# Assessing Local People's Preferences for Landscape Character in Teknaf Peninsula for Sustainable Landscape Conservation and Development

**SPSD**

# Assessing Local People's Preferences for Landscape Character in Teknaf Peninsula for Sustainable Landscape Conservation and Development

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**Abstract**:   Sustainable development requires better understanding of the human-landscape relationship in forested landscapes, one that facilitates more locally relevant and sustainable management. It can be more easily understood by the process of landscape characterisation and humans' valuation. Therefore, this study assesses local people's preferences and perceptions about the physical landscape, which is crucial for managing landscape and livelihood. The study investigates the diversification of landscape character types and landscape character areas (LCA), local people's perceptions about and preferences for different LCAs, and how and why they prefer some LCAs to others. An LCA is a distinct type of landscape that is relatively homogenous in character. Two different villages located in Teknaf peninsula, Bangladesh, are examined where the villages were selected by calculating vegetation cover within a buffer of 1 kilometre. Landform and vegetation data were collected as physical characteristics of the landscape to identify the LCA, and data for local people's perception and preferences were collected through focus group discussions and questionnaire surveys by selecting 10% of the households of each village in March 2016. The findings show that in Kerantali the diversification of landscape character types was more than in Tulatali. Homestead garden areas are highly preferred in Tulatali and forest is highly preferred in Kerantali. Kerantali's people receive poor material benefit from forest areas, whereas Tulatoli's people receive more material benefit from homestead garden areas. Furthermore, our findings indicate that homestead gardens play an important role as a supplement to forests.

## 1.     INTRODUCTION

Rural people are highly dependent on their surrounding landscapes (Fagerholm et al., 2012). They use natural resources available in their local landscapes for their daily needs (Kramer, Healy, & Mendelsohn, 1992; Silvano et al., 2005).

Thus, as they are directly connected with the surrounding landscape, it is important for any decision makers or conservationists to know what kinds of

services or benefits they perceive to gain from their surrounding landscape, which landscape type they prefer more for their daily needs, and how the landscape can be managed in accordance with their needs and preferences.

Landscapes are able to provide many different goods and services to society. Wandén and Schaber (1998) identified aesthetic services which have ethical values (e.g. right to existence for all living creatures), provisional services which have production values (e.g. production of food, fibre, fruits), and regulating and supporting ecosystem services which have life support values (e.g. carbon fixation by green plants, protection of the soil against erosion, the maintenance of soil structure and fertility by a healthy soil flora and fauna, and biological control of crops and fruits by insects). The capacity to provide goods and services is not evenly distributed over a regional landscape as it depends on the socioeconomic and biophysical components of the landscape (Wiggering et al., 2006; Syrbe et al., 2007). In order to identify physical components, landscape characterization is a widely used tool that helps to identify a single character area, such as forest, depending on a particular landscape component or character such as vegetation (Heritage Council, 2006).

However, local people perceive different services from different landscape character areas (LCAs) and modify some parts of these LCAs according to their needs and preferences. Moreover, a landscape is composed of different LCAs that provide various services to local people. Therefore, it is necessary to manage landscapes by considering both their character and the role that local people play as they are the key local stakeholders, actively using, managing and changing the surrounding landscape (Campos et al., 2012).

Some considerable studies have been done on local people's preferences towards landscapes. Most of the studies have focused on visual (Cheng, 2007; Abkar et al., 2011; Dramstad et al., 2006) and aesthetic preferences (Chen, Xu, & Devereux, 2016; Howley, 2011; Thompson & Boyd, 1998) for reserved or protected landscapes (Sowińska-Świerkosz & Chmielewski, 2014; Szell, 2012), particular landscape patterns, such as mountains, lakes, and forests (Brown & Brabyn, 2012; Muhamad et al., 2014), and urban landscape patterns (Chen, Xu, & Devereux, 2016). However, there is now a growing demand for assessing preferences for multiple services, including provisional, aesthetic, supportive and cultural preferences (Muhamad et al., 2014; Brown & Brabyn, 2012; Sowińska-Świerkosz & Chmielewski, 2014). Assessing people's preferences and perceptions about visual, aesthetic or cultural services towards landscapes is already popular in developed countries (Cheng, 2007; Abkar et al., 2011; Dramstad et al., 2006; Chen, Xu, & Devereux, 2016; Howley, 2011; Thompson & Boyd, 1998), but in developing countries, rural residents are mainly concerned about landscapes' provisioning services whereas urban residents tend to appreciate more regulating and cultural services (Martín-López et al., 2012).

Perceptions are likely to differ among people living in different landscapes because of the various aspects of their perceptions of the surrounding environment being based on their experiences with nature (Berkes, 1999; Campos et al., 2012) over different spatial and temporal scales (Hein et al., 2006; Rodríguez et al., 2006). In addition, people who are living in different landscapes perceived the same services from diverse landscape components. For instance, those who live close to the forest perceived different provisional services from the forest, but in other landscapes they may have perceived the

same services from the household garden or agricultural field. However, such differences in perception between different landscapes may lead to conflicts over natural resource management. In order to establish sustainable landscape management, it is important to know which landscapes are composed of which LCAs, and how local people perceive and prefer those LCAs. To our knowledge, no such study has been conducted for rural landscapes in developing countries. This research will help to identify landscapes with specific compositions of LCAs and local people's preferences and perceptions about those LCAs for provisioning services so that local people's relationships can be correlated with particular landscape characteristics which helps to manage landscapes and local livelihood in a sustainable way.

For conducting this research, the Teknaf peninsula located in Bangladesh has been selected. This is a unique area in Bangladesh where both coastal and hill landscapes exist. Recently this landscape has been highly degraded due to anthropogenic activities, natural disaster, and the over-exploitation of natural resources (Miah, Bari, & Rahman, 2010). Now the population is increasing and the land use pattern has changed dramatically (Rahman, Asahiro, & Tani, 2011). As a result, both forest and marine resources have been degraded (IUCN, 2005) and it is an area of great concern for conservationists. The main objective of this study is to identify what kind of LCA exists in two different landscapes and to assess the differences of local people's perception and preference about those LCAs.

## 2.       MATERIALS AND METHODS

### 2.1       Study Area

The Teknaf peninsula is located in the Teknaf upazila, Cox's Bazar district. The peninsula comprises about 153 villages. Among them are two villages named Kerantali and Tulatali, which were selected based on the vegetation characteristics (Figure 1) by calculating the vegetation cover within a 1 kilometre buffer area from the centre point of villages. One village was selected for 50% vegetation (Kerantali) and the other one for 30% vegetation cover (Tulatali). Tulatali is located on the western side of the peninsula, far from the forest, with an area of approximately 519039.803 sq. metres. Kerantali is located on the eastern side of the peninsula near to a forest, with an area of approximately 578240.595 sq. metres. In the village of Tulatali, there are 195 households, one mosque, one Madrasa, and one fishing ghat, and in Kerantali, there are 215 households, one primary school, one NGO school, one small market, and one fishing ghat. A major portion of the population of Tulatali are engaged in agricultural activities and fishing in the sea, whereas the major sources of income are in the tertiary sector, in occupations such as shop keeping, labouring in rice factories, industrial labour, and other jobs related to fishing activities or forest work, including forest guard work or firewood collecting.

### 2.2       Study Design

The following study design (Figure 2) was followed to complete the study, and this figure shows that data were collected in two steps. The first is landscape character data, collected from a desktop study and the other is local

people's perception and preference data, collected from face to face interviews and questionnaire surveys respectively.
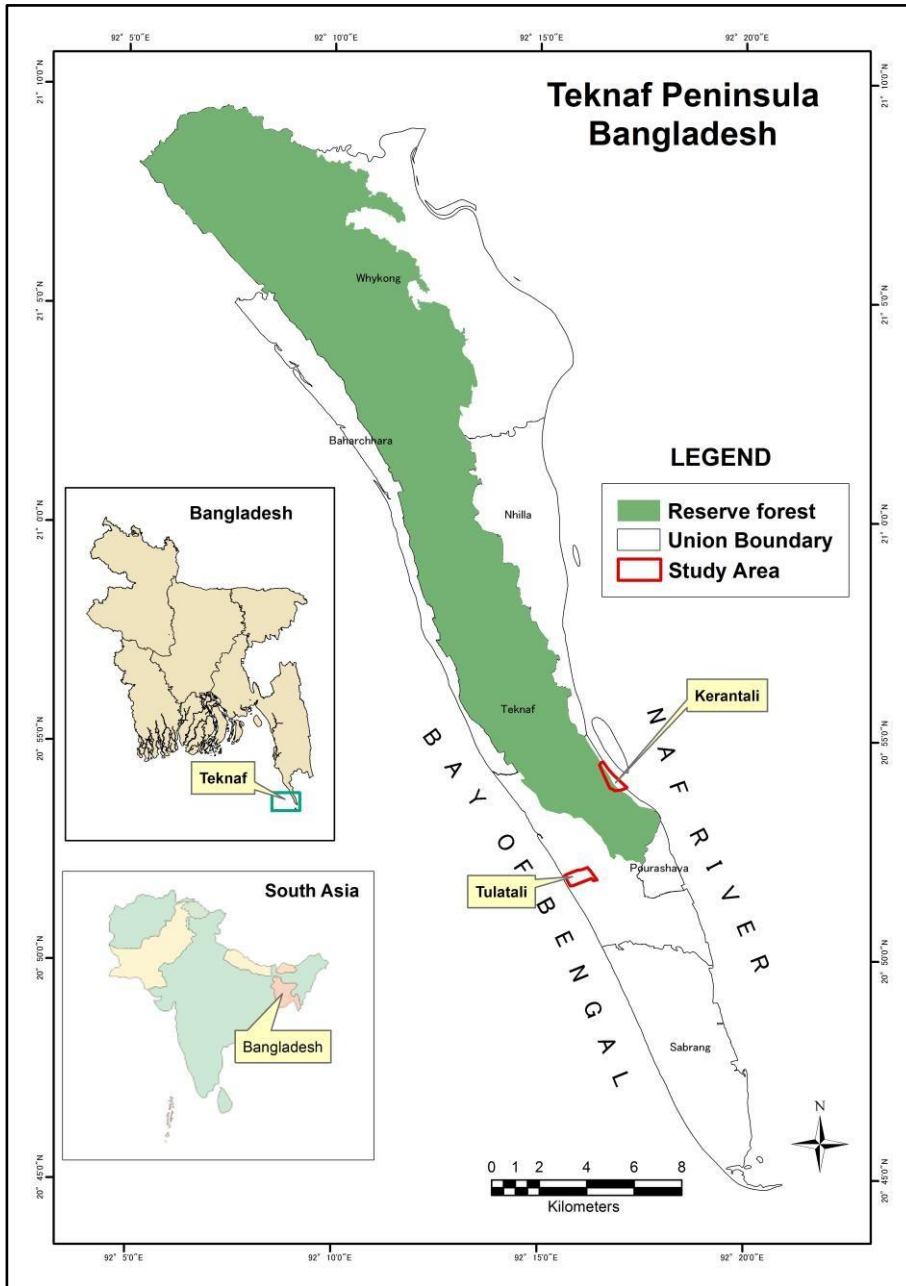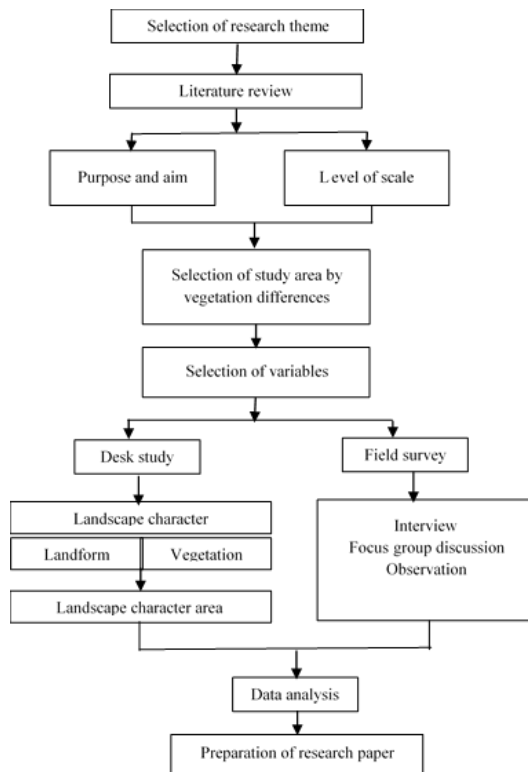


*Figure 1.* Study Area

*Figure 2.* Study Design

## 2.3    Data Collection

### 2.3.1    Landscape Character Type Data

Data on the landscape characteristics of two villages were collected from landform and vegetation maps, which aid in the classification of the LCAs associated with different physical landscape characteristics. A landform map (Figure 3) was prepared from a 5m resolution digital elevation model, which was composed from all of the ALOS satellite images taken between 2006 and 2011, and were finalised by the NTT DATA Corporation in September, 2015. The Hammond method was followed and ArcGIS 10.4.1 software was used to make a landform map that shows four categories of land type: plain land (0-30m), plain land with relief (31m-90m), high land (91m-150m) and high mountainous land (151m-300m).
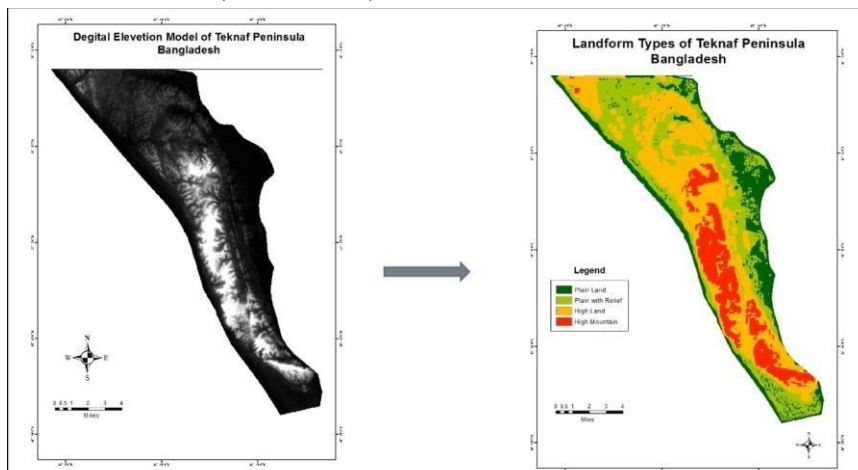


*Figure 3.* Landform Types in Teknaf Peninsula

Vegetation data were collected from a vegetation map. The vegetation map was prepared in two steps. First, a map was prepared from Landsat 8 images taken from October to March, 2013 using the NDVI (Normalized Difference Vegetation Index) method. Three categories were identified from the first map (Figure 4): G land, which includes grass land, and agricultural land; Mosaic land, which is considered water bodies, fallow land with bushy vegetation, and road; and high vegetation land that combines all forest (planted and natural), homestead gardens, and betel leaf fields. The satellite images were almost three years old and various high vegetation groups were in a merged category, therefore an image from Google Earth, 2016, was used to modify and make individual data layers of betel leaf fields, planted forest areas and homestead gardens (Fig. 2.4). The second vegetation map was a combination of those data layers and the first map. This final map shows 6 categories of vegetation: betel leaf areas, grass land areas, mosaic areas, homestead garden areas, natural forest and planted forest areas (Figure 5). All categories of landform and vegetation data were calculated for two villages.
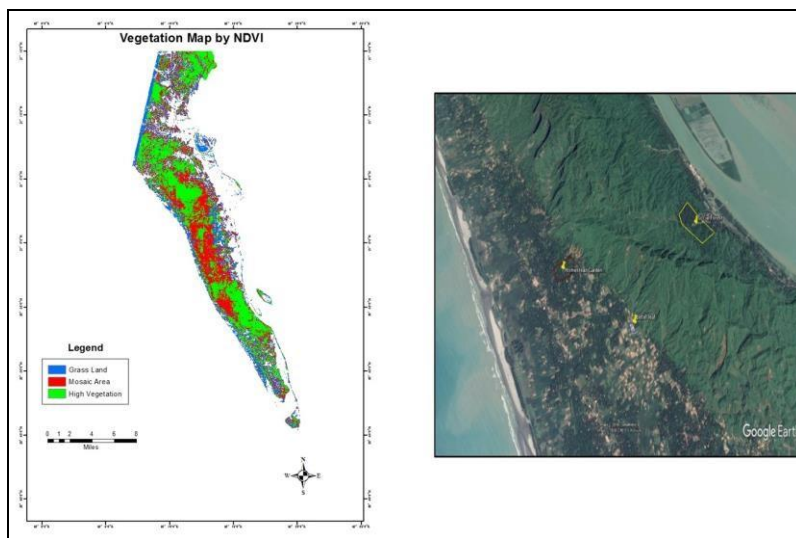


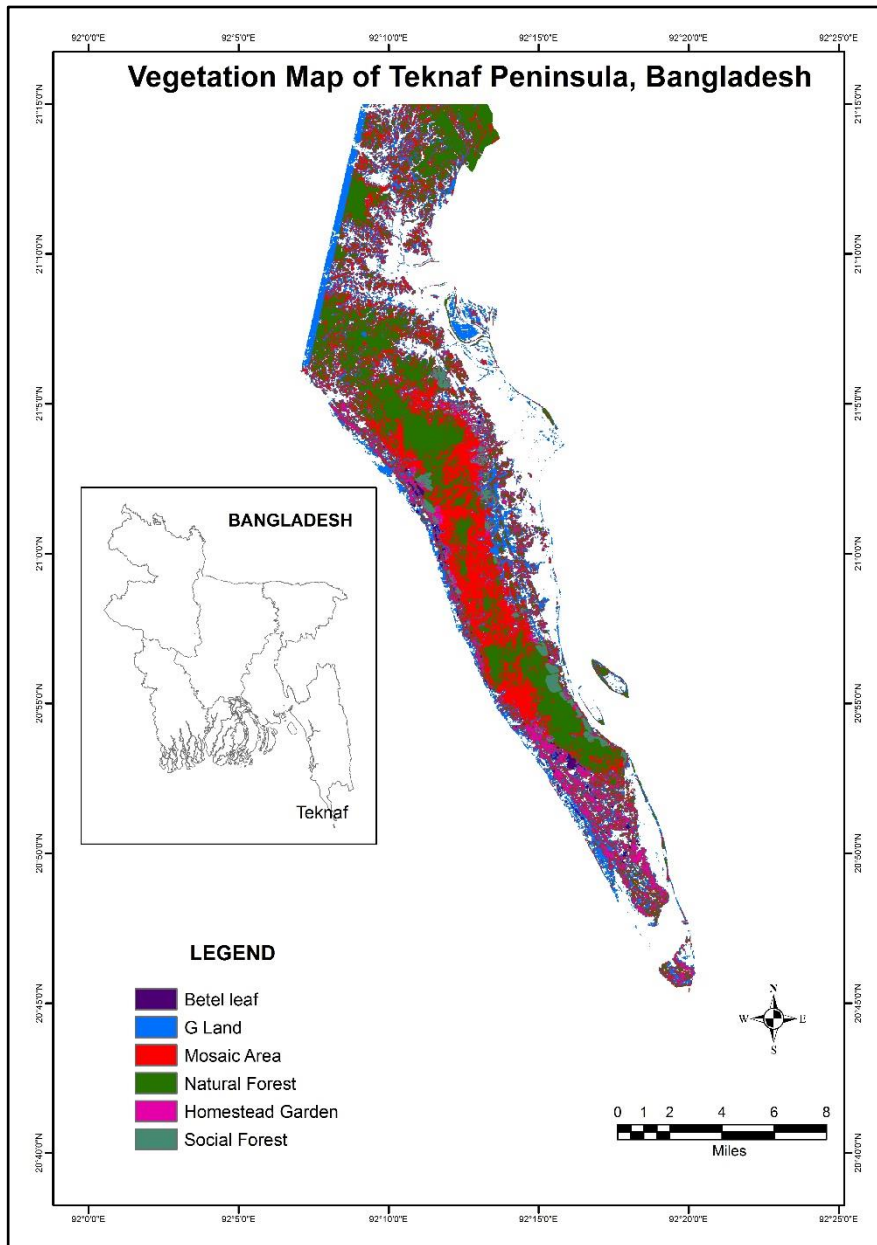*Figure 4.* Vegetation Map Methodology

*Figure 5.* Vegetation Types in Teknaf Peninsula

### 2.3.2    Landscape Character Area

LCA is based on a spatial hierarchy. In most cases at national, regional and local level, the classification breaks down LCAs further by landscape character types and areas. In accordance with the previous classifications for landscape character types and areas by Wascher (2005) and Heritage Council (2006), Tekanf peninsula can be considered as an LCA at the regional scale and the study area can be considered as two different landscape character types at the local level; in this research, the target was to classify landscape character area at the local level (Figure 6). However, the landform and vegetation character were used for classifying the LCA at the local level by customizing the landscape codes for European Landscape Character Types from Wascher (2005) (Figure 7), and this area was identified using a Google Earth image from 2016.
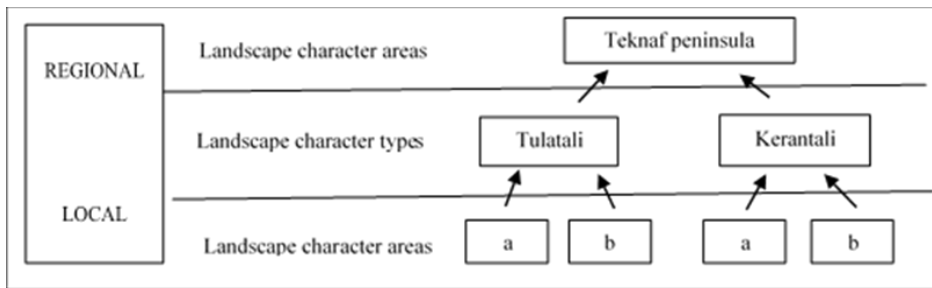
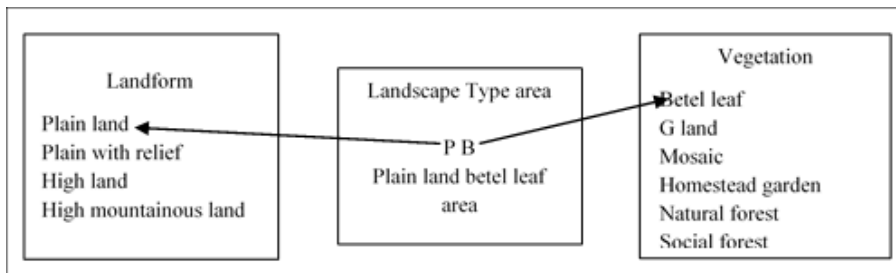*Figure 6.* Classification of landscape character area at regional and local level



*Figure 7.* Landscape codes used for landscape character areas in study area (customized from Wascher (2005))

### 2.3.3 Local People's Perception and Preference Data

Data on local people's perception and preferences of the provisioning services of different LCAs were collected through questionnaire surveys with the local population. The population was sampled by means of simple random sampling, where 10% of households from each village were selected. In Kerantali there are 215 and in Tulatali there are 195 households. There were 21 households from Kerantali and 19 households from Tulatali village sampled. The survey was conducted in March, 2016.

This questionnaire consists of two parts, socio-demographic information and preferences for LCAs. The former includes factors such as age, gender, income, occupation, education, and house status and land assets, included in order to understand their socioeconomic condition. The latter focuses on people's perception and preferences about different LCAs.

As mentioned above, according to the Millennium Assessment, four types of services (provisioning, regulating, supporting and cultural) were identified to assess how people perceived the landscape (Muhamad et al., 2014). For this research, six types of provisioning services were identified. Those are: main food and crops, vegetable, fruits, construction tools, firewood and marketable items. Each respondent was asked which landscape character area they use as the source of each service. The answer indicates how different LCAs were perceived by local people.

A five-point scale, ranging from 1 ('Not needeed') to 5 ('Extremely needed'), was applied for evaluating people's preferences for different LCAs.

## 2.4 Data Analysis

Several data collection methods were used to collect quantitative data. In this study, people's perceptions and preferences were treated as quantitative data, though generally it is considered qualitative data; however, perception data were collected as the number of perceived services from different LCAs

and preference data were collected on a five-point scale system that was counted as qualitative data. On the other hand, landscape character types and areas were calculated as quantitative data.

In this study, the data were analysed in two ways: an analysis of existing LCAs of each village, and an analysis of data on people's preferences and perceptions about those LCAs.

Firstly, landform and vegetation data was calculated for each village using TNTmips software and the landscape character types determined by following customized landscape codes (Figure 6). Then, the landscape character types and areas were calculated, and through analysis of the dominant types, LCAs were identified at the local level that is used for provisioning services to people.

Secondly, the number of perceived services from each LCA was calculated and ranked according to people's preferences.

## 3.     RESULT

The main focus of this paper is to identify LCAs in two different landscape type areas (villages) using landscape characterization, and to assess the differences of local people's preferences and perceptions about those landscape character areas. Results are described as follows:

## 3.1     Landscape Character Type and Area

From the desktop study, physical character data were obtained from landform and vegetation maps for each village (Table 1). The landform of Tulatali is almost entirely flat land with some local relief and there are no high land or high mountainous areas, whereas Kerantali can be recognised as a high mountainous area due to its larger percentage of high land and high mountainous area. Kerantali also has some flat land area. Among the vegetation categories, larger portions of Tulatali are covered by G land type (grass or agricultural), whereas a larger portion of Kerantali is covered by planted forest.

*Table 1*. Landform and Vegetation data of Tulatali and Kerantali

| Tulatali | | | | Kerantali | | | |
|---|---|---|---|---|---|---|---|
| **Landform** | | **Vegetation** | | **Landform** | | **Vegetation** | |
| Types | Area (%) | Types | Area (%) | Types | Area (%) | Types | Area (%) |
| Flat land | 31 | Betel leaf | 4 | Flat land | 14 | Betel leaf | 1 |
| Flat with relief | 69 | G land | 47 | Flat with relief | 1 | G land | 4 |
| | | Mosaic land | 15 | High land | 29 | Mosaic land | 20 |
| | | Homestead garden | 34 | High mountainous | 56 | Homestead garden | 13 |
| | | | | | | Natural forest | 7 |
| | | | | | | Planted forest | 55 |

By using the customized landscape codes (Figure 7) method and the Google Earth image from 2016, several existing landscape character types were identified in order to determine existing LCAs for two villages. Seven LCAs were identified and calculated from Tulatali and ten LCAs were identified and calculated from Kerantali. Table 2 represents where Tulatali is dominated by flat G land (agricultural fields), flat G land with relief

(agricultural fields) and flat homestead gardens with relief, whereas Kerantali is dominated by high mountainous planted forest with a higher diversity of landscape character type than Tulatali.

*Table 2.* Landscape character types of Tulatali and Kerantali

| No | Tulatali | | Kerantali | |
|----|----------|----------|-----------|----------|
| | **Landscape character types** | **Area (%)** | **Landscape character types** | **Area (%)** |
| 1 | Flat betel leaf land | 3 | High mountainous social forest | 61 |
| 2 | Flat G land (agricultural field) | 25 | High mountainous betel leaf | 1 |
| 3 | Flat mosaic land | 10 | High mountainous homestead garden | 7 |
| 4 | Flat homestead garden with relief | 23 | High mountainous natural forest | 2 |
| 5 | Flat betel leaf with relief | 3 | High mountainous mosaic | 6 |
| 6 | Flat G land with relief (agricultural field) | 25 | High mountainous G land (grass land) | 4 |
| 7 | Flat mosaic land with relief | 11 | High land natural forest | 5 |
| 8 | | | High land mosaic | 5 |
| 9 | | | Flat homestead garden | 8 |
| 10 | | | Flat mosaic land with relief | 1 |

Based on the above landscape character types, different LCAs were identified for each village that are used by people for provisioning services (Table 3). In Tulatali, the agricultural field area was identified from both flat G land and flat G land with relief, the waterbody, and fallow land area was identified from flat mosaic land and flat mosaic land with relief. In Kerantali, high mountainous G land type was identified as grass land area with no agricultural field area, but with a larger portion of forest area.

*Table 3.* Landscape character areas of Tulatali and Kerantali

| No | Tulatali | | Kerantali | |
|----|----------|----------|-----------|----------|
| | **Landscape character area** | **Area (%)** | **Landscape character area** | **Area (%)** |
| 1 | Agricultural field area | 50 | | |
| 2 | | | Forest | 71 |
| 3 | Betel leaf area | 7 | Betel leaf area | 1 |
| 4 | Homestead garden area | 36 | Homestead garden area | 16 |
| 5 | Waterbody area (mosaic land) | 1 | Waterbody area (mosaic land) | 6 |
| 6 | Fallow land area (mosaic land) | 6 | Fallow land area (mosaic land) | 6 |

## 3.2 Rural People's Perceptions and Preferences

In Tulatali, homestead gardens are widely used for collecting construction tools, firewood, and marketable items; betel leaf field areas are only used by six households for collecting marketable items; agricultural land is used for collecting the main food, vegetables, and marketable items; the waterbody is only used for collecting marketable items by one household and there is no service perceived from fallow land (Table 4).

Table *4.* The number of respondents who perceived services from existing LCA (Tulatali)

| Services | Landscape Character Area | | | | |
|---|---|---|---|---|---|
| | Homestead garden | Betel leaf | Agricultural land | Waterbody | Fallow land |
| **Main food and crop** | - | - | 3 | - | - |
| **Vegetables** | | - | 4 | - | - |
| **Fruits** | 3 | - | - | - | - |
| **Construction tools** | 14 | - | - | - | - |
| **Firewood** | 15 | - | - | - | - |
| **Marketable items** | 14 | 6 | 2 | 1 | - |

In Kerantali, the forest area is used by the highest number of households, but homestead gardens are used for the highest number of services. Most of the houses use the forest area for collecting construction tools, firewood, and marketable items; homestead gardens are used for collecting vegetables, construction tools, firewood, and marketable items; the betel leaf field area is only used for collecting marketable items by one household; the waterbody is only used for collecting marketable items by one household; and there is no service perceived from fallow land (Table 5).

Table *5.* The Number of Respondent who perceived services from existing LCA (Kerantali)

| Services | Landscape Character Area | | | | |
|---|---|---|---|---|---|
| | Homestead garden | Betel leaf | Forest | Waterbody | Fallow land |
| **Main food and crop** | - | - | - | - | - |
| **Vegetables** | 1 | - | - | - | - |
| **Fruits** | - | - | - | - | - |
| **Construction tools** | 3 | - | 10 | - | - |
| **Firewood** | 2 | | 10 | | - |
| **Marketable items** | 2 | 1 | 4 | 1 | - |

According to the perception of provisional services from two villages on different LCAs, an importance index has been made (Figure 8) and also based on the current amount of LCAs, an index has been made (Figure 9) so that local people's perceptions can be compared with existing LCAs. From the importance index, homestead gardens are highly perceived by Tulatoli people, where it is slightly less well perceived for offering services by Kerantali people. Fallow land has no importance for either of the two villages but shares an equal area. The forest is important forKkerantali people, but when comparing with its total area, the betel leaf has higher importance in Tulatali than in Kerantali.

A five-point scale, ranging from 1 ('Not needed') to 5 ('Extremely needed') was used for evaluating and ranking the local people's preferences for different LCAs, and Table 3 shows the comparative preference ranking between the two villages. In Tulatali, homestead garden areas are ranked 1, where the forest ranked 1 in Kerantali; homestead garden was ranked 3 in Kerantali, where the forest ranked 6 in Tulatali; agricultural land is ranked 2 in Tulatali, but it is ranked 4 in Kerantali where there is no agricultural land; the waterbody is ranked 2 in Kerantali, but in Tulatali it is ranked 4.
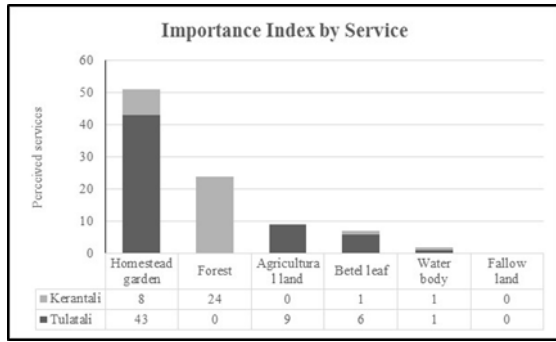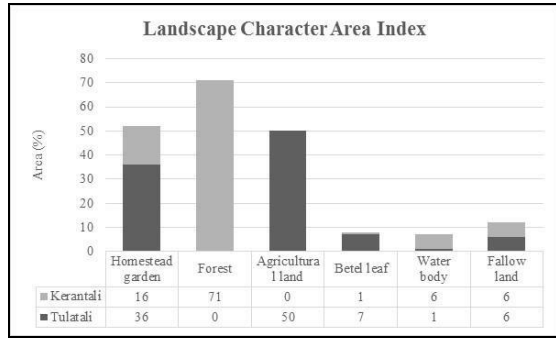
*Figure 8.* Importance Index by Perceived



*Figure 9.* Landscape Character Area Index

*Table 6.* Comparative preferences' ranking of landscape character area

| Landscape Character Area | Tulatali | Kerantali |
|---|---|---|
| **Homestead Garden** | 1 | 3 |
| **Betel leaf Field** | 3 | 5 |
| **Agricultural Land** | 2 | 4 |
| **Forest** | 6 | 1 |
| **Fallow land** | 5 | 6 |
| **Waterbody** | 4 | 2 |

# 4.     DISCUSSION

This paper shows that these two villages are significantly different according to the character of their landform and vegetation, even though they are located on the same peninsula; these particular characteristics generate diversified and sometimes similar landscape character types, but not all similar landscape character types support identical LCAs. For instance: flat G land in Tulatali is identified as agricultural field area, while also being identified as grass land area. However, from this study it can be said that flat land with relief and lower vegetation supports a larger agricultural field area and homestead garden areas (Tulatoli) and high mountainous areas with high vegetation support larger areas of forest (Kerantali) in the context of Teknaf peninsula.

The present study revealed that rural people living in the forest area of Teknaf perceived higher levels of provisional services from forests, while people living far from a forest perceived nearly the same services from homestead garden areas. In Tulatali, there is more agricultural field area than homestead garden area, but the perceived services from homestead gardens

are greater than for agricultural field areas. On the other hand, in Kerantali, almost 50% of the people perceived construction tools, firewood, and marketable item services from the forest area, and for other services they have to depend on the market. The waterbody area is larger in Kerantali than in Tulatali, but the number of perceived services is the same and, most importantly, these two villages hold almost the same area of fallow land, but there are no provisional services that local people can perceive.

An interesting finding of the study is the differing preference values of the people of the two villages, especially those from Kerantali. In Kerantali, the forest area is ranked 1, which is very natural due to the perceived benefit, but their second most preferable area is the waterbody, which makes up approximately 6% of the total area, but is perceived very poorly. There is no agricultural field area, but they ranked it number 4. In Tulatali, the homestead garden area is the most preferable area from their perceptions, but they preferred fallow land more than forest as they thought it could be more beneficial than forest.

Our findings elucidate the distribution pattern of LCAs according to landscape character types and local people's perception and preference values for the LCAs of two villages of Teknaf. The findings could be considered as a guide for decision makers or planners, where they can get a clear idea about what the character of the land is and which character types could be converted according to local people's perceptions and preferences.

## 5.        RECOMMENDATION

In this study, two villages were examined from among the 153 villages of Teknaf peninsula, so it is recommended to consider more villages in future studies, which could represent the whole Teknaf peninsula and which could provide in-depth recommendations and suggestions for spatial planning.

From the above discussion it can be seen that forest devastation is very high because of firewood and construction tool collection and that the area has some fallow land; this fallow land can be used for planting homestead species and local people can use their household's surrounding area for plantations.

Another noticeable point is that Kerantali people totally depend on the market for collecting crops and fruit, and their landform is mostly mountainous, therefore the local government can consider an upper mountain management policy for planting various fruit species and crop cultivation.

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