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Lecture

Participatory Mapping of Socio-Cultural Values in the Landscape: Cases from the Southern Highlands

Abstract

In Tanzania, there is an increased depletion of and intensified user conflicts over remaining land resources caused by rapid population increase and expansion of agricultural practices to other types of land use among other factors. These depleted resources often include natural and cultural resources of heritage value. Most of such resources are either unknown or unrecognized by local, district, regional and national communities of land users and policymakers. This article presents a Participatory Geographical Information System (PGIS) approach that was applied by an international collaborative project, 'Sustainability, scale relations and structure-function-benefit chains in the landscape systems of the Tanzanian Southern Highlands' (SUSLAND), to map landscape services in the region. This project's approach is suggested to create awareness among the policy makers and users of landscape services, while simultaneously mapping the objects, places, landscapes resources and their values that could have heritage potential at a local community through to national level. This article, therefore, describes PGIS, participatory mapping, landscape services and natural and cultural assets essential for heritage consideration. Step-by-step methods applied in the SUSLAND project approach, and the potential for its application in making inventories of socio-cultural values and ultimately identification of natural and cultural heritage resources, are presented. It is concluded that rigorous participatory approaches including the proposed PGIS are essential in Africa, where very few assets have been recognized as world heritage compared to other regions such as Asia, North America and Europe.

Key Words:

Natural and cultural resources, PGIS mapping, Landscape and ecosystem services, socio-cultural values, World heritage recognition

Introduction

Tanzania is experiencing rapid natural resource depletion, increased land use conflicts and haphazard agricultural expansion into other land uses and covers caused by increasing human population and new land development deals (Thetig and Brekke, 2010). At the same time, most natural and cultural heritage objects, places and landscapes, in this article referred to as assets, are part of land resources that have been disrupted during the agricultural expansion.

As a response to depleted land resources and intensified land use conflicts, various approaches have been applied. One such approach at local community level has been adopting participatory village land use planning (PVLUP) with the major objective of resolving land use conflicts in the country (NLUPC, 1998). Various critiques have been raised regarding the very high financial demand and time required to adopt PVLUP to cover many villages in Tanzania. However, recent studies have shown some improvements in PVLUP, whereby Participatory Geographical Information System (PGIS) could lower the financial cost as well as the time it would take to cover a given village (Elwood, 2006; Mango and Kalenzi, 2011; Kolagan et al., 2012).

While the solutions to land use conflicts and land degradation problems are dealt with using improved technical approaches that involve local communities (Mango and Kalenzi, 2011, Kisanga, 2015), very little has been reported on unknown and unrecognized natural and cultural assets that are affected by the haphazard and unplanned land use expansion. This problem is directly linked to the fact that, just like many developing countries in Africa, very few natural and cultural resources have reached world heritage recognition (Bandarin, 2015). This calls for an approach that can not only overcome multiple problems related to land resource depletion, conflicts and lack of awareness but also promote recognition of natural and cultural heritage assets for local, regional and national communities and policymakers. This article evaluates the applicability of Participatory Geographical Information System (PGIS) for raising awareness of natural and cultural resources and inventorying of potential heritage assets that could be recognized globally.

Participatory Geographical Information Systems (PGIS) is a term that describes the community application of a diverse range of geographic information technologies and systems (IIED, 2009). According to the authors, PGIS practice is based on using geospatial information management tools to represent peoples' local spatial knowledge in the forms of virtual or physical, two- or three-dimensional maps. McCall (2004) argues that PGIS practice has been most widely applied to natural resource management and to land and resource claims in developing countries (with some examples in developed countries). PGIS was recently applied to map ecosystem services, among other objectives, under the 'Sustainability, scale relations and structure-function-benefit chains in the landscape systems of the Tanzanian Southern Highlands'

(SUSLAND) project. The project, which was scheduled to last between September 1st 2014 and August 31st 2018, has involved public participation in mapping and measuring spatially explicit benefits, which people obtain from the landscape at local scales, and then developing methods for how the benefits could be realistically associated with regional scale ecosystems structures and functions. The project used remote sensing, Geographical Information Systems (GIS) and stakeholder analysis as the best Participatory Geographical Information System (PGIS),that is location-specific practices good for ecosystem service assessment for sustainable land use and natural resources management.

This article discusses the participatory mapping approach developed and applied in the SUSLAND project and evaluates its potential to assess and map socio-cultural values on the landscape for heritage recognition in Tanzania and other countries using local knowledge. PGIS, through mapping socio-cultural objects, places and practices of heritage value, should be an initial stage in the identification of formal world heritage entities, while also fostering local communities' appreciation. According to Harisson (2010), formal or official heritage concerns processes of heritage identification, management and preservation, and refers to objects, places and practices that have been classified as formal, by inclusion in a registration list of cultural heritage that is institutionally recognized and by which parameters are established. Yet, according to the same author, in legal terms, formal heritage has no agreed strict definition due to lack of consensus as the elements and parameters are not necessarily the same as those considered by communities themselves (Harisson, 2010).

This article also describes the applicability of PGIS methods that were employed in the SUSLAND project to enhance awareness of socio-cultural values and their mapping among policymakers from regional, district, ward to village level and local communities. The article demonstrates how Tanzanian decision makers at various levels from national to local can identify natural and cultural objects, places and landscapes that have either known, unknown, recognized or unrecognized values, which require further management and conservation for the possibility to attain world heritage status. This article, therefore, has three main objectives: (1) demonstrate how the PGIS approach to ecosystem service mapping applied in SUSLAND could be applied in identification and mapping of socio-cultural values while creating awareness among policymakers and local communities in Tanzania. This approach is justifiable because ecosystem services constitute the socio-cultural values embedded in natural and cultural assets found in most of our landscapes. (2) The article then describes the participatory mapping practice under PGIS methodology, in a step-by-step procedure as was conducted by the SUSLAND project on February 2016. (3) The potential for this approach on natural and cultural heritage potential values on the landscape is then discussed and concluded.

Participatory Geographical Information Systems (PGIS) Practice

Conventional Geographic Information System (GIS) is known for its capability to handle multiple data layers (overlays) for analysis and presentation. It can work across multiple scales and topographies (scale comparisons, zooming-in), combine data on different issues (e.g. transportation, hazards, socio-economic), and from different formats (e.g. satellite, paper) and sources (local, external, scientific), undertake spatial analysis of e.g. proximity, buffer zones, threshold distances overlaying different types of land use, efficient routes and networks (e.g. of people or roads) (McCall, 2004). Furthermore, the author argues that GIS treatment of temporal comparisons and spatial visualization of digital maps are particularly valuable in scenario development and exploration, interpolation and prediction. GIS can also handle spatial queries, record, protect, exchange and share spatial information in digital and analogue formats. Attempts to apply GIS to manage cultural resources have been explored (Dixon, 1999). Yet the technology has been left for mainly scientific community to practice. In addition, Dixon (1999) reported that, although the safeguarding of heritage has always been a central concern of UNESCO, the focus on the use of modern electronic and computer-based information technologies to support this work is a relatively recent initiative. There are, however, very few GIS related heritage studies conducted in Africa, let alone in Tanzania.

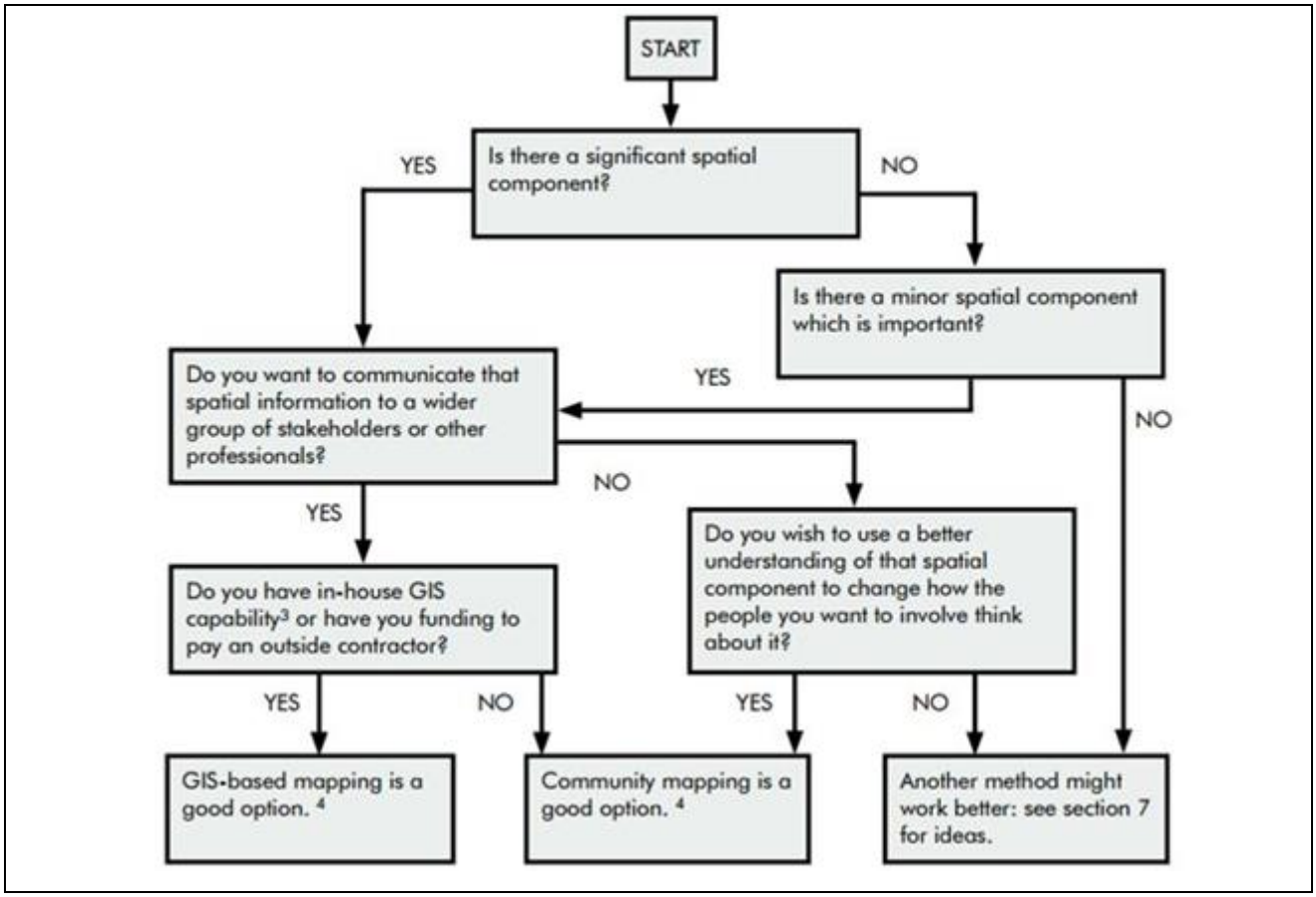
The applicability of conventional GIS to solve various environmental issues has faced some challenges in many parts of the world, since 1980 with the emergence of participatory rural appraisal (PRA) methods. This technical revolution spurred calls to develop and legitimize an 'alternative GIS incorporating people's participation' and practitioners began to adopt a variety of GIT&S to integrate multiple realities and diverse forms of information to foster social learning (originally called "counter mapping" (Peluso, 1995). These changes led to what is now generally termed as Participatory GIS (PGIS).

The most significant and valuable contribution of PGIS is that it elicits, represents and validates local (including indigenous) spatial knowledge (Eastman et al., 2000; McCall, 2004). According to McCall (2004), PGIS provides spatial specific information about local interests and priorities, values and perceptions and social Inclusivity. It can be representative of communities, as well as individuals, and incorporates local and external knowledge - local, indigenous knowledge, sacred knowledge, gendered knowledge - that doesn't necessarily conform to state visions of place, which is integrated with scientific knowledge e.g. implications of global climate change, globalization and urbanization. Furthermore, PGIS provides visual images as "spatial narratives". Pictures are rich in information and shared understanding, and increase information both quantitatively and qualitatively. Visual images often provide a strongly held opinion, though this may

have negative as well as positive implications, and involves multiple processes of people's participation in knowledge identification and selection. There are many opportunities for cross-checking, alternative validations and capacity-enhancement. Communities and groups can be empowered by involvement in PGIS processes, which, in turn, improves self-confidence and technical and political capacities (McCall, 2004). Using PGIS, it is quite possible to begin the process of inventorying natural and cultural value assets in a part of the world where most of these assets are not known or recognized by local communities and their decision makers.

Participatory GIS applied to landscape services mapping

According to Forrester and Cinderby (2014), mapping is any method where people are encouraged to use a map or maps in order to communicate their knowledge and ideas more clearly. Participatory mapping that is carried out with members of a community, and which can be used to represent the views of some or all of the members of that community, can be referred to as community mapping. Forrester and Cinderby (2014) described the PGIS mapping practice. The author pointed out that participatory GIS involves gathering data using traditional methods such as interviews, questions, focus groups, all using some form of paper maps to allow participants to record spatial details. This information is then digitized so that it can be analyzed and investigated using the power of the computer GIS software, and also so that any outputs can then be communicated using computer-drawn map outputs. Forrester and Cinderby (2014) summarized the requirements for PGIS application in solving community-related problems (Figure 1). The authors contend that not all community-related problems or issues can be solved by PGIS.



Adopted from Forrester and Cinderby (2014)

Figure 1: Decision tree on whether participatory GIS is good for a particular research study

The PGIS approach applied by the SUSLAND project further improved on that of Forrester and Cinderby (2014) by emphasizing awareness creation or description of the problem that PGIS intends to solve, and focusing on important policymakers, who could have a say or opinion on the objects, place, landscape and values. The study under the SUSLAND project was in the southern highlands of Tanzania including the two regions of Iringa and Njombe. The villages of Tungamalenga in Iringa Rural District and Lulanzi in Kilolo District in Iringa region were chosen. In Njombe region the study was conducted in Njombe district in Iboya village. The study was conducted in February 2016.

Introduction letters to the two regions, asking for permission to conduct research for the project period and study areas, were sent to each regional administrative secretary (RAS), the top policymaker of a region. A formal introduction meeting was conducted by the research team, attended by the RAS and all officials responsible for mapping, environment and land use issues in the region. In the meeting, the research team introduced the project's focus, objectives, methodology and expected outcome and relevance to local, national and international communities. This was the first awareness creation landmark of the PGIS. After

the questions-and-answers session, the RAS issued introduction letters to selected District Directors in the region concerned.

District Directors and their administrative team were also assembled for a similar introduction briefing. The directors then issued introductory letters to the village executive secretaries through ward executive secretaries. Upon arrival at the selected wards, researchers were led to village administrative secretaries where similarly detailed briefings took place, but now with selected village environment, land use plan and other related committee representatives who were identified as very useful for the objectives of the study.

One outcome from the meeting with RAS and his team and the researchers is that RAS asked the researchers' team to ensure that they submit a copy of the findings to the regional office. It was agreed that copies would be brought to the regional office and all policymakers' offices, in the region, district, ward and village. This brought some encouragement and motivation to participating stakeholders throughout the project execution period.

Stakeholder selection for PGIS mapping of landscape services

The research team proposed that stakeholder meetings at each village should include the village executive secretary, about 5 or 6 committee representatives, agricultural and livestock extension workers and any available village expert e.g. Community Development workers were here considered as key resource persons. The village leadership were requested to choose villagers who would participate in identification ecosystem services to include issues such as natural and cultural resources and landscapes that would be mapped. Careful selection process for participants was discussed with the village leadership team to ensure inclusion of male and female youths of ages 16 to 30, young men and women of age 31 to 50 and men and women over 51. The nature of the study, a statement on the problems to be investigated, advantages of the whole exercise to the village, the nation, and beyond, were discussed at this particular moment.

Tools and the process for participatory mapping of landscape service

Several tools were made available for identification of landscape services. The tools included a set of bilingual (English and Kiswahili) structured questionnaires, satellite images (Landsat oli and GoogleEarth), color pencils, color beads, laptop, global positioning system (GPS) receivers, high-resolution camera, large-memory computer storage drive, notebooks, pencils and pens. The questionnaires had four sections that were necessary to gather ecosystem services values. The first contained background information. This section contained a brief background of the study, which was explained carefully and slowly in the language

of the local person before the demographic information of respondents begun. The second section involved orientation of the stakeholder to the image map and locating the stakeholder's home. In this case, the expert knowledge about map reading was amalgamated with the local respondent to interpret features that could lead the two to local person's home. The third section involved actual mapping of provisional landscape services and values. Locations where services related to cultivation, livestock keeping, beekeeping, trees and tree planting, wild food collection, hunting of wild animals, firewood collection and charcoal making, building materials such as tree logs, leaves or soil, handcrafts and traditional medicine and water all were identified and marked using various colored beads (Plates 1 and 2). The fourth section involved identification, locating and mapping of cultural landscape services. The services included objects such as social activities

Plate 1: Key persons' orientation to the study area using a remote sensed image (map)

Landscape services were coded using color beads. Each particular color bead was pasted onto the map by a stakeholder to represent a specific value he or she benefits from in the landscape (Fagerholm et al., 2012). For instance, a yellow bead represented an agricultural field; blue bead water; white bead to represent wild food such as African leafy vegetables namely *Amaranthus spinosus*, mushroom or wild fruit; brown bead wild animals; and red building materials such as wood branches, thatch grasses, soil (Plate 2).

Plate 2: Color beads that were coded to associate each color of the bead to the type of service a stakeholder benefits from the environment

Since each printed map has a corresponding digital copy stored on the laptop, one of research team members had the task of locating each site the stakeholder flagged in the digital copy. In this case, specially designed identification for each stakeholder was agreed by the team, such as T3, to imply a third stakeholder in Tungamalenga village, Iringa rural village. The person digitizing stakeholder location on the digital copy had the task of adding some detailed information obtained from the stakeholder interview (Plate 3).

Plate 3: Respondent identification of ecosystem services she benefits from the landscape

Photographs were taken for each set of completed interviews and the color-coded map and identification were also recorded by camera and through software on the laptop. The next steps in the process were to process the digitized image for organization, storage and analysis and produce final meaningful maps that would show patterns of ecosystem services that benefit the local communities in the study area and necessary interpretations as related to objectives of the study (Plate 4)

Since one of the outputs from the PGIS is well crafted and labelled maps showing distribution and patterns of various landscape services that village community members benefit from in their environment, the stakeholders were motivated to learn the maps and about their surrounding resources by the understanding that at the end of the exercise they would receive a map copy (Termoschuizen and Opdam, 2009).

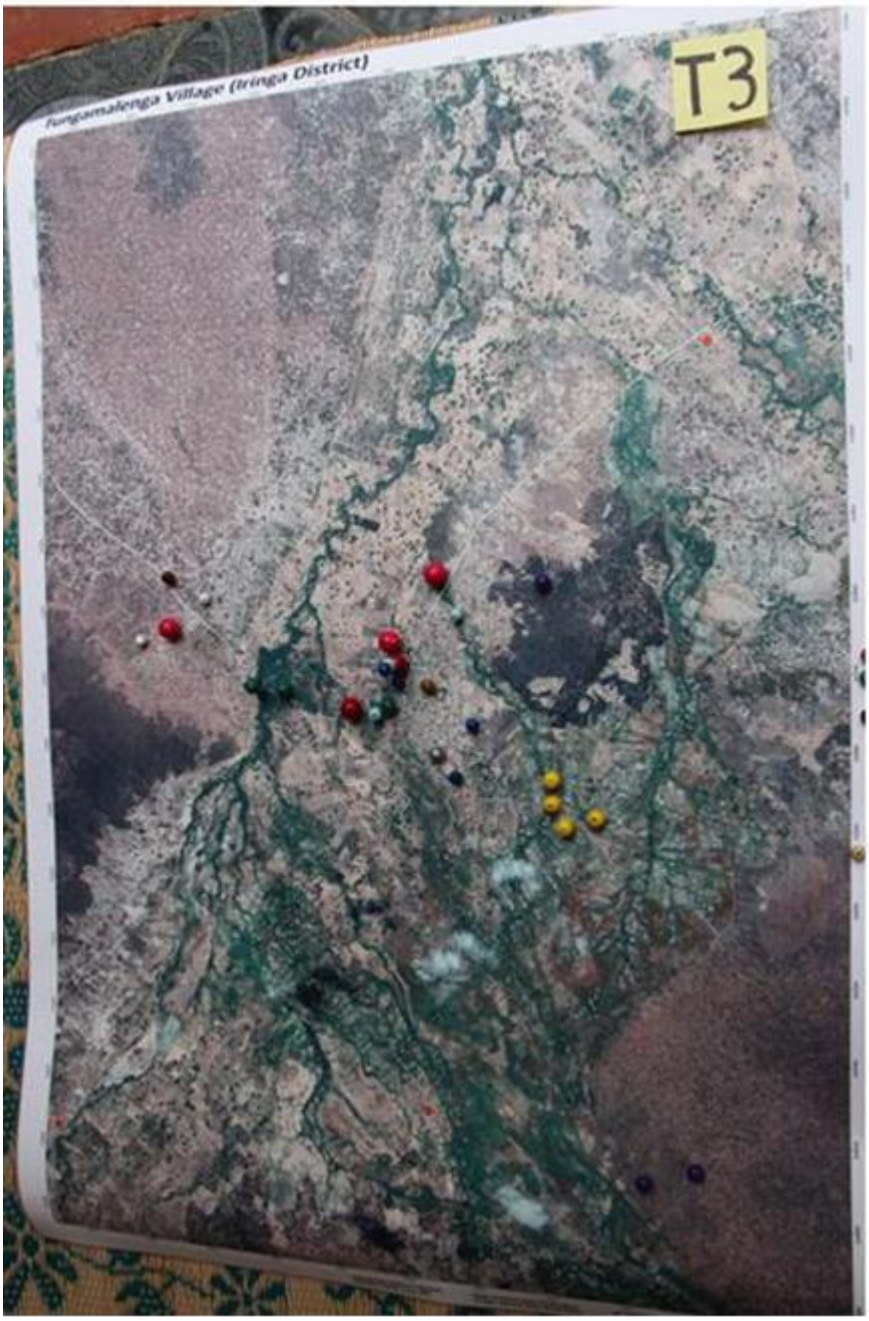


Plate 4: A photograph showing a completed village map showing an individual stakeholder list of benefits obtained from the environment in Tungamalenga village, Iringa rural district

After a day of interviews with stakeholders, recording their identification and locating of benefits on the hard copy map, in computer-stored digital image and photograph of the analogue map taken, field verification was done for random sampled sites, places and objects in the village (Plate 5). This exercise was performed to ensure the accuracy of locating the resources to minimize errors during GIS analytical excise.

Plate 5: Identified ecosystem service values were verified in the field and photos taken

Potential for PGIS to enhance inventory and mapping socio-cultural values on the landscape

Looking at world heritage whether natural or cultural from a lay person's perspective and evaluating its relevance to a local community, you would appreciate the concept of ecosystem services. According to Alcamo (2003), ecosystem services are the benefits people obtain from ecosystems. These include provisioning services such as food and water; regulating services such as flood and disease control; cultural services such as spiritual, recreational, and cultural benefits; and supporting services, such as nutrient cycling, that maintain the conditions for life on Earth. The author reported that people seek many services from ecosystems and thus perceive the condition of an ecosystem in relation to its ability to provide desired services. The ability of ecosystems to deliver services can be assessed by a variety of qualitative and quantitative methods. Mapping ecosystem services is one important step in making inventory for objects, places and landscapes that could qualify for heritage status. Alcamo (2003) added that an assessment of the condition of ecosystems, the provision of services, and their relation to human well-being requires an integrated approach. This enables a decision process to determine which service or set of services is valued most highly and how to develop approaches to maintain services by managing the system sustainably.

This is where the concept of natural and cultural values and heritage status comes in as an integral part of ecosystem services. This is clearly seen in the ecosystem services' definition given by Boyd and Banzhaf

(2009 p8), which states that “Ecosystem services are components of nature, directly enjoyed, consumed, or used to yield human well-being”. Boyd and Banzhaf (2009) illustrated the controversies between ecosystem services and benefits concepts (Table 1) which emphasises the importance of inventorying both benefits and services for various applications, natural and cultural values being among them.

Table 1. Inventory of Services Associated with Particular Benefits

Illustrative Benefit		**Illustrative ecosystem services**
Harvests		
	Managed commercial[24]	Pollinator populations, soil quality, shade and shelter, water availability
	Subsistence	Target fish, crop populations
	Unmanaged marine	Target marine populations
	Pharmaceutical	Biodiversity
Amenities & Fulfillment		
	Aesthetic	Natural land cover in viewsheds[25]
	Bequest, spiritual, emotional	Wilderness, biodiversity, varied natural land cover
	Existence benefits	Relevant species populations
Damage Avoidance		
	Health	Air quality, drinking water quality, land uses or predator populations hostile to disease transmission[26]
	Property	Wetlands, forests, natural land cover
Waste assimilation		
	Avoided disposal cost	Surface and groundwater, open land
Drinking water provision		
	Avoided treatment cost	Aquifer, surface water quality
	Avoided pumping, transport cost	Aquifer availability
Recreation		
	Birding	Relevant species population
	Hiking	Natural land cover, vistas, surface waters
	Angling	Surface water, target population, natural land cover
	Swimming	Surface waters, beaches

Source: Boyd and Banzhaf (2009)

Formal or official heritage concerns processes of heritage identification, management and preservation and refers to objects, places and practices that have been classified as formal, by inclusion in a registration list of cultural heritage that is institutionally recognized by which parameters are established in a given legal terms has no agreed strict definition. This stems from lack of consensus as the elements and parameters are not necessarily the same as those the community considers as their own (Harisson, 2010). Harisson (2010) adds that unofficial objects, places and practices of heritage may not be recognized by governments

or listed on official heritage registers but they are considered to be significant or culturally meaningful by communities. Awareness creation to immediate beneficiaries of ecosystem services and policymakers of a particular place where the benefits are found and mapping of socio and cultural values including possible conflict potential activities should be the most important initial step towards identification of unknown and unrecognized natural and cultural heritage potential entities.

Conclusion

Quite few world heritage sites and landscapes are recognized in different parts of Africa, including Tanzania. Mapping of ecosystem services could include properties with potential for heritage status as recognized by local communities. Mapping of such natural and cultural values associated with local communities can enhance awareness and improve perceptions from a local, national, regional and international level. Conservation of heritage sites and landscapes would be efficient and easily adhered to once they are recognized by local communities using boundaries established by themselves. Application of PGIS procedures outlined in the SUSLAND project would enhance identification of unknown valuable natural and cultural objects, places and landscapes that could be elevated to world heritage status. This has been demonstrated by the integrative nature of the approach and a series of awareness meetings held at regional, district, ward and village level, through discussion of the study objectives, procedures and expected outcomes with all involved levels and beyond prior and during the participatory mapping process. At the end of the research, the output must be disseminated back to all levels that were contacted before embarking on the study. Experience gained from the on-going SUSLAND project execution is that PGIS requires a composition of multi-disciplinary persons depending on the objectives of the study.

The suggested PGIS mapping approach could identify known and unknown heritage potential ecosystem resources, while at the same time including various national communities' values, knowledge and recognition. This would enhance identification of unrecognized properties and sites of heritage potential at various scales using participatory GIS techniques. At the same time, having natural and cultural values mapped for the entire country would enable categorizing of potential heritage as well as archeological sites easier during presentation and lobbying for world heritage status. Furthermore, having maps of landscape services, natural and cultural landscapes could facilitate policymakers in designing logical and efficient ways of management and conservation in identified priority areas while safeguarding sustainable development beginning at the grassroots level where the maps were composed.

Conclusively, PGIS and participatory mapping are useful in identifying and mapping cultural as well as natural values. The benefits of the in-depth interviews with key informants such as elders, elites and

religious leaders to capture existence of various cultural, historical and social values and more information is also very important. Local people can be involved in identifying the cultural assets first and then mapping them. It is usually important to hold a discussion with these local communities and then develop a questionnaire that can focus on actual assets researchers may intend to map. During such a discussion process, very high-resolution satellite images such as quickbird and digital globe (https://www.digitalglobe.com/resources/satellite-information) can be used to generate discussion on what is in the landscape. Further, during the participatory mapping, narratives of cultural practices, values and history via discussions, interviews, landscape walks, drawings and photos can be collected and linked with the satellite images and eventually to the final maps using GIS techniques. In the latter case, videos, text and photos can be linked to particular location information. This process also accounts for PGIS being recommended for identifying the values and objects that are potentially the natural and cultural heritage of Tanzania.

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