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The Satoyama Development Mechanism (SDM) 2018
on
Sustainable Intensification of Ecosystem Services for Conservation of Production Agriscape and Biodiversity in Community Conserved Forests of Western Arunachal Pradesh, India

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South Asian Forum for Environment (SAFE)

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1. Introduction:

In several parts of the world agriculture is the leading land use and considered as the backbone of the rural economy (Brett et al., 2009). Livelihood of a large share of population in the Himalayan region is still dependent on subsistence farming in the marginal hilly tracts. However, several physical and socio-economic limiting factors including poor soil fertility, marginal land holdings, water scarcity, and lack of farm mechanism have in many cases made the hill agriculture less sustainable. Comprehensive research considering both the ecological and socio-cultural problems as well as potential advantages related to the hill agriscapes is imperative for better understanding, proper resource management, and livelihood sustenance of the hill populace (Pratap, 2011). Formulation of appropriate planning and policy guideline for sustainable resource management requires land use information at pertinent temporal and spatial scales (Brett et al., 2009). In this backdrop, agricultural resource mapping, identification and plotting of the 'practice changes' have been made an integral part of the present study, which aimed at identifying existing resources and formulating a place-based agriscape management framework towards sustainable intensification of ecosystem services in the study area.

2. Major Findings:

2.1. Resource Mapping:

Resource mapping aimed at identifying the existing resource bases of the agroecosystems within the study area. Resources included physical assets such as amount and quality of available land, water resources, livestock, and infrastructure. Besides, social and cultural resources such as existing traditional knowledge, social cohesiveness have also been taken into consideration. Both perception based study and application of GIS have been applied for data acquisition.

Within the intervention area, agroecosystems under three villages, viz. Chug, Sangti and Kitpi had been identified for conducting the present study.

2.1.1. Land resource:

The village landscapes included built-up areas, agricultural plots, pastures, forests tracts, rivers, and canals. Based on elevation and slope, the available land area under the villages can be grouped into uplands with relatively higher slope of more than 30^0, lands with moderate slope between 15^0 to 30^0, and the low lands having slope below 15^0 (Fig. 1 & 2). The upland areas were dominated by forests which included both protected forests and community governed forests. Lands with relatively gentle slope were found to have mixed land uses including terrace cultivation, pastures, orchards, built-up areas, waste lands, and patches of forests. However, rice cultivation dominated the land use of the low lying areas flanking the rivers. Average size of the landholdings ranged between 0.5 ha - 0.8 ha. Maize, rai, and oil seeds were generally grown in the slopping lands where the availability of water remained low. Rain fed terraced farming was found to be practiced in these tracts. However, in recent years these tracts are getting converted into orchards. In the low lying areas along the river banks wet rice was cultivated based on rain water and canal irrigation.

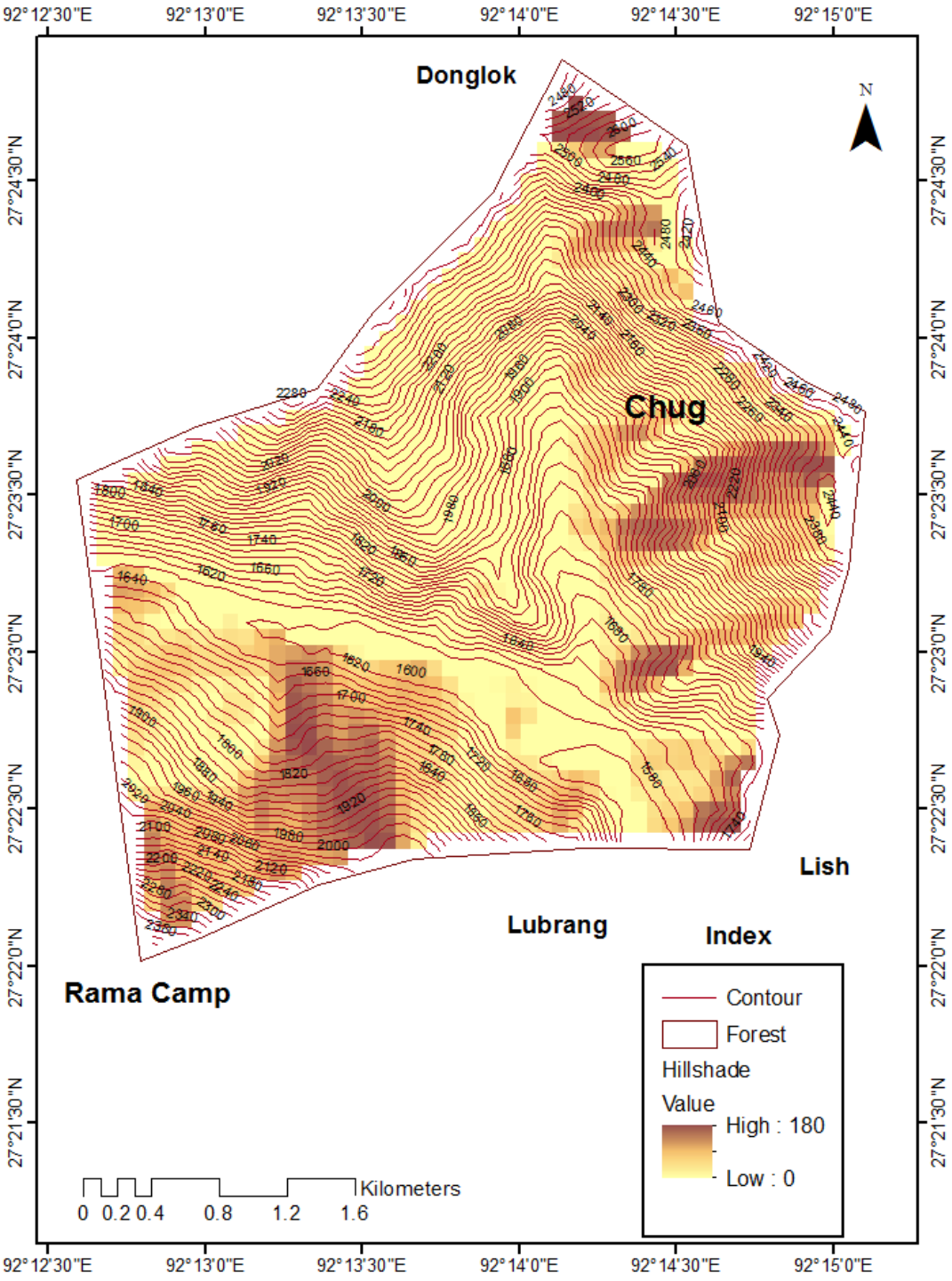

Fig. 1. Contour and elevation map of Chug Village, Dirang, Arunachal Pradesh

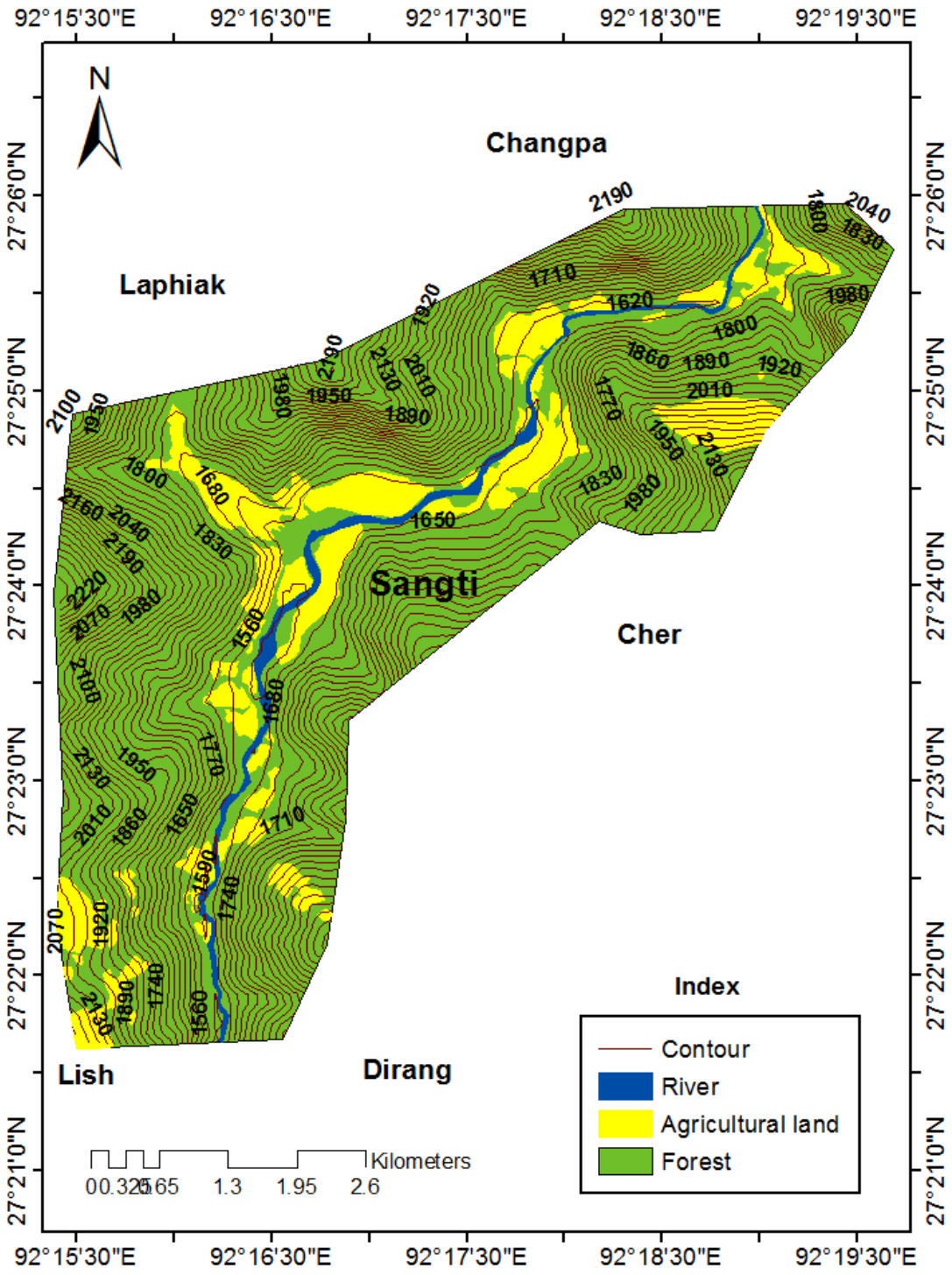

Fig. 2. Elevation wise distribution of agricultural lands around Sangti Valley, Arunachal Pradesh

2.1.2. Water resource:

Although agriculture in these areas is mainly dependent on rain water, canal irrigation supplements water need in the drier periods of the year. Streams emerging from the surrounding hills has been tapped and channelized through the canals in to the agricultural plots. Scarcity of water during the dry spells of the year often led to crop failure. For instance, in Sngti valley it was found that, about 50 percent of the total crop lands were lying unused as the irrigation canal had become defunct since last 10 years (Fig. 2).

2.1.3. Soil fertility:

Soils in the valley region were relatively deep and mainly alluvial in nature which was developed from the silts washed out from the adjacent hilly tracts. Soils were found to be rich in nutrients as the nutrient pool in the soil gets recharged in every rainy season when washed out silts from the adjacent hills gets deposited in the lower valley regions. Besides, thick vegetation cover adds enough organic matters in the soil making them rich in organic carbon and nitrogen. Due to presence of relatively high organic matter in the soil, the bulk density was low and moisture retentive capacity was high. Soil pH ranged from 5.5 to 6.5.

2.1.4. Livestock:

Livestock rearing had been found to be an integral part of mixed farming practiced in the intervention areas. Livestock included caws, buffaloes, goats, sheep, pigs, and poultry. Relatively low crop production from the small landholdings was supplemented by livestock. Livestock supplement both family income and nutrition demand. Besides, almost entire draught energy requirement in the agricultural fields were fulfilled from the bullocks. The main source of cattle fodder came from crop residues. Nevertheless, shortage of pastures and crisis of fodder were major challenges regarding cattle rearing in the intervention area.

2.1.5. Agricultural system and production:

It was observed that mainly indigenous verities of rice are cultivated in the low lying areas having very long growing period of 8 to 9 months. Nursery is raised in the month of April to June while the harvesting is usually done in October to November. This long growing time has restricted the cultivation to be mono-cropped. At Sangti valley and Chug valley, both red rice and wet rice are cultivated. On an average 250-300 kg/ha of red rice and 250-250 kg/ha of white rice are produced in this area. In Kitpi on the other hand the farm practice was found to be slightly different, where crop rotation is an integral part of farm management and 7-8 varieties of food grains including red rice, black rice, soya bean, and millets are produced. Red rice is the dominant food crop produced in Kitpi with average production of 150-200 kg/ha. Vegetables are also grown in small patches of land to fulfill the daily food demand. However, in the recent years tomato production is growing popular as a cash crop. In the slopping lands terraces were found where maize, rai, and oil seeds are grown between April to June.

Nutrient and soil fertility management in the agricultural plots are done mainly through

recycling of agro-wastes. Burning of crop residues also adds potassium in the soil. Pig and poultry droppings are used as organic manures. After the harvesting of the rice, cattle are allowed to graze in the fields and thus the cow dung also act as organic manure. Nevertheless, absence of crop rotation and reduction of availability of organic manures have led to degradation of soil fertility and as a consequence since last 10-15 years use of chemical fertilizers have been increased steeply to sustain the crop production.

Lack of modern farm mechanism was found all over the intervention area and most of the woks were found to be done applying small tools. Ploughing is done by the bullocks and the rest of the works at the agricultural fields such as sowing, transplanting, weeding, application of fertilizers, harvesting etc. are done either by hand or by using small hand driven traditional tools.

2.1.6. Human resources and existing traditional ecological knowledge:

The production system and management of the production landscape in the intervention area was still found to be dominated by the existing traditional ecological knowledges (TEK). Indigenous seeds are mainly used in food crop farming and women conserve the seeds and carry the knowledge of seed preservation. Distinct division of labour within the family and community understanding is an inherent characteristic of the farming practice. Women play pivotal role in seed selection, application of fertilizers, swing, transplanting, weeding, harvesting, and post harvesting management, while men are mainly assigned with laborious jobs such as land preparation, ploughing etc. Absence of farm mechanism had made the agriculture human labour intensive.

3. Practice changes:

Land use study in the intervention area reveals the fact that, land use pattern change at various degrees are taking place all over the intervention area indicating a gradual shift in economic as well as socio-cultural setting. Population in the area is gradually increasing and as an obvious consequence built-up areas are expanding. Slow but steady growth in built-up areas has been found in Chug (Fig. 3). Built-ups are also found to be emerging within the agricultural plots. Due to population growth and related land fragmentation, size of the landholdings is declining. As a result expansion of crop lands and built-up areas along the forest fringes have been marked all over the study area. Moreover, rapid conversion of food-crop lands to cash-crop lands, especially orchards has been marked within the agriscapes. It was found during the land use survey that at all the three agriscapes, viz. Chug, Sangti, and Kitpi, orchards producing kiwi, persimmon, and apple are growing especially in the slopping tracts replacing the maize producing areas. High market price and low moisture requirement are the two major drivers behind the growth of orchards in this region.

It was also found that, low productivity of food crops due to water scarcity, decreasing soil fertility, small landholdings, mono-cropping, and labour shortage in many cases has provoked the farmers shift to other economic sectors leaving the subsistence farming altogether. For instance at Sangti valley it was found that a large share of farmers have quit rice production due to unavailability of irrigation water abandoning the crop lands (Fig. 4).

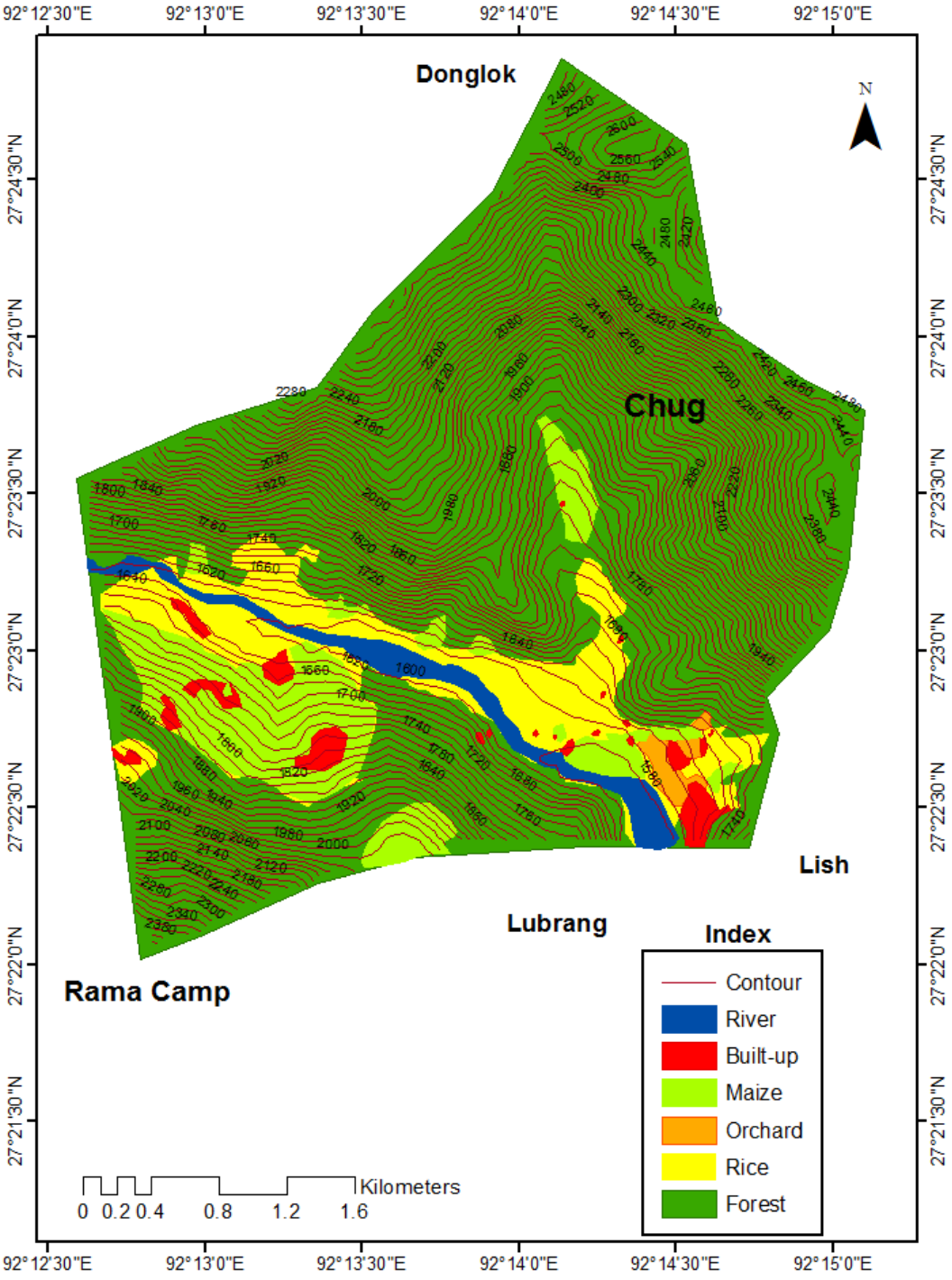

Fig. 3. Land use map of Chug Village, Dirang, Arunachal Pradesh

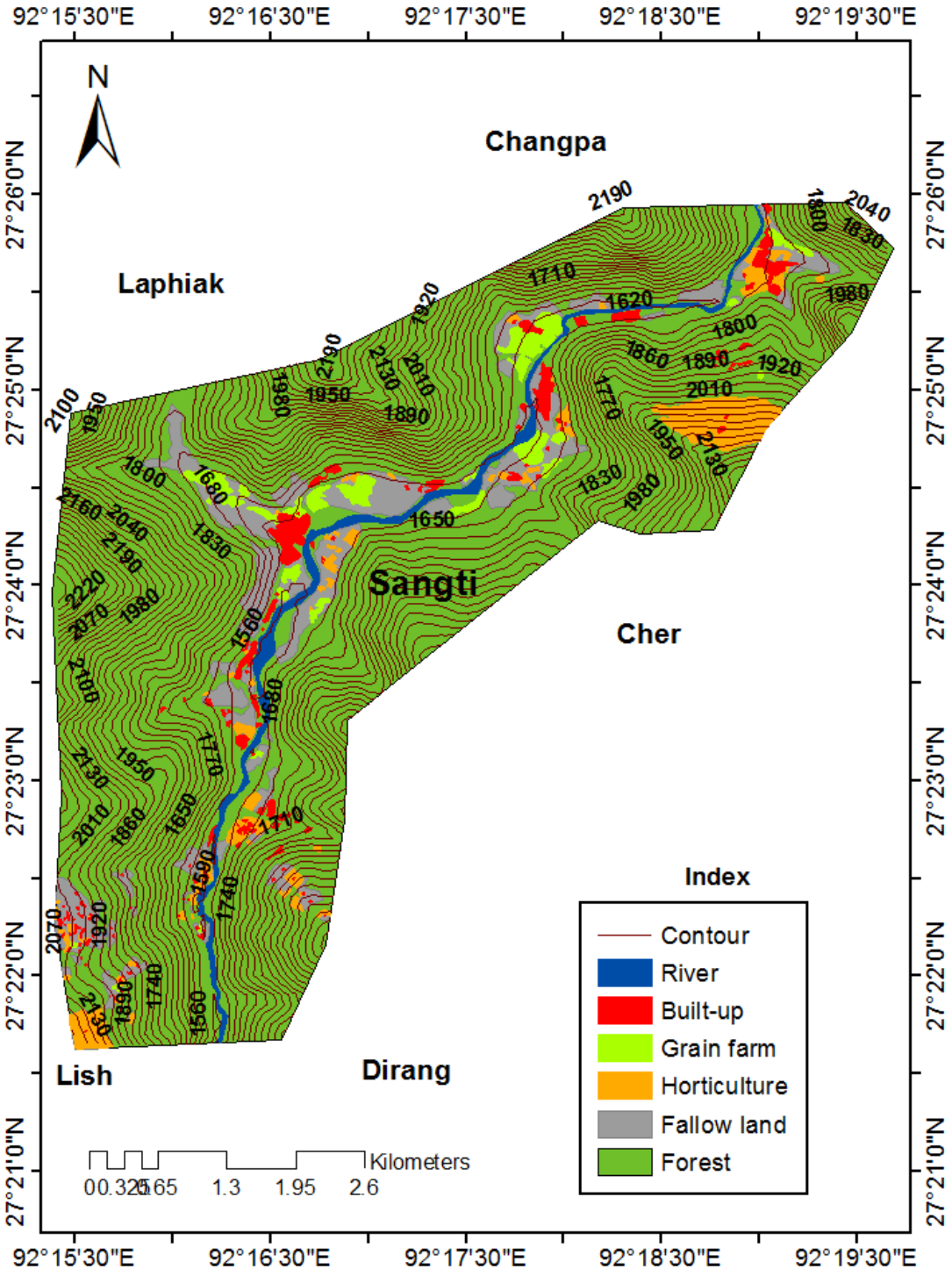

Fig. 4. Land use map of Sangti valley, Dirang, Arunachal Pradesh

4. Conclusion:

The perception based study revealed the fact that although agriculture continued to be the main livelihood of the community, a notable shift in agricultural practice had been taken place in last 15 to 20 years indicating gradual shift from food crops to cash crops. As a result the area under paddy and maize has declined gradually which constantly had been replaced by fruit orchards.

The recent trend of rapid expansion of market oriented cash crops has positive implications on improving economic profile of the farmers. However, market failure, crop failures can lead to major economic crisis and food insecurity at any point of time. Again, shift from subsistence based mixed farming to market oriented mono-cropping may have adverse ecological and social consequences.

Urbanization and consequential increasing demand of lands have resulted into gradual land use and land cover pattern change. Land use conversions such as forests and waste lands to farm lands as well as non-farm lands, crop lands to built-up areas were noticeable at various degrees. However, notable land use change has been detected at many places where the maize producing areas has been converted to fruit orchards. Overall decline in croplands in general and decrease in areas under maize and rice producing areas in particular has been observed. Shrinkage of crop lands and declining crop production were the key issues related to food and livelihood security of the farming communities in the intervention area.

5. Reference:

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