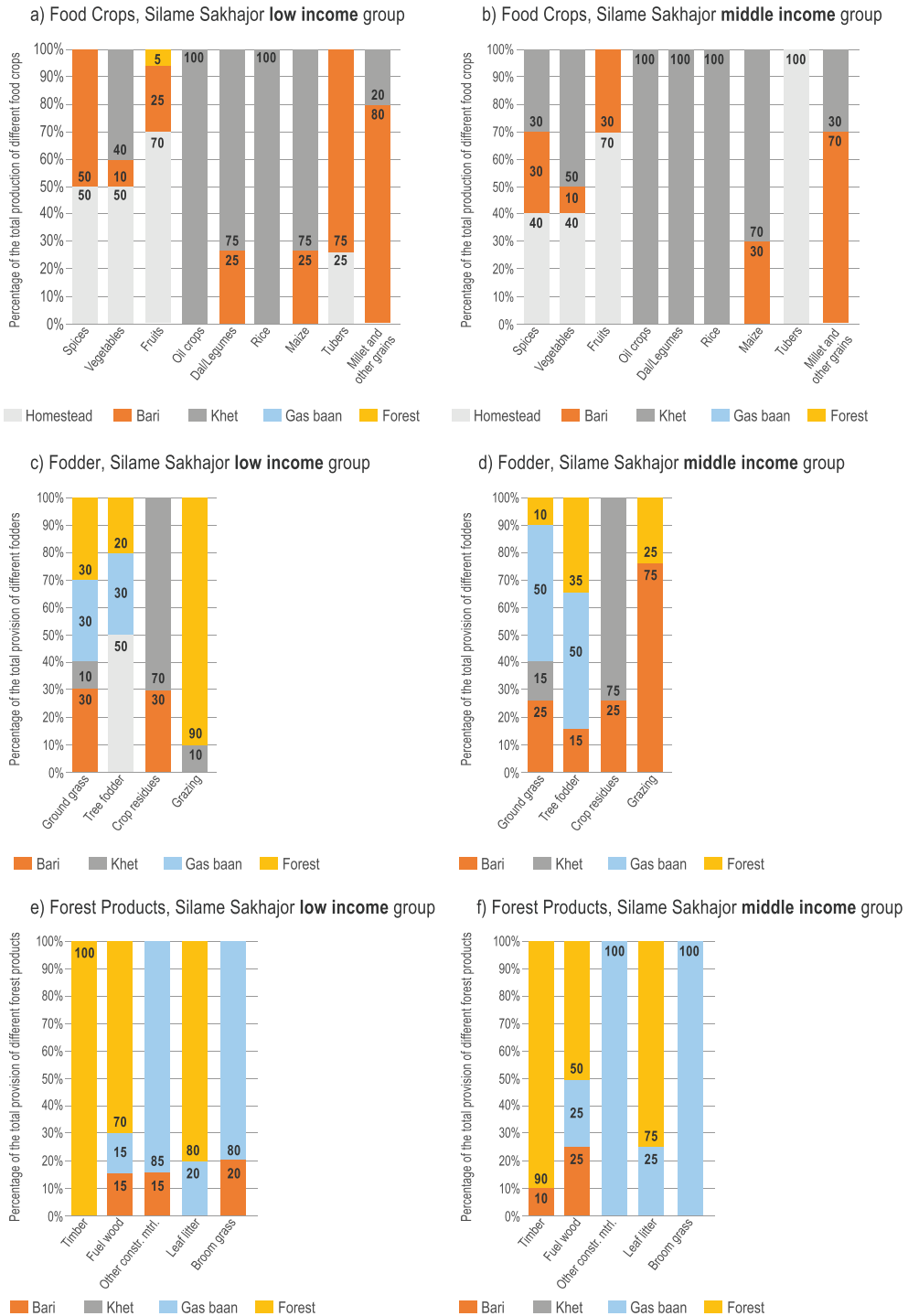
#### ***Rampur***

Rampur village is located on the drier southeastern side of Ramechhap. The households are a mix of the majority ethnic groups Tamang and Newar with a minority of families of Magar and Dalits ethnicity. The village is spread out between two mountain ridges and the various social groups have settled in different hamlets on the slopes. Most of the community forest is located below the village and stretches up to the village centre in two thin strips. Though the forest had recovered to a certain degree since the late 1980s there was a destructive forest fire in 2015. The use of community forest is regulated by the CFUG and there are specific rules and time periods allocated for the collection of fuel wood and fodder. Grazing is only allowed in small areas on a rotational basis during certain periods. Household livestock holdings are typically 1–2 buffalos, 1–2 cows and 3–10 goats and some farm also have hens and ducks.

The social and bio-physical patterning of the landscape means that the forest is not equally accessible to all community forest users. The low-income farmers who were part of



**Figure 3.** The estimated proportion of different food crops, feeds, fuel wood and timber harvested in different land use patches in Rampur. Other constr. mtrl. - Other construction material.



**Figure 4.** The estimated proportion of different food crops, feeds, fuel wood and timber harvested in different land use patches in Silame Sakhajor. Other constr. mtrl. - Other construction material.

the patch scoring exercise (Figure 1-point 3) were all Tamang households living in a hamlet just next to the community forest area (Figure 1). This allowed them to make frequent use of the forest. Some Tamang households prepare and sell *airakh*, a locally distilled spirit normally made from millet and need large amounts of firewood, which they collect from the community forests under certain regulations. The patch scoring middle income group were mostly Newars, an ethnic group known to be skilled commercial farmers. From their hamlet (Figure 1-point 2), the forest is distant and downslope. A lack of time combined with the effort required to carry forest products upslope means that their forest use is limited.

In the household interviews, most of the poor respondents said that *bari* and *kharbari* now largely met their fodder and fuel wood needs which in the past they got from the community forests. There was a consistent account of declining use of community forests in the two other case villages in Ramechhap. *Kharbari* land was traditionally managed for producing *khar* or grass used as thatching material. The *khar* species were planted and maintained through weeding. Now there are few *khar* roofs and the *kharbari* areas have therefore become the land where people grow and collect grass and tree fodder for livestock.

The declining level of forest use reported in the interviews is however not fully reflected in Figure 3 (c, e). The frequent collection of fodder and forest products from the forest described in Figure 3c,e is accounted for mainly by the Tamang hamlet located next to the community forest. Figure 3a,b shows how Tamang low-income farmers only have *bari* land for their food cropping. They manage their *bari* plots intensively for maize, millet, lentils etc. and the trees on these *bari* fields are important sources of animal feed (c, d) and fuel wood (e, f) in combination with the *kharbari* areas. Thus it is the locality in the landscape and proximity to forest rather than income level that determine different household's levels of forest use.

While the *airakh* makers in the Tamang hamlet can use the community forest resources for income-generating activities, this has not been the case for other social groups which in the past have used forest resources. A Dalit blacksmith, for example, complained that the CFUG had prohibited him from taking out timber from the community forest for charcoal making. His clients, therefore, have to bring their own charcoal when they need his services. They collect this from their *bari* and *kharbari* fields and not from the community forest.

Most of the patch scoring middle-income Newar households have areas of *khet* land in the valley bottom in addition to their upland *bari* fields (Figure 3b). These *khet* fields are usually very small (e.g. 0.15 ha) but irrigation allows for double and even triple cropping. The Newars hardly use the community forest, and the *kharbari* land in combination with the *bari* fields cover the fodder and fuel needs of these households. However, independent of their use of the community forest, all members of the CFUG are required to patrol the forest area about once every 2 months.

For both income groups, a notable contribution to the household food economy comes from the homestead patch (Figure 3a,b). The food items produced in the homestead include food items such as *sagh*, other vegetables, fruits and spices, indicating the importance of the homestead to a households' nutrition security.

The landscape use in Rampur is thus determined by socially based land ownership patterns with different capacities and abilities to access the forest. However, cutting across this differentiation is the lack of farm labour and increasing water scarcity which we return to later.

### **Silame Sakhajor**

Silame Sakhajor village in Sindhuli provides a strong contrast to Rampur. Households migrated from mid-hills, including from Ramecchap about 3–4 decades ago and apart from a few Tamang are mainly Newar households. The mix of agricultural fields and forest vegetation has created a mosaic landscape. The Silame Sakhajor households are scattered along a water stream and the community forest surrounds the inhabited areas (Figure 2). This spatial arrangement gives most households relatively easy access to forest areas. In contrast to the Rampur community forest where the CFUG management started with a degraded forest, the community forest handed over to the Silame Sakhajor village was a relatively large and healthy broadleaf forest dominated by valuable *saal* trees.

With a rich forest, the Silame Sakhajor CFUG has been able to manage the forest to meet members' needs, as reflected in Figure 4 which shows the relative contribution of fodder and fuel wood coming from the forest in both income groups. Some families even use the community forest for generating extra income by selling firewood to hotels in the nearby town of Sindhulimadi. Collection of fuelwood for private sale in a community forest area is in principle not allowed, but is done with discretion by Tamang women who collect bundles of fuelwood at dawn and other villagers do not protest.

After much conflict on how the forest should be managed and used when the CFUG was created (1995), the CFUG committee decided to create a semi-individual forest patch called *gas baan*. This literally means fodder forest and lies on the outer border of the community forest in a sparsely treed 5–20 meter strip. This has been divided into parcels of about 0.5 hectare for forest user group members to manage individually. Most households therefore have a *gas baan* lot near their house and manage it for fodder, fuel wood and construction material (Figure 4). Several households have a relatively large number of livestock (e.g. 2 oxen, 1–2 buffaloes 1–2 cows, 6–8 goats and some hens) and combine the fodder production from their *gas baan* with forest fodder. The low-income households with less farm land rely more on the use of forest for grazing than the better-off families (Figure 4c-f).

As can be seen in Figure 4a,b), both income groups have *khet* land. Owning of *khet* land in Silame Sakhajor is not an indicator of wealth status as it is in Rampur. Rather it is the size of the *khet* holding and investments made in the nearby town of Sindhulimadi that indicates a households' wealth, a pattern that was also found in the two other Sindhuli case villages. The relatively large areas of irrigated *khet* (0.3–0.5 ha) fields combined with *bari* land provide the middle-income households in Silame Sakhajor with a substantial income. The poorer families with smaller *khet* plots (0.1–0.3 ha) rely on their irrigated land as well, but their *bari* land is also very limited. In general, the poorer families need to use resources from more patches in the landscape for both food, fodder, fuel wood than the middle-income farmers (Figure 4c-f). The homestead patch is as with Rampur is important for planting vegetables, fruits, tubers and spices.

### **Labour as a limiting resource for farming**

With the progressive shrinking of farm size across generations and with no room for expanding the cultivation boundary it became impossible by the 1980s for many households in mountain villages such as Rampur to survive. Many migrated southwards towards the lowland in search of land and founded new villages such as Silame Sakhajor.

Most of the Rampur smallholders only produce sufficient food for half of the year or less from their combination of fields/patches and need additional income which comes from remittances

sent by family members or other non-farm sources, such as making bamboo products, iron work, construction work, small shop keeping, *airakh* making, or renting out a house in town. The young men in particular leave to find paid work elsewhere, usually abroad and the Rampur CFUG executive committee estimated that as many as 70% of the households have at least one family member working away. This has led to labour scarcity for agriculture.

There is also increasing competition for labour by the Silame Sakhajor households. But in contrast to Ramechhap where many youths are pushed to into a foreign labour market, there are more work opportunities to be found locally around the rapidly growing town of Sindhulimadi two kilometres away. According to its CFUG executive committee only 20% of the Silame Sakhajor households had a member working abroad. One young interviewee explained how he had worked abroad for about 2 years and had now returned to set up a local carpentry workshop. He estimated that the workshop income would be less than his work abroad, but he expected a reliable income from making furniture and he valued being able to live together with his family. The better-off households had made profitable property investments in Sindhulimadi (and in Kathmandu). However, the fertile landscape in combination with the closeness to an urban market made it feasible to live from what farm land produced in the village and the villagers sell agricultural surplus, processed produce (milk, *airak*) and 'forest' products (fuel wood). The labour shortage is somewhat mediated at peak labour demand (e.g. paddy transplanting) by traditional labour exchange arrangements which the households have maintained, drawing on their joint history as settlers and shared ethnic identity.

The decreasing availability of farm labour means that farming families in both locations carefully balance their labour resources between outside opportunities and their farm production, but the constraints and opportunities differ. Whereas Silame Sakhajor households seek to maximise harvest output on their *khet* fields and forest areas, Rampur minimise their labour input on their *bari* and *kharbari* land. Sugden et al. (2018) found that many households cannot cover their costs of living by remittance alone and continue to depend on their agricultural production. Households with the best migration outcomes were those with reliable subsistence production, allowing them to strategically invest the remittances rather than live off them. Households in Rampur survive primarily due to remittances and off farm income but have not prospered.

However, the major earthquake that hit Nepal in April 2015 had unexpected economic consequences. Few people were killed in the Ramechhap but the earthquake had three effects. First there was extensive damage of houses and buildings in both rural and urban areas imposing costs for rebuilding. But second the reconstruction aftermath created a 'boom' of local working opportunities and third a number of local water sources took new routes and/or dried out as a result of the earthquake. The need for temporary construction labour for the reconstruction created a notable rise in local wages. During the time of the field study the wages for a day's labour were almost double those from before the earthquake, an income opportunity many of the Rampur households have tried to benefit from. This has had knock on effects in terms of labour availability and costs.

### ***Changing land use-intensification through labour in Rampur and irrigation in Silame Sakhajor***

There are consequences when a labor-intensive farming system loses labour and an increasingly drier environment reduces crop productivity. Land use practice in Rampur



now speaks to a logic of managing constraints and risks rather than that of striving to maximise production and market engagement. Firstly, the localised land intensification management efforts are primarily focused around subsistence production. All the farmers interviewed, as found earlier in Dolakha (Marquardt et al. 2016), reported that their yields had increased considerably during the last decades. They explained that they have about half the land that their parents used to have. However, the number of food secure months (which range from 5 to 12) in the year are the same or even higher in comparison to 20 years ago, indicating an intensification of the whole agricultural system combined with decreasing household sizes. The increased crop production is a result of the increased use of animal manure due to the shift to stallfeed livestock and chemical fertilizer. They are also using new varieties. But apart from some small pockets of cash cropping (e.g. cauliflower and cabbage), the major part of this crop produce is for the own household consumption. The imperative to meet subsistence needs by Rampur households speaks to the limits of remittance flows to secure household economies (Marquardt et al. 2016; Sugden et al. 2018).

Secondly, the logic of household practice is essentially that of a peasant household (van de Ploeg 2013) seeking to balance labour investment against consumption needs. Households concentrate their limited labour to the most fertile plots close to the homestead and the more distant lower productivity areas are gradually converted towards tree-based land uses such as *kharbari* land or private forest. An increasing wildlife population causes large harvest losses in certain areas and these have pushed land owners to convert their distant lands to more extensive tree production. In this transformative process, tree fodder production has moved from the community forest area into the private agricultural *bari* land (Figure 3). However, in none of the Ramechhap study villages did the villagers talk about these as *bajho jagga*. Rather, they described a spatial management of resources where land use transitioned from *bari* into *kharbari*. When *bari* land is converted into *kharbari* it normally involves some kind of limited management input such as weeding and protection from grazing animals. But the crucial driver of the land-use shift is the reduced labour availability.

With increasing frequency of drought the importance of livestock appears to have increased. Several households reported that their main agricultural income was gradually shifting away from selling small quantities of their grain to selling a couple of goats. Their livestock herd has not necessarily increased in numbers although there has been a shift to keeping improved goat breeds. Although there is more fodder available in the landscape today (in the *bari* and *kharbari* patches) in comparison to when the community forest was established, the Rampur farmers however said it was risky to increase goat numbers due to the insecurity of water supply.

Thirdly, the *bari* land use in Rampur is increasingly diversified to produce a larger variety of products (Figure 3). In many cases it provides almost all the resources households needed; a range of food and tree fodder, fuel wood, construction material and even charcoal that used to be seen as forest products.

Silame Sakhajor landscape is also the result of enormous labour investments. The Silame Sakhajor villagers' first step for land use intensification was to use the local water resources to expand their *khet* fields. The farmers use fertilisers, chicken manure and improved seeds to increase their harvests. The *khet* production is focused on rice and vegetables to be sold in the adjacent town. Several middle-income households in Silame Sakhajor have specialised in intensive poultry raising and generating high-value manure.

The proximity to an urban market has stimulated intensification and semi-commercialisation of farming. However, as with Rampur the livestock component of the farming system is central. The size of livestock holdings of the Silame Sakhajor households reflects the almost free access to fodder. The *gaas ban* areas, as with the *bari* land and the *kharbari* areas in Rampur secure feed for animal production, but at a different scale and on common land. Both illustrate the importance of animal husbandry to the household and how trees remain at the heart of the farming system. But now tree fodder, which traditionally has been seen as a 'forest product' is mainly produced in patches outside the community forest. Yet neither *gas baan*, tree production on *bari* land nor *kharbari* fields are officially considered as land uses with a role in agricultural production. From a forestry perspective, at best they count as degraded forest land.

However food crops and fodder depend on reliable rainfall or irrigation. But with declining rainfall and increasing periods of drought in the hills agriculture is becoming more risky and less productive. Adaptive responses are site specific (Gentle and Maraseni 2012; Bhattarai et al. 2015) and the possibilities of coping with climate change depend on the availability of water sources. Thus water scarcity in Rampur and relative water abundance in Silame Sakhajor have encouraged two contrasting trajectories of land-use change.

### ***Water – as a constraint and an opportunity***

In the last 5–6 years Ramechhap has had crop failure and reduced rainfall. The case villages lie across a spectrum of water availability. In Rampur the reduced water availability is driving changes in production patterns but in Golmarja where water stress is acute, the forest has started to dry out. In Sindhuli water is abundant and the concern is more with torrential rains and floods sweeping away *khet* land on the banks of the river.

In Rampur the 2015 earthquake caused several water sources to dry out and many families experienced an acute shortage of drinking water and several have had to buy water. One family reported that each month they spent around 1000 rupees (9 USD) for water, paid for by their son in law's work in construction. The poorest households who cannot afford such costs brought their water from a well 30–40 minutes' walk downhill. Some households have started to collect rain water from house roofs for the animals and washing purposes, and in some cases also for small scale drip irrigation of vegetables. These water collecting practices function best with steel roofs rather than the traditional straw roofs, a common feature of poor families' houses.

With the drought in Rampur the area of maize was reported to have declined. The driest areas of *bari* land has become unworkable and households are gradually converting them into *kharbari*. As much as 25% of the *bari* fields was reported to have been converted to *kharbari*. There is a gradual shift from food production towards goat fodder production on the lands, pushed by the drier climate. There is also a shift to goats from other livestock as they require less water.

In Silame Sakhajor, the land conversion process is working the other way around; by using local water resources *bari* land is levelled and converted into irrigated *khet* fields, leading to double or triple cropping. The livestock is easily watered in local streams.

However, even in Silame Sakhajor there is an emerging concern about future access to drinking water, as it comes from a distant source and the pumping arrangements do not

always work. Some better-off households have dug their own wells. Several villagers have observed falling water tables and periods of insufficient water for their irrigation needs as a result of the increasing use of irrigation in the village

## Discussion

Sugden et al. (2018) did not find abandoned land in their three study sites in eastern Nepal and nor did we in our six sites. This does not in itself dismiss the possibility that in other locations land abandonment may happen and degradation occur. In response to the narrative of land abandonment (Ohja et al. 2017), we agree that *bari* land is being converted to uses other than crop production. But our evidence is clear that it is not un-managed but simply being used for different purposes, often to less intensive management.

The problem is that formal land use classifications do not help see what is actually going on in this agro-ecologically complex mountain environment. Presumptions about what is proper land use affect how changes are assessed and judged. The narrative of land abandonment as a proxy for land degradation is a narrow sectoral understanding of complex land-use changes. We are unconvinced that land which has not been ploughed for 2 years, which is how land abandonment is defined by Nepalese authorities, is necessarily abandoned (Jaquet et al. 2019, 1349). Moreover, conversions to other forms of land use such as grazing, grass or shrubs do not necessarily lead to environmental degradation. Goat keeping can as our evidence suggests be seen as a strategic adaptive response and it is doubtful that permanent vegetation on terraces would generate more erosion than annual crop production. Indeed from our observations, the retreat of the cultivation boundary and the concomitant regeneration of perennial vegetation has environmental benefits in this risk-prone environment. Whether or not land-use changes provoke environmental degradation is a site-specific question.

The wider land abandonment literature addresses both the degrading and regenerating outcomes of land abandonment. It tends to focus on the ecological and environmental effects of abandonment including heterogeneity in the landscape, species pools, biodiversity, climate and the biophysical conditions (e.g. Benayas et al. 2007; Sitzia et al. 2010; Quiroz et al. 2014). The importance of site specificity in terms of effects is usually highlighted. But as Quiroz et al. (2014) note, different studies on impacts of land abandonment for similar land uses and geographical locations often reach conflicting conclusions in terms of the negative and positive effects of changes in agricultural landscapes. In short a much more nuanced story than the *bajho jaggera* debate offers is needed to address the complexities of land-use change. For the fragile ecologies of the Nepalese mid-hills and the Chure range, policy needs to be more attentive to the multiple land uses and their production and recovering landscape outcomes. However the ecological aspects of land-use change are only a part of the land-use change story and as we show, the social dimensions of migration, labour, shifting production patterns and climate change responses are all central for understanding land-use dynamics. We suggest that a patch approach that takes account of niche and adaptation responses in a highly variable agro-ecological environment (Jodha 1992) and of its socially differentiated nature is analytically useful for understanding these land-use dynamics.

Our findings point strongly to the close integration between crop and tree land-use practices within the village landscape. This is central to the mid-hill agriculture but also

underpins land use practices in more environmentally favourable areas. Neither the sectoral lenses of forest and agricultural authorities and institutions, nor the agricultural land use classification systems (Scott 1998) manage to see or appreciate the fine details of what farmers do and their rationale for doing so. Likewise, agroforestry, which has a wider notion of land-use systems (ICRAF 2014) does not incorporate the whole span of land use practices shown in this paper, or take account of how they are used in relation to each other. For example, many *bari* plots are complex agroforestry fields, while the irrigated *khet* fields, fertilised with manure, are intensively managed just for annual crops, and in the fodder areas there is no grain production. From the farmer household and the integrated landscape perspective, the livestock provides the link between different spaces in the terrain.

Observations on the micro-management of the hill landscape for subsistence purposes as evidenced in this paper have a long history (see Schroeder et al. 1985). But our evidence also raises new questions. Earlier observations spoke to conditions where the margins of cultivation were being pushed to the limits under acute population pressure (Blaikie et al. 1980). Now the pressure on land in the mid-hills has been reduced as a result of labour migration overseas and the growth of a remittance economy. Forests have recovered although the ecosystem flows between forests and agriculture have now largely been severed. But in agreement with van de Ploeg (2014), despite the remittance income flow, the logic of production remains essentially a subsistence and peasant one, heavily dependent on farm labour. This in part is due to the limits and precariousness of the remittance flow itself which while relieving the household consumption demand is sufficiently unreliable for many to provide a means to accumulation and prosperity (Sugden et al. 2018). Outside the Mid-hills, as our findings from Sindhuli show, remittance flows are not the only source of non-farm income, and in a more productive environment, close to a growing urban economy, agriculture is more market oriented.

But there is no agrarian transition under way with a systematic move to market-oriented production or evidence of land accumulation. Farmers may leave the countryside but do not sell their land, and agricultural production is becoming concentrated to the most fertile areas but mainly for subsistence purposes with trees and forest-supporting land-use intensification. Where surpluses can be generated, as in Silame Sakhajor, it will be sold. The two cases show how different forms of transition and intensification are happening at the same time but in different patches and how extensive land uses are part of other intensification strategies. It speaks to a rationale of intensification of labour rather than land use. The patches concept can help us understand different agrarian trajectories and the ways that land use intensification can contribute to household survival (van de Ploeg 2013).

## Concluding remarks

The long-term decline in farm size is inexorable and the ability of hill farming systems to support even a subsistence economy has its limits. We are not seeing here a rapid process of commercialisation and land accumulation leading to dispossession and landlessness as Li (2014) has reported from Indonesia. There are already high levels of landlessness (Alden Wiley et al. 2009) in Nepal but a similar process of reaching land's end where many of Nepal's Mid-hill rural population can neither find sufficient work in the agrarian or urban economy may be approaching. Moreover, it seems that, apart from reaching or not a point of land's end (Li 2014), villages such as Rampur (and to a degree also Silame Sakhajor) have

reached the limits of labour and water resources. The consequence is both intensification and extensification happening in parallel but in different parts of the landscape.

While we cannot foresee the future any more than poor rural households in Nepal's Mid-hills can, this analysis of actual land use points to the ways in which such households are adapting to the constraints that they face now of labour availability, climate risk and drought. The adaptive responses are generally not seeking to generate greater income from agriculture as promoted by many development interventions as suitable climate adaptation responses (Khatri 2018). Rather the adaptations farmer make are more to secure the subsistence component of living within the labour resources available. The apparent direction that these are taking – towards a more tree and livestock-based farming system in the hills – brings a new twist to processes of continuity and change in the Himalayas.

## Notes

1. The Chure is a low mountain range in the foothills of Himalaya consisting of mountain and flat terrain in valleys.
2. We used the Nepalese word *jaggako tukra* for the term 'patches' in the conversations in the study villages.

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