Participatory mapping and geographical patterns of the social landscape values of rural communities in Zanzibar, Tanzania

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People attach commonly approved social values subjectively to landscape. These values vary spatially and can be studied in geographical context. In sustainable management of cultural landscapes, social values should be taken into account as professionally as the analysis of physical landscape features. This case study applies participatory and GIS techniques in the mapping and geographical analysis of social landscape values in a multifunctional cultural landscape in Zanzibar island, Tanzania. Social landscape data were collected with single-informant interviews using participatory GIS (PGIS) techniques. Four different social landscape values (subsistence, traditional, aesthetic and leisure) were mapped on an orthophotoimage individually by 149 informants. Data were spatially and statistically analysed to construct understanding of the community level patterns of the social landscape values. Results show geographical differences between individually and collectively held values in their distribution and clustering across the landscape. These patterns reflect local culture and its interpretation of different social landscape values. Results address the importance of local stakeholder participation when spatial planning and management of multifunctional cultural landscapes are realized. The paper discusses these management implication and methodological challenges of using participatory GIS techniques in studying cultural landscapes.

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Introduction

Social values in cultural landscapes

Most of the current problems in the management of natural resources in cultural landscapes lie in the interface between people and the environment. Sustainable management can only be achieved if pluralistic land uses under the umbrella of long-term social, economic and ecological values are appreciated and taken into account in land use planning (Luz 2000; Potschin & Haines-Young 2006; Raquez & Lambin 2006). There is a need for broader understanding of the complex human-nature interaction in contemporary cultural landscapes especially in political decision making. Solutions for many of these management challenges lie in the actions of the people and the ways they value and use the land. However, there is a great imbalance in how the knowledge and needs of different stakeholders are taken into account in spatial planning. It has been argued that far too little emphasis is still given to the expertise of the local residents and communities in relation to, for example, patterns and qualities of vegetation, soils, species and land cover (Williams & Patterson 1996; Luz 2000; Brown et al. 2004; Black & Liljebald 2006). It is well known that local communities play a crucial role in sustainable landscape management. They possess valuable knowledge of the functions and social values attached to cultural landscapes, and this social knowledge is essential when tackling land use and land management issues for better future development.

Social landscape values are subjectively experienced, place-related and contextual, and tend to vary spatially (Tuan 1977; Zube 1987). Capturing social knowledge in landscapes requires the dedi-

cated participation of local inhabitants (Sauer 1925). In societal processes, the meeting and control of the physical and social environment is crucial (Kaltenborn 1998; Luz 2000; Brown 2005; Black & Liljeblad 2006). Spatial data on the social landscape can depict how communities are using the environment and how they perceive and experience it and, as Soini (2001) sees it, mapping enables understanding of differences between the social values of landscapes and natural scientific assessments made on them. It is necessary to gain knowledge of the complex social-ecological systems within contemporary landscapes and provide techniques which enable collection, retrieval and analyses of social landscape values in a spatial form (Alessa et al. 2008). Recently, the social meanings of places have started to gain wide interest in the context of the geographical analysis of landscapes (Brown et al. 2004; McIntyre et al. 2004; Brown 2005; Black & Liljeblad 2006; Kyttä & Kahila 2006; Brown & Raymond 2007; Gunderson & Watson 2007; Tyrväinen et al. 2007). As landscapes can be understood both as complex mosaics of the physical environment and social constructions and processes experienced by people with their senses, contemporary landscape research faces a challenge to integrate these approaches, especially for practical landscape management needs (Potschin & Haines-Young 2006). Cultural landscape research has also been criticised for concentrating merely on the textual interpretation of landscapes which tends to lack the necessary applicable knowledge to landscape management and planning (Olwig 1996; Soini 2001). Potschin and Haines-Young (2006) identify needs for transdisciplinary models and tools in landscape analysis which would serve practical needs in society and support the sustainable management of cultural landscapes.

Physical landscape patterns and distribution of natural resources can be quite effectively mapped with the aid of various spatial data sets, such as aerial photographs and satellite images. Recently, the combined use of spatial data has produced an increased understanding of the dynamics and development of landscapes from the perspective of land use and land cover patterns (e.g. Lambin et al. 2003; Pontius et al. 2004; Käyhkö & Skånes 2006; Hartter et al. 2008). Social values, which are associated with various places in landscapes, on the other hand, are more difficult to measure, since they are built on individually perceived, subjective and qualitative information. When people become acquainted with a specific space, this space develops into a place and values are attached to it (Tuan 1977). Hence, it can be said that social landscape values emerge from environmental experience (Brown 2005). These values can be e.g. aesthetic, religious, cultural or recreational. Social landscape values have commonly approved meanings, as they are socially constructed. The concept of landscape value can be seen to act as an operational bridge in applied landscape management and planning (Brown 2005). It connects the geography of place, i.e. the location of specific places, with the psychology of place, which refers to the underlying place-related perceptions. It is important to remember, however, that people have different expectations, needs and desires and these influence the ways they attach values and set preferences to various places (Relph 1976; Zube 1987). For example, aesthetic values do not concentrate on the same places for all people because of individual differences in perception and experience.

Participatory GIS and mapping of social landscape values

Participatory GIS (participatory geographical information systems, PGIS) techniques combine community participation with the use of digital geospatial techniques and enable the collection, storage and analysis of stakeholder data in a geographical form. In practice, PGIS solutions are various, depending on the aims of the application, the level of the information needed and the knowledge of the participants. PGIS practices have been commonly used in urban planning and in the allocation of natural resources (e.g. Kingston et al. 2000; Craig et al. 2002; Voss et al. 2004). For the mapping and geographical analysis of social values attached to landscapes, the use of participatory GIS techniques is a useful approach. Land management challenges are typical examples where stakeholder participation is needed in a geographical form. In many developing countries, for example, information on the local social values on cultural landscapes is completely missing, and natural resources are under constant pressure from various stakeholders (MA 2003; FAO 2006). For rural developing communities, a sustainable landscape has a multiple social and economic importance by providing e.g. life support, energy, shelter, food and means of income (Sitari 2005; Käyhkö et al. 2008). Hence, understanding of the geo-

graphical patterns and variation of social values on the land is urgently needed in the circumstances where traditional and new stakeholders meet and share the use of natural resources. Such a baseline understanding is essential for the sustainable management of multifunctional landscapes and could be potentially integrated with geographical data of physical resources.

Participatory mapping of social landscape values has been approached both from the individual and group data collection perspectives (e.g. McIntyre et al. 2004; Gunderson & Watson 2007). Methods, such as sticker dots, point markers and polygon delineations on the maps have been applied (McIntyre et al. 2004; Brown 2005; Black & Liljeblad 2006; Tyrväinen et al. 2007) and in some cases data have been collected via map interfaces through the Internet (Kyttä & Kahila 2006). One particular challenge for PGIS is the application of ambiguous data set structures in the participatory mapping efforts. For example, social values are often continuums rather than discrete points and patches in the landscape.

In previous studies, social value typologies have been approached from different starting points. For example, Alessa et al. (2008) used 14 landscape values, namely aesthetic, biological, cultural, economic, future, historic, intrinsic, learning, life sustaining, recreational, spiritual, subsistence, therapeutic and wilderness, in the mapping of the social spaces. This value typology has been modified by Brown and colleagues in several case studies (Brown & Reed 2000; Brown 2005; Raymond & Brown 2006) and is originally founded on the work of Rolston and Coufal (1991). Tyrväinen et al. (2007) used 11 different values, such as valuable nature site, forest feeling and unpleasantness in mapping urban green areas in Finland. The values were based on previous Swedish studies regarding the social values of open spaces (Regionplane- och trafikkontoret 2001; Ståhle & Sandberg 2002, cit. Tyrväinen et al. 2007). In addition, Manning et al. (1999) have proposed 11 human preference-based values for national forests and Tarrant et al. (2003) a 12-point scale to measure public values of national forests.

This case study explores possibilities of applying participatory and GIS techniques for the mapping and geographical analysis of social values in multifunctional cultural landscapes, especially in the context of a developing society. Through studying social landscape values it is possible to establish an understanding of the geographical patterns of the social values; what kind of patterns the social landscape values form, what and where the most important areas in the social landscape are, how the values might change and modify cultural landscapes and how the social spatial data reflect the land cover data of the physical environment. The study has three main objectives. Firstly, to map social landscape values of the local inhabitants in the village of Matemwe, Zanzibar (Tanzania) based on single-informant interviews and participatory GIS techniques. Four social values, namely subsistence, aesthetic, traditional and leisure, were selected for the study because these were considered essential in the social landscape of the local community. Secondly, to analyse and compare the geographical patterns of these social landscape values, and thirdly, to identify the most important characteristics of the social values, which could contribute to the sustainable planning and management of multifunctional cultural landscapes, such as Matemwe. Furthermore, the paper discusses methodological aspects of the use of participatory GIS techniques for the spatial analysis of social values.

Description of the case study site

The Zanzibar islands are located in the eastern coast of Tanzania, approximately 30 km north-east from Dar es Salaam. The population of the main island Unguja (Zanzibar) is estimated at about 700,000 people and is growing approximately with an annual rate of 3.1% (Tanzania Sensa 2003). The Zanzibar islands have a tropical monsoon climate, with two rainy seasons from March to May and October to December and an average annual temperature of 26 C° (Hettige 1990). The contemporary Zanzibar landscape is a mosaic of indigenous and cultivated vegetation, which expresses the combined and long-term influences of different cultures and land use activities, such as spice farming and shifting cultivation. The Zanzibar islands have experienced dramatic changes in land use and land ownership throughout their history (Lofchie 1965). Today, the "environment is being more heavily utilised than ever before" and the fast growing tourism since the early 1990s is one significant contributing factor to this (RGZ 2004).

The administrative region (swa: *shehia*) of Matemwe is situated in the north-eastern coast of Unguja Island (Fig. 1). Matemwe consists of sev-

eral sub-villages with a total population of about 7300 (Tanzania Sensa 2003). Geologically, Matemwe lies in the coral rag area, where bedrock consists of exposed, porous coral and where loose soil deposits are generally shallow and mainly found in the crevasses of the bedrock. The majority of the coral rag forests are characterised by ferns, grasses, indigenous trees and scrubs (ZFDP 1997) with marginal opportunities for permanent agriculture (Commission for Land and Environment 1995). Shifting cultivation is practiced widely across the forested and scrub covered land as the traditional form of agriculture, and occasional permanent fields and agroforests can be found in the vicinities of the villages. The cultivation cycle is short (3–5 yrs) and in many places fields are shifted even annually.

Coral rag forests provide important livelihood services, such as firewood, extraction of coral and building poles for construction, materials for handicrafts, medicinal plants and sites for practicing traditional beliefs (Sitari 2005; Käyhkö et al. 2008). Thus, the socio-economic importance of the forest products is high for the local communities, but due to multiple uses, there is general concern over the long-term sustainability of the forest resources (ZFDP 1997; RGZ 2004). Sea resources bring additional sources of livelihood for the villagers, especially through fishing and seaweed farming (Käyhkö et al. 2008). As tourism is rapidly intensifying along the coastal fringe, it influences both the forest and sea related livelihoods of the villagers. Tourism potentially creates new opportunities for employment and the market in general, but tourist facilities also push local people to migrate inland, sell their lands, change areas for cultivation and restrict access to beach areas and sea resources in particular (Gössling 2002; Mustelin 2008).

Material and methods

Overall study design

The mapping and analyses of the social values of the Matemwe communities consisted of several

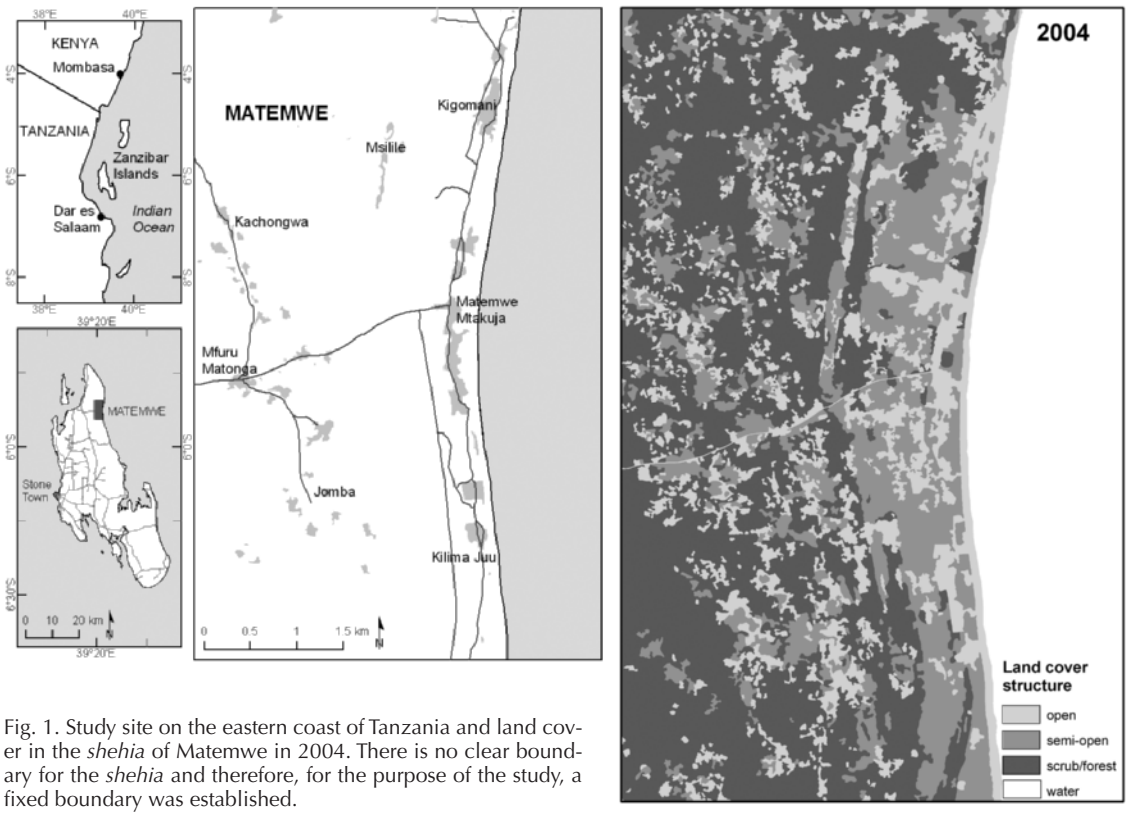

Fig. 1. Study site on the eastern coast of Tanzania and land cover in the *shehia* of Matemwe in 2004. There is no clear boundary for the *shehia* and therefore, for the purpose of the study, a fixed boundary was established.

work phases. Initially, the theoretical considerations and practical preparations for the study were made, including a literature review of the practical approaches of PGIS and selection of the social landscape values. Four social values, subsistence, aesthetic, traditional and leisure, were chosen for the study of the social dimension in the landscape among the local communities of Matemwe. These values were based on commonly practiced land use activities as well as the values they attach to their village landscape which were grouped under a typology of four social landscape values (Table 1). Comparisons to similar research papers were also made when formulating the value typology applicable to the Matemwe case, even though most previous studies concern developed societies (Brown & Reed 2000; Brown 2005; Raymond & Brown 2006; Tyrväinen et al. 2007; Alessa et al. 2008).

Once the theoretical setting was formulated, the research approach was locally adjusted for Matemwe through discussions with the village leader (swa: *sheha*) and planning officers in the Department of Commercial Crops, Fruits and Forestry (DCCFF), which is a government department under the Ministry of Agriculture, Livestock and Natural Resources in Zanzibar. A combination of participatory mapping with semi-structured interview questions was chosen for the data collection technique (see e.g. Black & Liljeblad 2006; Gunderson & Watson 2007). Social values were collected individually as geographical information from each of the informants because of the subjective nature of the information, but the data were analysed collectively to identify the geographical patterns of the values across the whole landscape of the study area. Subsequently, the results were shown to a group of 20 informants in a reflective focus group with lively discussion. The focus group discussion played an important role in informing the community members and raising discussion among them. It also assisted in the interpretation of the results. Together with the case study, these participatory methods and the significance of social data in landscape planning were also introduced to the planning sector in Zanzibar.

Participatory mapping and the interviews

The spatial collection of the social value data was organised through a participatory mapping campaign, which took place in Matemwe in November–December 2007. This PGIS campaign was based on the use of the most recent digital georeferenced aerial photographs (2004, 0.5 m pixel size), which were obtained from the Department of Survey and Urban Planning (DoSUP) in Zanzibar town. Aerial photographs have been found useful in PGIS campaigns since they are visually attractive without too much abstraction of the landscape (Corbett et al. 2006). The use of aerial photographs was tested in earlier PGIS campaigns in Zanzibar and found useful and reliable for location-specific tasks given to the community members (Makandi 2008). Aerial photographs were printed at a scale of 1:5000 on a laminated paper sheet for data collection.

A total of 149 community members from all the 21 sub-villages of Matemwe were interviewed.

Table 1. Social landscape values and their respective activities/indicators and interview questions used in the study.

Social value	Activity/indicator	Interview questions to locate the activities
subsistence	shifting cultivation	Do you or your family cultivate crops or seaweed, where?
	seaweed cultivation	
	grazing	Where are your grazing areas?
	collection of firewood, construction materials, medicinal plants, wild fruits/vegetables, building poles for selling, coral rock for making lime stone, hunting areas	Where do you collect forest products?
traditional	religious or sacred place	Are there religious or sacred places for you in the landscape, where?
aesthetic	beautiful, attractive place	Where are the most beautiful places here?
leisure	social interaction, recreation	Where do you go on your spare time? Are there e.g. some important meeting places for you or do you go to the surroundings?

The boundaries of the recent census (2002) enumeration areas were not available, and thus the amount of persons sampled in each sub-village was determined according to the relative amount of buildings in the sub-villages according to the 2004 aerial photograph interpretation. This provided the only applicable spatial estimate of the population distribution in Matemwe. Informants were selected from the sub-villages by the *sheha* or his assistant who were given detailed instructions of the amount of participants, their age (15–30 yrs, ≥31 yrs) and gender division for each sub-village. Because most of the people have several livelihoods (Sitari 2005), this was not included in the selection criteria. The informants were selected on the same day or the day before the interview situation. Each participant received a small monetary compensation since they were not able to attend their normal daily activities while waiting to be interviewed.

The interviews were made by two local field assistants from the DCCFF. Local field assistants were used since it was considered essential that the interviews were conducted in fluent Swahili. Before the interviews, the questionnaire had been translated from English into Swahili and the social value concepts and related interview questions (Table 1) were discussed with the field assistants to ensure that the same understanding of terms and concepts was shared. The semi-structured interviews lasted 20–40 minutes for each informant and started with an introduction to the topic of the interview, orientation with the aerial photographs and collection of the background information (e.g. age, household details, source of living, and level of education). Then the participants marked their homes onto the printed aerial photographs and continued marking social landscape values one by one as polygon delineations using drawing ink. For each value mapped the participants were allowed to mark as many places on the map as they wanted to. Via supplementary questions, such as what crops they cultivate and how often they change the field location, additional attribute information was associated with the value polygons. All delineated polygons had unique identifiers in terms of the social values and these were linked with unique informant identifier codes to each person interviewed.

Social value delineations were transformed into cell-based geographical information immediately after each interview since informants marked their values on the same map sheet but were not allowed to see each other's delineations. The data transformation was done manually in the field as follows. The image map which contained informant delineations was overlaid with a transparent grid (Fig. 2). Each grid cell (50x50 m, 0.25 ha) had a unique identifier number. If the delineated value polygon covered at least one third of a cell area, the cell code number was attached with the social value polygon. Informants' homes were marked with one cell accuracy. Subsequently, unique identifiers could be used to transform manual cell data into digital data in GIS.

Methods of analysis

Analogue spatial data sets collected in the field were recorded on the computer after each interview day. This MS Excel 2003 database included informant background as well as data on the delineations for each value (Fig. 2). The general characteristics of the informants were analyzed with

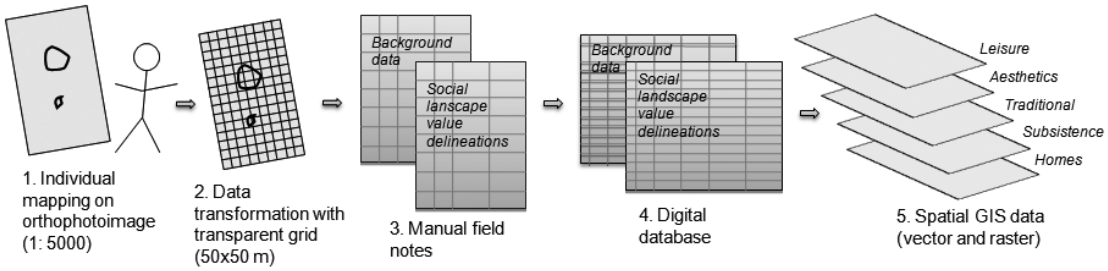

Fig. 2. Spatial data collection of social landscape values with participatory mapping and data transformation from manual field notes into digital form and GIS datasets.

SPSS 14.0 using descriptive statistics and cross tabulations. These statistics were used to obtain an overall understanding of the informants for the interpretation of the social landscape value data. Descriptive statistics were also analysed from each of the four values in MS Excel. However, given the data collection methodology and the approximate character of social value data in geographical form, these measures, especially data on the size of the delineated areas, should not be interpreted as exact but rather as uncertain geospatial data of social values (MacEachren et al. 2005).

The geographical data on the informants' homes and their individual social value delineations were converted into digital GIS data (in ArcGIS 9.2/9.3) on the basis of the unique cell identifiers (numbers) (Fig. 2). Each value area (minimum one cell, 0.25 ha) and home data were stored as vector polygons, which were rectangular in shape. Additional information related to the social landscape value delineations was stored as attribute data for polygons representing one delineated social value.

To analyse the geographical distributions of each social landscape value, individual informant-specific delineations were grouped into social value layers in GIS for spatial analysis and visualisation. Since it was expected that the physical distance between informant homes and value locations might explain some of the variation in the geographical distribution of the values, the approximate distances between informant's home and corresponding social value delineations were calculated as the straight-line distance using Hawths's analysis tools (Beyer 2004). The calculations were made from the middle points of the polygons (0.25 ha).

Each social landscape value layer (4 layers) contained two types of geographical data: the presence (cell value 1/0) and intensity (total number of informants' entries for each cell) of the social value. The social value intensity data were spatially analysed with a selection of landscape metrics using Fragstats 3.3 software. The purpose of the analysis was to describe the geographical patterns of each social value in landscape (within the whole study area). The intensity values were classified into four classes based on natural breaks in the data and converted into raster format to be handled in the software. Total patch area, number of patches and patch area mean, range and standard deviation were calculated with the 4-neighbour rule. Mean Euclidian nearest neighbour distance was calculated for each intensity class based on the nearest straight-line neighbours of each patch. This analysis was used to measure patch context and isolation at landscape scale.

To analyse the overall diversity of the social values at landscape scale, all four values were combined into one GIS vector layer. The diversity and relative occurrence of the overlapping four social values were analysed with the Shannon diversity index which is a popular measure of species diversity and has also been used to study social data (Krebs 1989; Reed & Brown 2003). The index was calculated to every social value cell based on the relative amount of informant entries of each value in the cell. The index does not have a specific range but is dependent on the richness and occurrence of social landscape values.

From the vector intensity grids, the spatial distribution (clustering vs. distribution) of the values was analyzed using a hot spot analysis. Getis-Ord Gi* statistics were calculated for each cell based on the summed intensity (total amount of overlapping informants' entries in every cell) (Haining 2003). Looking at the neighbouring cells, the statistics calculate where features of high value and features of low value tend to cluster in the study area and compares this to random chance. Clusters of high values represent hot spots of social landscape value intensity. The outcome from the analysis is a statistically significant Z score. The larger the positive Z score is (i.e. how many standard deviations away from the mean it is), the more intensive is the clustering of high values and vice versa. A Z score near zero indicates no apparent concentration of the intensity values. Based on the distance at which spatial autocorrelation peaks, a threshold distance of 100 meters was used in the analysis. In this study, the confidence level of 95% was used and the intensity value hot spots were identified as those areas where the Z score is more than 1.96 standard deviations away from the mean.

Results

Characteristics and livelihoods of the informants

Altogether 149 informants were interviewed in this case study (Fig. 3). According to the gender and age, 50% (74) were men and 50% (75) women with a mean age of 35 years. Approximately half of the informants (47%) were over 30 years

the youngest informant being 15 and the oldest 80 years old. The majority were married (72%) and around 20% were single, 1% divorced and 5% widowed. Households were large with 5 to 10 members (73% of informants) and 4 children on average (max 19). A quarter of the informants did not have children. The education level among adults was low. Half of the informants had no formal education, 12% had some elementary education and 5% had completed elementary school. Secondary education was completed by one third (32%) of the informants and one of the informants was a high school graduate.

The informants commonly depended on several livelihoods. The main livelihoods were subsistence farming (71%), fishing (19%) and seaweed cultivation (43%). In general, men seemed to practise fishing and women cultivation of seaweed. Only one of the male informants said he helped his wife with seaweed cultivation and only some women practised fishing. Subsistence farming was practised by both genders and the main form of farming was shifting (slash and burn) agriculture. Livestock, such as cows, goats, chicken or ducks were maintained by only 13% of the informants, primarily in the sub-villages towards the inland regions. Some (7%) practised small-scale business such as selling chicken soup. Only one out of ten informants earned a salary through working for the hotels, schools, or shops or as drivers and tailors.

Social landscape values and associated activities

The informants delineated a total of 989 areas on the aerial photographs during the participatory

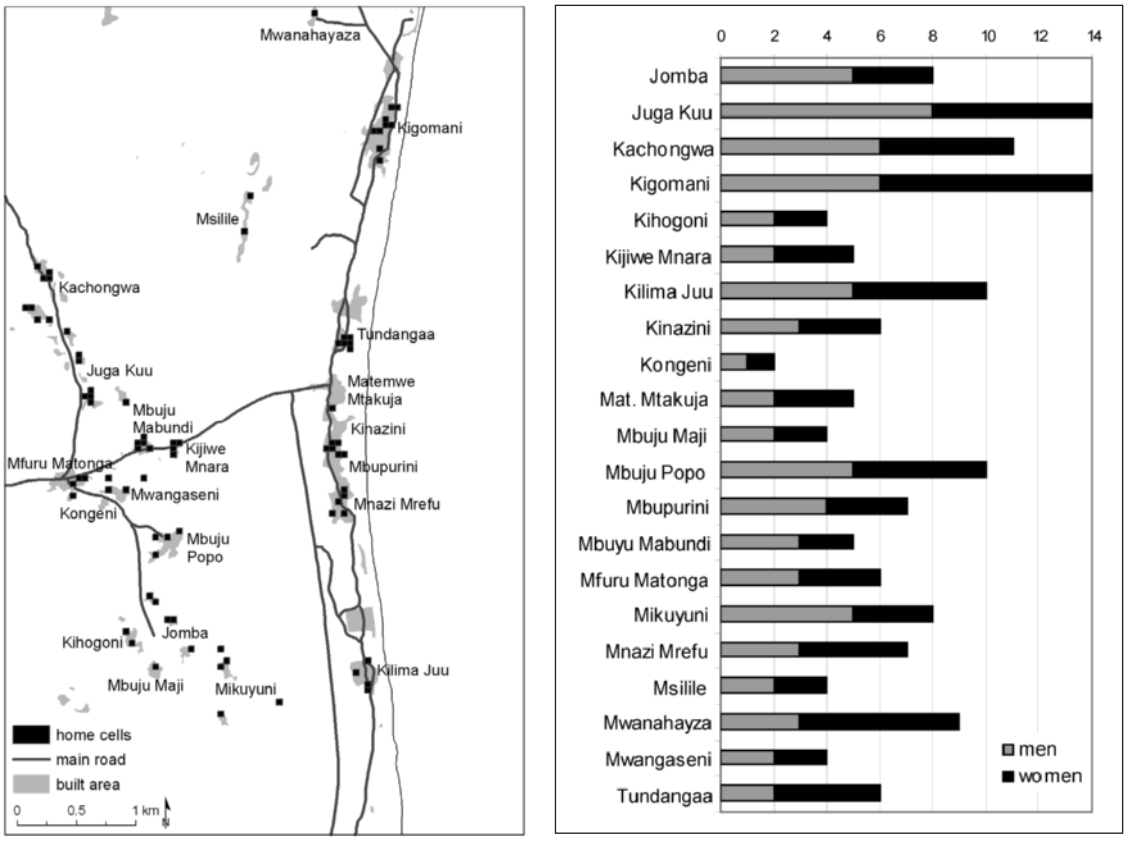

Fig. 3. Location of the informant homes (n = 147, cells = 111) and the total number and gender distribution of the informants per sub-village.

Table 2. Statistics on social landscape value delineations (n = number of informants, n (%) = relative number of informants, SD = standard deviation, intensity 1 (%) = relative amount of cells that have no overlapping area delineations).

	n	n (%)	No. of cells	No. of areas	Areas/ inform.	Area size (ha) aver	min	max	SD	Aver dist. to home (m)	Inten. 1 (%)
Subsistence	110	73.5	640	492	4.47	0.45	0.25	2.25	0.27	685.5	69.8
Fields	138	92.6	256	158	1.14	0.42	0.25	1.00	0.21	523.8	96.5
Grazing areas	52	34.9	104	66	1.27	0.41	0.25	1.75	0.29	356.0	97.1
Seaweed cult.	107	71.8	130	111	1.04	0.41	0.25	1.00	0.19	1219.1	75.4
Forest prod.	141	94.6	303	157	1.11	0.56	0.25	2.25	0.37	643.0	96.7
Traditional	146	98.0	205	206	1.41	0.44	0.25	2.25	0.29	695.5	59.8
Aesthetic	93	62.4	166	144	1.53	0.51	0.25	2.00	0.35	1974.2	62.7
Leisure	131	87.9	133	147	1.12	0.36	0.25	1.50	0.24	394.5	72.9

mapping campaign. These consisted of places which represented subsistence, traditional, aesthetic and leisure values of the local inhabitants. The highest response rate (n %) was established for the traditional and lowest for the aesthetic values (Table 2).

Subsistence value primarily concerns those land uses which satisfy the basic daily needs of the community members in Matemwe. Subsistence value consists of four land use activities, namely agricultural fields, grazing areas, seaweed cultivation and collection of the forest products. On average, the informants had one to two agricultural fields in cultivation with four to five different food crops. This cultivation pattern is typical for the coral rag areas, where fields are shifted regularly and where mixed crops are cultivated. The most common crops are maize, cassava, sorghum and different kinds of peas. Livestock consists mainly of goats, cows, chicken and ducks which are kept freely in the forest areas and around the home but gathered together for the nights. Various forest products, such as firewood, construction materials and medicinal plants, are collected from the surrounding environment. Some men also practice hunting and extract coral stone for lime making. Women cultivate seaweed in the tidal area, and sell dried harvest for industrial purposes.

Traditional value primarily relates to religion, and plays an important role in the rural communities. Hence traditional value was readily mapped by almost all of the informants (Table 2). Typical traditional places are graveyards (86%) and sacred sites for practising traditional natural religions (12%) alongside Islam. One of the drawn traditional places also represented a place where a sorcerer practises his healing traditions.

Aesthetic value was attached to sites where the informants have the possibility for social interaction or finding business opportunities and shopping (together 53%). Beautiful views, the beach and occasional newly-built private buildings and the cooling sea breeze were mapped as aesthetic only by approximately one quarter of the informants. Home was mentioned as a beautiful place by 15% of the informants, mainly women. The low response figure (Table 2) indicates that a large part of the informants found it challenging to map beautiful places.

The places where the informants spend their leisure time were different between men and women. Men have their own meeting places (swa: *maskani*), where third of the informants (30%) meet to change ideas and play board games. These sites are usually located in central places in the subvillages. Popular meeting places are also around the shops in inland Mfuru Matonga and at the fish market in coastal Kigomani (see Fig. 3). Half of the informants (50%), usually women, spent their spare time at home doing home chores and weaving baskets. Some attended Quran school classes (8%) in their leisure time and young men liked to play soccer on the soccer grounds (9%).

Geographical patterns of the social landscape values

Most of the informants marked one to two areas per value (for subsistence value per land use activity) on the orthophotomap (Table 2). The average

area size of the delineated areas ranged between 0.4 and 0.6 hectares, which is equal to one to two cells. In general, leisure places seemed to be the smallest in size and areas for the collection of the forest products the largest. The standard deviations for the sizes of the areas were highest for the collection of forest products and aesthetic places. This is explained by the varying nature of the sites attached to these values (e.g. spot-like houses and sea front area). Seaweed cultivation and agricultural fields are generally small and compact, and they also have the smallest variation in size between the informants.

The subsistence value had the highest coverage (160 ha), number of patches (360) and largest geographical distribution of the four mapped values (Fig. 4, Table 3). The proportion of the cells with intensity value 1 (only one informant entry in the cell) is highest (75–97%) (Table 2) and the nearest neighbour distance between subsistence patches was also notably shorter compared with the other values (Table 3). The components of subsistence value all tended to be individual delineations for subsistence uses with little overlap between the informants (Fig. 5). Coral rag forest has high individual subsistence value for the community members of Matemwe, which is why their geographical patterns in the forest areas surrounding the sub-villages were scattered and quite evenly distributed. Geographically, distribution of seaweed farming was distinct and concentrated on the tidal zone with long average distances to homes. Agricultural activities and use of the forest products, on the other hand, concentrated in the vicinity of the informant homes but were geographically fragmented (Table 2 and Fig. 5).

Although all the values mapped in Matemwe included direct use of land, subsistence could be considered as the most important value for the livelihoods of the villagers. However, it was not located nearest to the informants' homes. This is contrary to previous studies made in developed context, which have pointed out that values which include direct or active use of the land are located nearest to home sites (Brown et al. 2002). For the villagers in Matemwe, it is not always possible to obtain fields or keep livestock and to collect forest products in the immediate vicinity of the home because of the limited space and the characteristics of the coral soil. Hence, these activities need to be scattered in the surrounding forest areas.

During the mapping process, the informants delineated altogether 206 areas for traditional values with an average size of 0.4 ha (Table 2). Approximately 40% of the traditional sites overlap between the informants, which means that traditional value has the least amount of individual delineations between the informants. This results from the fact that graveyards and scared places are normally shared with several families. Traditional sites are spatially fragmented, but concentrate around the sub-villages within approximately 700 m from the informants' homes (Fig. 4, Table 2).

Aesthetic and leisure values concentrated on sub-villages. In general, leisure values tended to cover small areas, and there were many single cell entries, which were marked as appealing leisure spots on the aerial photographs (Fig. 4). In total, there are 82 leisure patches, which cover an area of 33.3 ha (Table 3). Because leisure time is usually spent near homes, the mean home distance to delineated leisure places was short, around 400 meters. Beautiful places are often shared between the informants and thus had the highest geographical concentration and intensity in the studied landscape (Table 3, Fig. 4). The amount of delineated aesthetic places was 144 and their size was on average 0.5 ha (Table 2). In total, the aesthetic places cover an area of 42.3 ha of Matemwe landscape (Table 3). While leisure spots are found in most of the sub-villages, aesthetically appealing places seemed to be concentrated along the coast-

Table 3. Landscape metrics on social landscape value patch mosaic (ENN dist. = Euclidian nearest neighbour distance).

	Tot.	Patch	Patch area (ha)			ENN dist. (m)		
	area (ha)	no.	mean	range	SD	mean	range	SD
Subsistence	160.00	360	0.44	2.00	0.32	162.9	3104.6	220.1
Traditional	51.00	111	0.46	1.50	0.31	226.6	1499.3	254.3
Aesthetic	42.25	71	0.60	4.75	0.77	309.4	2396.1	537.1
Leisure	33.25	82	0.41	2.00	0.33	248.3	1183.3	217.8

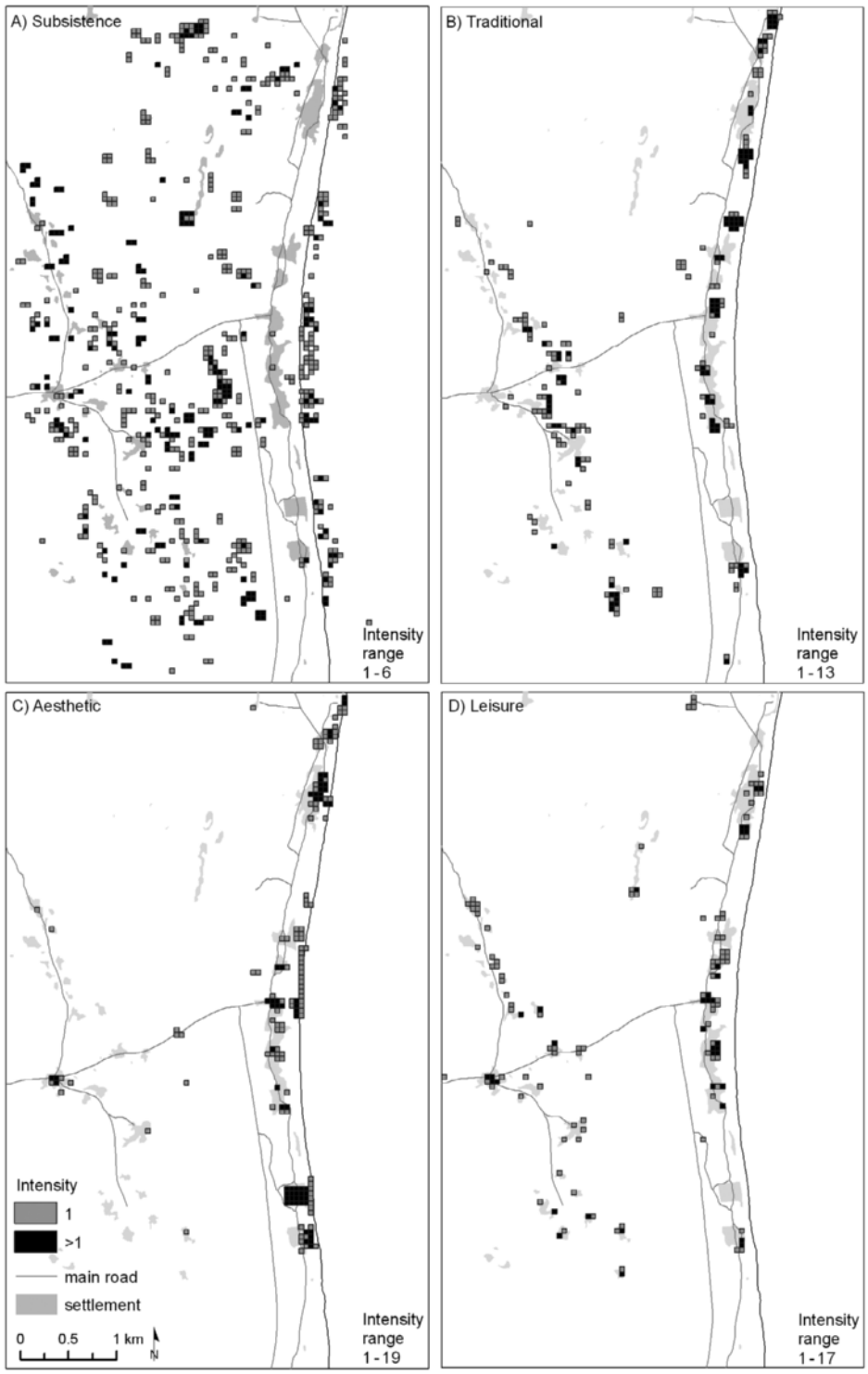

Fig. 4. Geographical distribution of the delineated areas, the intensity of overlapping areas and intensity range for the four social landscape values in Matemwe.

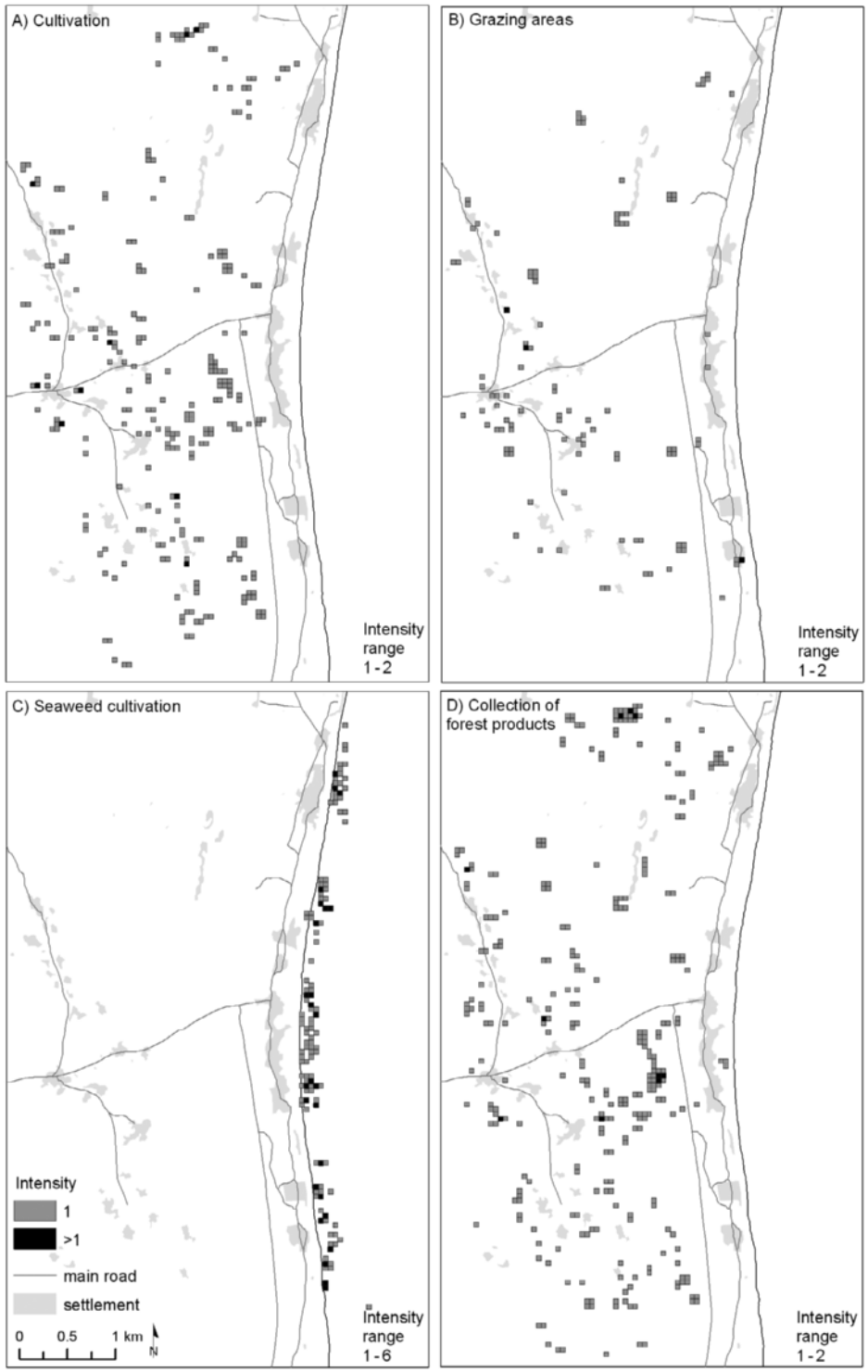

Fig. 5. Geographical distribution of the delineated areas, the intensity for overlapping areas and intensity range for the components of subsistence value in Matemwe.

line with the longest distances (1974 m) from the homes of the informants (Fig. 4, Table 2). However, distribution of the aesthetic value overlapped with that of leisure value and it is evident that among the villagers of Matemwe beautiful places are for large part related to social interaction.

Together, the four social landscape values covered 262 ha (1049 cells) of Matemwe land and tidal area (Fig. 6A). Values seemed to have little overlap as over 90% of the cells illustrate the presence of one value and the diversity index was zero. The highest diversity class (1.50–2.00) represented only less than one percentage of the cells and all four values coexist only in two cells (diversity index 2.0). In general, the social value diversity is low in Matemwe and the few cells of high diversity were scattered in the major sub-villages.

When the intensities (total amount of informant entries/cell) from each social landscape value were taken into account, there were eight geographical hot spot clusters of the social values (Fig. 6B). These were mainly sub-villages, such as Kigomani, Matemwe Mtakuja, Mbupurini and Mfuru Matonga, or graveyards (see Fig. 3). One specific hot spot was the area of an international hotel in the southern part of Matemwe with high aesthetic value. Hot spot areas varied from 1.25 to 4.25 ha with a mean size of 2.4 ha and a total coverage of 21.5 ha (8.2% of the total area covered by the social values). All hot spot sites were located in or nearby the sub-villages, where the highest intensi-

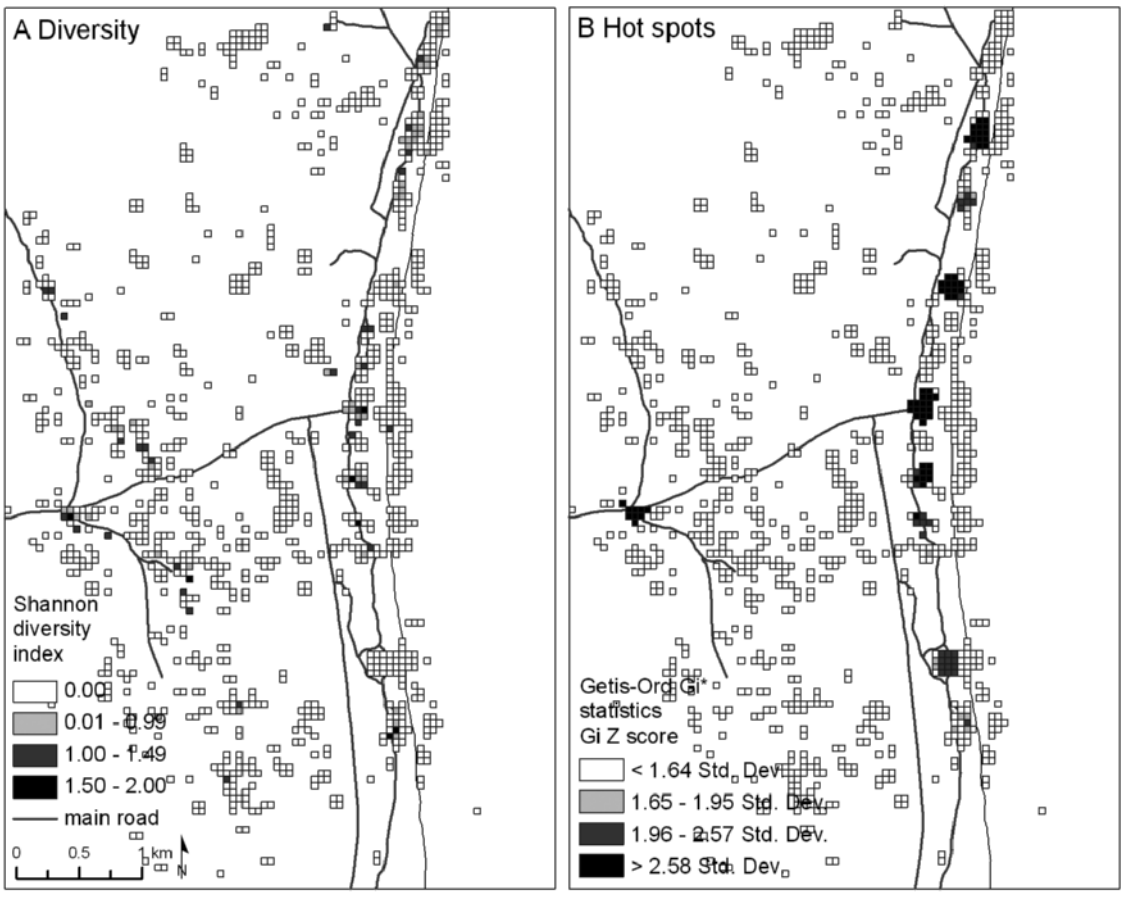

Fig. 6. A) Value diversity as Shannon index and B) hot spot map as the Gi Z score deviation from standard deviation for subsistence, aesthetic, traditional and leisure values.

ties of leisure, traditional and aesthetic values could be identified. These meeting places, graveyards and beautiful places represent shared social space of Matemwe community and are mainly located on the coastal area. The subsistence value overlapped the hot spot areas only by one hectare (four cells). It must be kept in mind, however, that the hot spots do not alone depict important areas for the community since individual subsistence values are crucial for the livelihoods of the community members.

It is evident that, in contrast to subsistence value, traditional, aesthetic and leisure values are collective in character and they are clustered into the same socially meaningful sites in the village. Such sites act as key nodes for social activities and are also aesthetically appreciated places among the community members and appeared as hot spots in the analyses. This fundamental difference in the meaning of subsistence and other social values is the reason why there was little spatial overlap between them.

Discussion

Social landscape values and management of multifunctional cultural landscapes

The participatory mapping and geographical analysis of four social landscape values has broadened the understanding of the social landscape of the rural community of Matemwe. These results have several implications for the development of multifunctional cultural landscapes. In the following section, the most important characteristics of these social values and their potential contribution to future landscape planning and management are discussed especially in the light of the situation in Matemwe and Zanzibar, but also in the wider context of developing societies.

The most significant result of this paper is the difference in the geographical patterning of the four studied social values and how this influences landscape development and planning. While subsistence value was individual-based and scattered in the landscape, other values tended to cluster and be shared between the informants. These patterns of the social landscape values reflect fundamental activities of the local inhabitants the long-term influences of the land uses to the present landscape patterns, both physical and social. Subsistence farming, grazing and other uses of the forests form the basis of the livelihoods of the local communities and create a constant element of change in the landscape. One of the most alarming influences of this dynamic land use pattern is the gradual diminishing, even loss of the essential forest resources. Especially along the coastline, where the largest sub-villages are located, forests have clearly deteriorated during the last decades (Käyhkö et al. 2008; Käyhkö & Fagerholm, submitted).

For land use planning, scattered and dynamic subsistence farming is challenging to manage because natural resources should be maintained not only for the purpose of the community livelihoods but also for the essential ecosystem services they provide at the local, regional as well as on a global scale (UNEP 2007). The changes in the state of forest resources has been studied quantitatively to find the key areas of forest loss and recovery but in shifting cultivation landscapes there is a call for research in multiple disciplines to find the drivers of the changes (Hartter et al. 2008). This knowledge, together with a supportive policy environment directing investments in local participation, alternative livelihood development, protection area allocation and technology and infrastructure investments can reduce the pressure of shifting cultivation on forests (Müller & Zeller 2002).

In contrast to the scattered subsistence values, traditional, aesthetic and leisure values were clustered to places characterised by intensive social interaction and cultural traditions. The well-being of the local people is dependent on these meeting places, graveyards and aesthetically appreciated sites and changes in these key nodes would have a significant effect on the social landscape in Matemwe. These areas, where collective social landscape values meet, have stability established through the long-lasting past and present interaction of several community members and in development and planning processes the implication of this shared social landscape is essential.

The study has shown that culture has a significant effect on the interpretation of social landscape values. In a rural developing society such as Matemwe, subsistence value is so crucial for the livelihoods of the local communities that it also affects the perception and experience of other social values. For example, aesthetic value was related more to social interaction than to the visual view. It is evident that most of the villagers in Matemwe do not experience nature in an aesthetic way as something they would interpret as beautiful with their eyes. In contrast, nature is mainly

seen as a resource because it has high utility importance in daily life, also noted by Gössling (2002) in a study in coastal Zanzibar. The results from this study are essentially different from social values studies made in a developed context where aesthetic places are among the most important and easily mapped (e.g. Brown & Raymond 2007; Tyrväinen et al. 2007). It seems that rural subsistence-based communities hold a different concept of aesthetics compared to a society where direct contact to nature is not predominant.

Another landscape planning and management challenge emerging both from the results of the analyses as well as from other social value studies is the interaction between local communities and other stakeholders active in the area. The coastal area in Matemwe seems to be an essential part of the social landscape of the community where social values cluster. However, the very same coastal space is today occupied by hotels and international tourists as a substantial part of the eastern coastline in Zanzibar is being sold to tourism entrepreneurs from abroad (RGZ 2004). The coexistence of the traditional and new land uses is evident in Matemwe (Käyhkö et al. 2008) and raises questions about sustainable landscape development and management. Due to hotel construction, some settlements have been forced to move inland and traditional religious places, such as graveyards have been transferred away from the coast. Additionally, access to the sea resources has been restricted, especially in front of the hotel areas (Gössling 2001; Mustelin 2008). These developments are against the national principles where regarding tourism development "prior and traditional right of use and access to land" is recognised for the local communities (RGZ 2003).

For the future planning of rapidly changing coastal landscapes, these local and multifunctional needs and expectations should be taken seriously and efforts to increase positive interactions between stakeholders should be introduced. The local communities and tourism need to find a way to share the same land successfully to mutually benefit each other. An initial starting point would be to respect and appreciate the geographical meanings of the social landscape values. For the practical needs in landscape management, knowledge of landscape perceptions are needed (Soini 2001). Participatory techniques, where multiple stakeholder preferences are collected and analysed in a spatial form, would be one possible way of trying to solve conflicting land uses. This case study included only the community people in Matemwe but it would have also been interesting to include other stakeholders, such as the hotel and private land owners. Such analyses would be interesting to implement in the future. There is already evidence of successful efforts of combining social values held by varying stakeholders to allocate future tourism growth and development (Raymond & Brown 2007). It is a well acknowledged fact that sustainable management of multifunctional cultural landscapes can only be achieved if participation of local stakeholders with their multidimensional and pluralist values are included in the process.

Methodological considerations of participatory mapping of social landscape values

Participatory mapping is a valuable tool to capture spatial information on social landscape values at local community level (Soini 2001; Brown 2005; Black & Liljeblad 2006; Kyttä & Kahila 2006; Gunderson & Watson 2007; Tyrväinen et al. 2007). The method used in Matemwe enabled the community, who do not have experience in landscape management, to produce valuable data of the social values attached to their land and living space. Furthermore, it can be concluded that the participatory mapping process itself had value in capacity-building among the villagers. Participation is stated in several national documents of Zanzibar, such as the *National Land Use Plan* (Commission for Land and Environment 1995), the *Indicative Tourism Master Plan for Zanzibar and Pemba* (United Republic of Tanzania 2003) and the *Zanzibar Tourism Policy Statement* (RGZ 2003), but thus far its practical implementation has remained modest. Some interview based participation has been realised but this case study is among the first to collect stakeholder data in spatial form. With spatial analysis of social landscape values, it was possible to establish understanding and produce data of the geographical patterns and the variation of social landscape values and depict areas that are especially important in the social landscape of Matemwe. However, the methodology used has some aspects regarding representation, informant sampling and data collection, which need to be considered and discussed.

Mapping of social values was done with the aid of aerial photographs. In contrast to abstract map

representations, which have been found to be problematic in participatory GIS campaigns (e.g. Zurayk et al. 2001), use of the image map was successful, since participants were able to read and identify places and areas on it with little support (see also Taylor et al. 2006). It seems the people in Matemwe have good site knowledge and have come accustomed to their environment in their daily lives. Mapping scale has an effect on the size of the social value delineations made by the informants and hence area sizes vary in different studies (Black & Liljeblad 2006). In this study, the social value delineations made by the informants were in general quite small in size and seem to be area specific because of the large scale orthophotoimage.

Interpretation of individually identified social landscape values is challenging as one needs to estimate the representativeness of the samples used in the analyses both in terms of their geographical distribution and content. Originally, the informant sampling was planned to be accomplished according to the proportion of inhabitants on the basis of the 2002 census enumeration data. However, census areas were geographically inadequate and thus, the sampling was based on the relative amount of buildings according to a 2004 aerial image. This method has shortcomings as the amount of buildings does not really reflect the number of inhabitants. Furthermore, selection of the informants was in the hands of the village leader, *sheha*, and his assistant. It is possible that some of the informants were their relatives. However, as most of the sub-villages are clan-based i.e. they are formed around the same family or a couple of families, it is not likely that such subjective selection had too much influence on the geographical representation of the sample. Additionally, the monetary compensation for the informants could have generated some prejudice in the results, but had compensation not been given it would have certainly lowered the motivation to participate in the mapping process.

The collection of data with the grid sheet was experienced to be appropriate and effective in the context of Zanzibar. With a smaller amount of informants other methods of data collection (e.g. using transparent sheet on which the mapping would be done) would also have been worth considering. The method of data collection for the social value delineations has not been used previously and it can be argued that some of the precision of information was lost when data were collected with the 50x50 m grid sheet. It is obvious that some of the areas drawn on the map were smaller than the 0.25 ha grid cell which was the minimum resolution in the study. In participatory GIS approaches, we should, however, question the necessity of accuracy which, in general, is seen as an essential character of scientific data (McCall 2006). The delineations of the social values in the real world often have an imprecise boundary like some natural features such as habitat boundaries. Reality is frequently ambiguous (McCall 2006) and we should consider if it is misleading to represent it in a precise and accurate way. In addition, ethical aspects were considered as data were not collected with such a precision that it could be connected to individual informants and their delineations on the map. This study represents one approach for handling uncertainty in geospatial data and it can be said that there is a need for further research and technical development in analyzing ambiguous and continuous data sets.

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