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Sustainability of Nundu Catchment Forests under Conventional Forest Management in Njombe, Tanzania

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ABSTRACT

The catchment forests, which account for 398 million ha (equivalent to 9.8%) of the world forest, are threatened by anthropogenic influence. Despite the drawbacks of conventional forest management (CFM), which is top-down, it is adopted to manage the catchment forests in Tanzania. For a CFM to work successful, its strengths and weaknesses need to be explored. A study to investigate the performance of CFM on the long-term viability of catchment forests was conducted in Nundu, Njombe-Tanzania. With 97 respondents, a descriptive research design was chosen. Data were gathered through observations, surveys, interviews, and document reviews. Descriptive statistics were used to analyse quantitative data, whereas content analysis was used to analyse qualitative data. The research revealed that the sustainability of the Nundu catchment forest is threatened by a lack of community involvement, predominance of legal enforcement, and existing land conflicts. The findings demonstrate the inefficiency of the conventional approach to the management of catchment forests. It is recommended that the Tanzanian government review its policies and guidelines for managing catchment forests to ensure community involvement, work to resolve disputes, address managerial issues related to catchment forests, and provide adequate and timely funding for catchment forest management.

Key words: Forest management – protected forest – sustainability – conflicts.

INTRODUCTION

Forests are among the largest components of natural resources, covering about 31% of the total world's land surface. They are a valuable resource not only for their timber and biodiversity values but also for their prospective values in the global market, which emerge for the sequestering of carbon from forests (UNESCO 2013, MNRT 2010, Brukas and Weber 2009, Zahabu 2006, Malimbwi 2003, MNRT 2000).

According to FAO (2020), the world's total forest area between the years 2015 and 2020 was 4.06 billion hectares (ha), equivalent to 31% of the planet's total land area. A little more than 73% of the world's forests were classified as being owned by the government, 22% as being privately owned, and 5% as being owned by others. Over 726 million ha of forest were thought to be protected areas around the world, of which South America accounted for 31% and Africa for 27%. About 398 million ha were set aside for the conservation of soil and water, 424 million ha for the conservation of biodiversity and 186 million ha for social services. About 96% of the forests in Europe had management plans, while less than 25% of the forests in Africa and less than 20% of the forests in South America had management plans. Yet, since 2000, the area of forests subject to management plans has grown by 233 million ha, reaching 2.05 billion ha in 2020.

FAO (2020) report also states that due to a decrease in the rate of forest expansion, the rate of forest loss decreased from 5.2 million ha per year in 2000–2010 to 4.7 million ha

per year in 2010–2020. Nevertheless, with 3.9 million ha, Africa had the highest yearly rate of forest loss, followed by South America with 2.6 million ha. A number of disturbances such as fire, insects, diseases, and severe weather events, also impacted the health and vitality of the world's forests and diminished their capacity to offer a full range of ecosystem services. In 2015 alone, about 98 million ha of the world's forests experienced fire damage.

These statistics confirm that the world forest is experiencing forest loss, fragmentation, and a decrease in carbon stock worldwide. Most of the carbon emissions of developing countries, which account for 10%-30% of global carbon emissions, come from deforestation (Keenan *et al.* 2015, FAO 2015, Lister *et al.* 2014, IPCC 2014). In Tanzania, for example, before independence, the forest cover was greater than 50%, which gradually decreased to 45% in the late 1970s, about 41% in the mid-1990s, and about 36% in the late 1990s (Luoga *et al.* 2000, cited in Hamza and Kimweri 2007). Agricultural activities, overgrazing, wildfires, charcoal production, and a lack of land use plans have been identified as the primary causes of forest degradation in developing countries, particularly Tanzania (Subedi *et al.* 2014, Blomley 2006). However, these anthropogenic based forest degradation factors can be addressed through conventional or participatory forest management interventions with varying levels of effectiveness (Wang 2004).

Conventional Forest Management (CFM) is the type of forest management intervention where the government is both owner and manager of the forest (Wang 2004). The advantage of this intervention includes short time spent for decision making processes and implementing interventions (Kaaria *et al.* 2016, Keenan *et al.* 2015, FAO 2010). However, CFM discourages the local communities from taking part in forest conservation and protection (Siraj 2018, Romano and Reeb 2008, Lemenih *et al.* 2015, FAO 2004). The community's local knowledge and ownership of forest management interventions are also undermined by CFM (FAO 2004). Evidence indicates that CFM results in conflicts between government forest managers and nearby residents, as well as significant costs (Siraj 2018).

In Tanzania, during the pre-colonial era, customary institutions, including beliefs, taboos, and customs, were used to manage and utilize the forest. Due to the small population, there was little deterioration of the forest resources (Zahabu 2009). Forest resources were heavily exploited throughout the colonial period (1891–1961), which led the colonial authorities to establish laws and policies that restricted communities' access to natural resources (Misana *et al.* 1996). Some of the forests were made into reserves, including protected areas, by the colonial states. The state's control over forest resources resulted in the weakening of indigenous knowledge of natural resource management. Up until 1998, when a new forest policy reflecting Participatory Forest Management (PFM) was implemented, Tanzania continued to engage in colonial forest management practices that restricted and prohibited people to access benefits from the forest reserves (URT 1998). The Tanzania Forest Act, which was established in 2002, enhanced the forest policy of 1998 (URT 2002). The Tanzania Forest Policy (1998) and Forest Act (2002) both place a strong focus on PFM.

Despite the emphasis on PFM by the Forest Management Policy (1998), the Tanzania Forest Act (2002), and the researchers (Hamza and Kimweri 2007, Soto 2014, Kashaigili *et al.* 2016), Tanzania is still practicing Conversional Forest Management (CFM) in managing catchment forests. One of the reasons for continuing to adopt CFM is the fact that most of the protected forests lack direct community-accrued tangible benefits such as timber and charcoal (URT 2013, Pima *et al*. 2016). While the CFM, which is a top-down approach, is used to manage protected forests in Tanzania, the

question is, "What management aspects should be integrated within the CFM to ensure the sustainability of the protected forests?" This study intended to answer this question through Nundu catchment forest.

The Nundu catchment forest is located in Yakobi ward, Njombe town council, Tanzania. The catchment forest comprises the Mapala, Itoni, and Nguruka forests. Mapala was declared a reserve in 1955, and Itoni, and Nguruka in 1939. These forests are owned by the government of Tanzania and managed by the Tanzania Forest Service (TFS). Being among the protected forests in Tanzania, TFS manages the Nundu catchment forests through CFM in spite of the influence of adjacent Nundu and Iboma villages with a total population of 3,500 inhabitants. Such a large population may demand a lot from the forest, leading to degradation to the extent that the forest fails to deliver other ecosystem services. This study, therefore, assessed the performance of conventional forest management by exploring key issues that can be integrated to avoid degradation, thereby ensuring the sustainability of protected forests. The forest sustainability indicators such as neighbouring community perception of the existing forest management approach, mechanisms for maintaining forest sustainability, fire events, local community involvement, and endeavours to resolve forest management challenges while improving successes were the bases of assessment.

MATERIAL AND METHODS

Site description

The study was conducted in Nundu and Iboma villages, located adjacent to the Nundu catchment forests (Figure 1). Nundu was registered as a village in 1975 and given the registration number IR/VC/479; where Iboma became one of its hamlets. Rapid population growth in these villages has been putting pressure on Nundu catchment forests and ecosystem services. The Nundu catchment forests consist of three protected forests: Itoni (211.5 ha), Mapala (220.5 ha), and Nguruka (194 ha), all of which are located in Njombe town, Tanzania's Southern Highlands (NTSEP, 2013)..

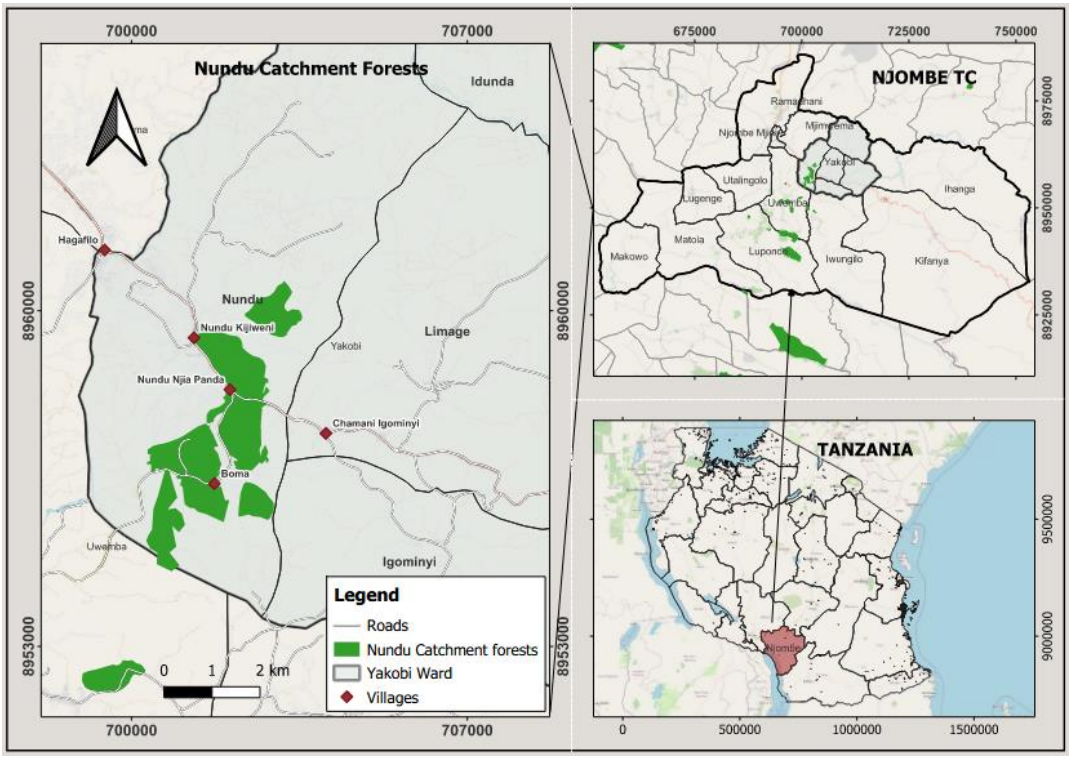

Figure 1: A map for the study locations *Source:* University of Dodoma GIS Laboratory, 2023.

While Mapala was legally protected in 1955, Itoni and Nguruka were both legally protected in 1939. The forest boundary revision and mapping were carried out in 2010, an exercise that was accompanied by beacons setting. The Nundu catchment forests are owned by the Government of Tanzania and managed by Tanzania Forest Service (TFS) under the guidance of Tanzania Forest Policy (1998) and Tanzania Forest Act (2002) with their various amendments. The adopted forest management approach is conventional management, where forest planning, decision-making and implementation of the forest management plans are exclusively undertaken by the state

Climate

Njombe Town Council is found at the altitude of 1600-3000 meters above sea level. The rainfall is between 1000mm to 2000 mm per annum and the temperature is estimated to be below 15°C. Njombe is surrounded by three climatic zones, namely the highlands zone, the midlands zone, and the lowlands zone (NTSEP, 2013).

Study design

The study adopted a cross-sectional research design and a mixed research approach to collect quantitative and qualitative data. The target population for the study was all villages adjacent to Nundu catchment forests. As long as there were two villages, namely Iboma and Nundu, adjacent to the catchment forests, all of them were considered for the study. There were 3,500 inhabitants, with 129 households in total. Using the Yamane formula, a total of 97 households were obtained, which is 75.8% of the total households in the study area. The Yamane formula is denoted as $n = N/1 + Ne^2$, where n = sample size, N = total population (129 households), and e = precision level (e = 5%). The sample distribution was calculated using the Israel formula for proportional sampling, denoted as n = Np/P, where n = sample contribution/proportion, N = sample size, p = specific village population adjacent to the catchment forest (1500 for Iboma and 2000 for Nundu), and P = total village population adjacent to the catchment forest (3,500). A sample distribution of 42 respondents was obtained for Iboma and 55 for Nundu. The sampling frame for each village was obtained from a village household's register. Both probability and non-probability sampling techniques were employed for selecting the respondents.

A simple random sampling technique was adopted to select the household heads. The key informants were chosen based on their administrative positions, and knowledge and experience in forest management. While the knowledge was determined based on the level of professional education, the experience was based on the number of years spent working with forest management or conservation issues. Therefore, the key informants involved in the study were the Town Council Executive Director (TED), Ward Executive Officer (WEO), Forest Officers (FOs), District Land Officer (DLO), District Forest Manager (DFM), Village Executive Officers (VEOs), and Village Chairpersons (VCs).

Data collection

Data was collected to measure the performance of conventional forest management on the sustainability of Nundu catchment forests. The indicators included community perceptions of the existing forest management approach, mechanisms for maintaining forest sustainability, fire events, local community involvement, and endeavours to avert existing forest management challenges while improving successes. Different methods, such as questionnaire surveys, key informant interviews, and direct observation, were employed for collecting primary data, while document reviews was employed for collecting secondary data.

Data analysis

Quantitative data collected through questionnaires were coded and processed using IBM-SPSS statistical software, while

the analysis was carried out through descriptive statistics to generate frequencies and percentages. Qualitative data collected from interviews was analysed through thematic-content analysis.

RESULTS

Local community's perceptions on the existing forest management approach

A majority of the respondents in all villages perceived that the management approach for Nundu catchment forests was inadequate (68.7% on average) (Table 1). An interview with the Director for Njombe Town Council also showed that the local community was unhappy with the existing forest management approach. This created hatred between the local community and forest management authority, thereby threatening the forest.

Table 1: Local community' perception on the forest management approach adopted in Nundu catchment forests.

Responses	Perception on forest management approach (%)		Average (%)
	Nundu (n=55)	Iboma (n=42)	
Adequate	18	26.2	**22.1**
Inadequate	73	64.3	**68.7**
Do not know	9	9.5	**9.2**

Mechanisms employed to sustain the forest

A majority (48.4% on average) of the respondents reported that legal enforcement was the main way used to sustain Nundu catchment forests. Other mechanisms were education or awareness, community involvement, and carrying out forest patrols (Table 2). This implies that legal instruments (i.e., laws, by-laws, and fines) were the dominant mechanisms used by the Nundu catchment forest management to enforce the conservation of the forest. The types of by-laws included fines, forest entrance, and eviction from the catchment forest. Even though the use of forest laws and by laws were successful in sustaining the forests, the respondents insisted that the management should enforce the laws and by-laws after the community awareness creation. This implies that more emphasis is put on the application of laws and by-laws to manage Nundu catchment forests compared to awareness campaigns and community involvement. While legal actions are convenient for the CFM, a bias can be avoided by inclining toward educating the community.

Forest fire management

The findings indicated that a majority (79.2% on average) of the respondents reported forest fires to be caused by agricultural activities (Table 3). The use of fire to prepare farms was reported to be a major threat to Nundu catchment forests. Another cause of forest fire was the use of fire while collecting honey and hunting. Similarly, in response to disputes over forest boundary conflicts, local communities set fire on purpose.

Table 2: Mechanisms used to sustain Nundu catchment forests (n = 97)

Responses	Mechanisms for sustaining the forest (%)		Average (%)
	Nundu (n=55)	Iboma (n=42)	
Legal enforcement	49.1	47.6	**48.4**
Awareness campaigns	18.2	16.7	**17.4**
Community involvement	18.2	14.3	**16.4**
Forest patrols	14.5	16.7	**15.6**

Table 3: Causes of fire in Nundu catchment forests (n = 97)

Causes of fires events	Responses (%)		Average (%)
	Nundu (n=55)	Iboma (n=42)	
Agricultural activities	72.7	85.8	**79.2**
Collection of honey and hunting	18.2	7.1	**12.7**
Intentional fire setting	9.1	7.1	**8.1**

The Land Officer for Njombe also revealed that the local community was being attracted by the nearby forest for agriculture as its soil was very fertile. The findings obtained through observation further showed that the forest was burnt. However the forest was observed rejuvenating (Plate 1).

Plate 1: Areas burnt for agricultural activities around Nundu catchment forests (Photo by Manga)

Involvement of the local community during revising forest boundaries

A majority (71.4% on average) of the respondents reported that they were not involved in revising the forest boundaries, while 16.3% of the respondents reported having been involved (Table 4).

Table 4: Local community's involvement during revising boundaries of Nundu catchment forests (n=97)

Local community involvement	Responses (%)		Average (%)
	Nundu (n=55)	Iboma (n=42)	
Yes	18.2	14.3	**16.3**
No	69.1	73.8	**71.4**
Do not know	12.7	11.9	**12.3**

Observation revealed a beacon located as a boundary between the forest and farms of the local communities, with no buffer zone (Plate 2). This is an indication of farmers illegally encroaching on the forest.

Plate 2: One of the beacons demarcating forest boundary in Nundu catchment forests (Photo by Manga)

An interview with the Village Executive Officer (VEO) for Iboma also noted the existence of complaints from the local communities about forest boundaries that overlapped their farms. However, he made clear that although the beacons were set late (in 2010) to clearly show forest demarcations, the forest was declared a reserve before the villages were registered. He further reported that Mapala, for example, was given legal protection in 1955, and Itoni and Nguruka in 1939, all before Nundu was registered in 1975. Based on the VEO's observations, the Njombe District Forest Officer for the TFS insisted that during boundary setting, forest management was working in accordance with the Tanzania Forest Policy (1998) and Tanzania Forest Act (2002) to ensure standards were met in order to achieve the sustainability of

Nundu catchment forests. These findings confirm that the villagers made and intentional forest encroachment.

Success and challenges experienced in the management of Nundu catchment forests

Identified successes

Respondents identified forest protection activities as the most significant success in the management of Nundu catchment forests. Other successes mentioned were defining and mapping the forest, and capacity building and awareness creation among community members (Table 5). According to respondents, the training program included the significance of catchment forests, conservation agriculture, forest fires, and guidelines for the safe harvesting of both wood and non-wood forest products.

Identified challenges

Conflicts

Despite the fact that the Tanzanian Central Government has managed Nundu catchment forests since 2010, the findings showed that it was still encountering both conflict and managerial-related challenges. The major conflicts were caused by land boundaries due to a lack of community involvement during the revision of forest boundaries, a lack of compensation over resources, and restrictions on accessing forest resources (Table 6). However, information obtained from the key informants showed that compensation could not be possible due to the fact that the involved communities were regarded as having encroached on the forest. The VEOs also admitted that there was a shortage of agricultural land for the local community due to the population increase.

Managerial challenges

The major managerial challenges reported to have been facing the Nundu catchment forests include low community involvement and forceful eviction in the forest (Table 7).

Table 5: Identified management success in Nundu catchment forests (n = 97)

Success	Responses (%)		Average (%)
	Nundu (n=55)	Iboma (n=42)	
Forest protection (establishing beacons, posters, and fire lines)	52.7	64.3	**58.5**
Defining and mapping the forest	29.1	21.4	**25.3**
Capacity building and awareness creation	18.2	14.3	**16.2**

Table 6: Causes of conflicts in Nundu catchment forests (n=97)

Causes of conflicts	Responses (%)		Average (%)
	Nundu (n=55)	Iboma (n=42)	
Land boundary	43.6	64.3	**53.9**
Government forest ownership	20.0	28.6	**24.3**
Lack of compensation	36.4	7.1	**21.8**

Table 7: Managerial challenges in Nundu catchment forests (n = 97) *

Challenges	Responses (%)
Low community involvement	78.4
Forceful community eviction	50.5
Inadequate education and awareness campaigns	25.8
Inadequate fund for the forest manager	10.3

Other managerial challenges included both inadequate awareness campaigns and funding. The activity of revising the forest boundaries was also claimed by the community to be inadequate. Due to the late placement of beacons, the community adjacent to the forest had to undertake several human activities beyond the area considered to belong to the Nundu catchment forests. This led to forceful evictions, which displaced people from their settlements and properties. The researchers noticed demolished houses in the buffer zone of Nundu catchment forests, thus evidencing forceful evictions.

DISCUSSION

A majority of the local community had the perception that the existing forest management approach was inadequate. This is an indication that the community is not satisfied by the prevailing conventional forest management, which may create hatred between the local community and forest management authority, thereby threatening the forest. These findings are supported by that of Hamza and Kimweri (2007), who asserted that forest management belongs to both the management authority and the community, which demands that all sides be in harmony so as to sustain forest management. Failure of forest management to meet the needs of the local communities may result in degradation.

Findings showed that legal enforcement (i.e., use of laws, by-laws) was the major mechanism adopted by the Nundu forest management to sustain the forests. This approach may not be perceived positively by the community, particularly when there is a weak adherence to good governance principles. This finding is similar to that of URT (1999), which indicated that the conventional management is dominated by legal enforcement to manage resources.

A majority of the respondents reported that forest fires were caused by communities when preparing their farms. Another cause of forest fire was reported to be the use of fire while collecting honey and hunting, and community-initiated fires set due to disputes arising from forest boundary conflicts with the forest management. Forest fire due to honey collection and hunting arise from the facts that conventional forest management is a top-down approach that restrict and profit neighbouring communities easily entrance to the forest. However, community members may get into the forest illegally with little attention to fire outbreaks. The findings affirm those of Prestemon *et al*. (2013) and Hirschberger (2016), who have highlighted that revenge from the local community, commonly known as arson, is among the sources for forest fires. FAO (2013) affirms that forest fires are a major cause of deforestation, constituting an average burned area of 15 ha in every 1000 ha. Hirschberger (2016) has explained that forest fires can be successfully prevented by having site-specific strategies formulated based on the root causes of the fire. Creating community awareness about undertaking honey harvesting and agriculture that cannot harm forests and resolving land conflicts are mandatory for the sustainability of the Nundu catchment forest. Yet, some of the respondents acknowledged having attended training sessions on conservation agriculture and forest fires. As long as the problem persists, it gives forest management information to improve training methods and review the training package.

Few respondents (16%) reported that they participated during forest boundary setting. This may mean that some of the community members either do not know well the different levels of participation or there was poor feedback from the representatives. The findings corroborate those of FAO (2006), who asserted that land conflicts over resource boundaries are caused by failures of management to involve the local community in allocating resources. Adherence to the agreed forest land tenure systems between the community and forest management avoids forest resource boundary conflicts (Zahabu 2009). Adequate involvement of the

community in managing the forest could make them live in harmony with the forest management authority while maintaining forest safety. Iddi *et al*. (2011) comment that to avoid harm to the forests, conventional management should be flexible by involving the community in its managerial activities. The local communities can be involved in setting forest fire lines and forest boundaries.

Forest protection activities were mentioned by the community members as a major success of the management of the Nundu catchment forest. This implies that the forest management is more inclined toward protecting the forest, thereby forgetting issues of community capacity building and awareness creation in forest management. Shivdenko *et al*. (2005) reveal that local community capacity building on forest management makes them aware of the significance of forests to their well-being. Vodouhe *et al*. (2010) and Kwaslema *et al*. (2018) have also shown that community awareness creation avoids degradation of natural resources, particularly in protected areas.

The findings on the challenges encountering the Nundu catchment forest included both conflict-related and managerial-related issues. It has been noted that a conventional forest management approach faces conflict-related challenges all over the world (Zahabu 2009, UNESCO 2013). Among the managerial-related issues were low community involvement and forceful evictions in the forest. Other managerial challenges included both inadequate awareness campaigns and funding. Brennan and Lo (2011) argue that eviction of the local community from protected areas goes hand in hand with displacement and habitat demolition.

It has been noted that inadequate funding has been affecting management in fulfilling its activities, such as setting fire lines, motivating employees, and meeting corporate social responsibilities. According to the World Bank (2004), one of the main causes of conflicts in Africa is a lack of funding for forest management. Adequate provision of funds by the government enables the forest management authority to execute its duties, such as paying for labourers and meeting emergency cases such as forest fires. Adequate funding facilitates the completion of planned activities on time. In contrast, under-estimated funds lead to poor performance of duties, which become bottlenecks for attaining forest management goals. According to FAO (2007), adequate funding is a solution to improve service delivery in project management approaches.

CONCLUSION AND RECOMMENDATIONS

Conclusion

This study investigated the sustainability of Nundu catchment forests under conventional forest management. The general findings show that the sustainability of Nundu catchment forests is threatened by negative perceptions from the local community about the management approach, inadequate community involvement in the management of the forest, community forest encroachment and conflict, and managerial-related challenges. The findings inform forest planners and policy makers on the importance of integrating community participation within the conventional forest management to improve the performance of protected forests.

Recommendations

Based on the study findings, it is recommended that: The Central Government (CG) of Tanzania should review its forest management policy to adequately incorporate local communities in conserving protected forests managed under a conventional management approach. The CG should render enough financial resources for catchment forest managers to enable day-to-day execution of activities. The Tanzania Forest Service (TFS) should give priority to community awareness creation before legal

enforcement is undertaken to avoid unnecessary conflicts.

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REFERENCES

Bettinger, P. & Boston, K. 2001. A conceptual model for describing decision-making situations in integrated natural resource planning and modeling projects. Environmental Management 28: 1–7.

Blomley, T. 2006. Mainstreaming participatory forestry within the local government reform process in Tanzania (p. 25). International Institute for Environment and Development. London. https://dlc.dlib.indiana.edu/dlc/handle/10535/5947. Retrieved on 20/3/2023.

Brennan, A. & Lo, Y.S. 2011. Environmental Ethics Stanford Encyclopedia of Philosophy. Retrieved from http://plato. stanford. edu/archives/fall2011/entries/ethics-environmental.

Brukas, V. & Weber, N. 2009. Forest management after the economic transition at the crossroads between German and Scandinavian traditions. Forest Policy and Economics 11: 586–592.

Dryzek, J.S. 2013. The politics of the earth: Environmental discourses (3rd Ed.). New York: Oxford University Press.

FAO. 2004. Simpler Forest Management Plans for Participatory Forestry. Food and Agriculture Organisation: Rome, UN.

FAO. 2007. State of the world's forests. Food and Agriculture Organisation: Rome.

FAO. 2010. Empowering women for the sustainability of natural resources and family livelihood. Food and Agriculture Organisation: Rome, UN.

FAO. 2013. Sustainable forest management in a changing climate: Fire management policy and institutional review. Food and Agriculture Organisation: Dar es Salaam, UN.

FAO. 2015. Global forest resources assessments: How is the world's forests changing? (Second Edition). Food and Agriculture Organisation: Rome, UN

FAO. 2020. Global Forest Resources Assessment 2020 – Key findings. Food and Agriculture Organization of the United Nations: Rome. https://doi.org/10.4060/ca8753en. Retrieved on 19/2/2023

Hamza K.F.S. & Kimweri, E.O. 2007. Tanzania's forest policy and its practical achievements with respect to community-based forest in Miti-miombo. Tanzania Forest Research Institute. Morogoro: TAFORI. 24 – 33.

Hirschberger, P. 2016. Forests ablaze: Causes and effects of global forest fires. Berlin: WWF.

Iddi, S., Mpokigwa, M.K. & Sangeda, A.Z. 2011. Toward communication, education and awareness raising for participatory forest management: A case study of Mufindi district, Tanzania. International Journal of Social Forestry 4 (1): 17-31.

IPCC. 2014. Synthesis report of the inter-governmental panel on climate change and global warming. Inter-governmental Panel on Climate Change: New York, Oxford University Press.

Kaaria, S., Osorio, M., Wagner, S. & Gallina, A. 2016. Rural women's participation in producer organizations: An analysis of the barriers that women face and strategies to foster equitable and effective participation. Journal of Gender, Agriculture and Food Security (Agri-Gender). 1(302-2016-4754): 148 – 167.

Kashaigili, J.J., Kadigi, R.M.J., Mbungu, W.B., Sikira, A., Sirima, A., Placid, J.K., Mbwambo, E. & Minde, A. 2016. Laying the Foundations for Effective Landscape-Level Planning for Sustainable Development in the SAGCOT Corridor: Ihemi Agricultural Development Cluster (LiFELand). Draft Report Submitted to TNC, Sokoine University of Agriculture, Morogoro.

Keenan, R.J., Reams, G.A., Achard, F., de Freitas, J.V., Grainger, A. & Lindquist, E. 2015. Dynamics of global forest area: Results from the FAO Global Forest Resources Assessment 2015. Forest Ecology and Management 352: 9-20.

Kwaslema M.H., Robert, D.F., Jafari, R.K. & Eivin, R. 2018. Awareness and attitudes of local people toward wildlife conservation in the Rungwa game reserve in Central Tanzania. Human dimensions of wildlife. DOI:10.1080/10871209.2018.1494866.

Lemenih, M., Allan, C. & Biot, Y. 2015. Making forest conservation benefit local communities: Participatory forest Management in Ethiopia. Farm Africa technical review process, London EC2Y 5DN. United Kindom.

Lister, A.J., Andersen, H., Frescino, T., Gatziolis, D., Healey, S., Heath, L.S., Liknes, G.C., McRoberts, R., Moisen, G.G., Nelson, M. and Riemann, R. 2020. Use of remote sensing data to improve the efficiency of national forest inventories: a case study from the United States national forest inventory. Forests 11(12): 1364.

Luoga, E.J., Witkowski, E.T.F. & Balkwill, K. 2000. Economics of charcoal production in miombo woodlands of Eastern Tanzania: Some hidden costs associated with commercialisation of the resources. Ecological Economics 35: 243-257.

Malimbwi, R.E. 2003. Inventory report of Duru village forest reserve in Babati, Manyara, Tanzania. Morogoro: Sokoine University of Agriculture.

Misana, C., Mung'ong'o, B. & Mukamuri, E. 1996. Miombo woodlands in the wider context: macro-economic and inter sectoral influences. https://agris.fao.org/agris-search/search.do?recordID=Q11997000081. Accessed 20/2/2023

MNRT. 2000. Protection of natural resources for the development and future generations. Ministry of Natural Resources and Tourism: Dar es Salaam.

MNRT. 2010. Tanzania forest service framework document: Ministry of Natural Resources and Tourism: Dar es Salaam.

NTSEP. 2013. Njombe Town Council Socio-Economic Profile. https://njombetc.go.tz/storage/app/uploads/public/59b/0e6/6cd/59b0e66cd3e2f345891953.pdf. Retrieved on 20/2/2023.

Pima N.E., Maguzu, J., Bakengesa S., Bomani F.A. & Mkwiru, I.H. 2016. Indigenous systems of forest management and beekeeping practices: Case of Mzoghoti village forest reserve, West Usambara Mountain, Tanzania. Morogoro: Tanzania Forest Research Institute. https://www.cabdirect.org/cabdirect/abstract/20163362226. Retrieved on 20/2/2023.

Prestemon, J.P., Hawbaker, T.J. & Bowden, M. 2013. Wildfire ignitions: A review of the science and recommendations for empirical modeling (General Technical Report No. SRS-171). Asheville, NC: U.S. Department of Agriculture Forest Service.

Romano, F. & Reeb, D. 2008. Understanding forest tenure in Africa: opportunities and challenges for forest tenure diversification. Forestry Policy and Institutions Working Paper. Rome: Food and Agriculture Organization.

Shvidenko, A., Barber, C.V., & Persson, R. 2005. Forest and woodland systems 2005. Proceedings from Ecosystems and Human Well-being: Current State and Trends, Washington, DC, U.S.A: Island Press, 585-621.

Siraj, M., Zhang, K., Xiao, W., Bilal, A., Gemechu, S., Geda, K., Yonas, T. & Xiaodan, L. 2018. Does participatory forest management save the remnant forest in Ethiopia? Proceedings of the National Academy of Sciences, India Section B: Biological Sciences 88: 1-14.

Soto, H.A. 2014. A SWOT analysis on conservation agriculture in Njombe, Tanzania (Master's thesis). Norwegian University of Life Sciences, Norway.

Subedi, M., Matthews, R.B., Pogson, M., Abegaz, A., Balana, B.B., Oyesiku-Blakemore, J. & Smith, J. 2014. Can biogas digesters help to reduce deforestation in Africa? Biomass and Bioenergy 70: 87-98.

UNESCO. 2013. Operational guidelines for the implementation of the world heritage convention. United Nations Educational, Scientific, and Cultural Organization: Paris.

URT. 1998. National forest policy. United Republic of Tanzania: Dar es Salaam: Government Printers.

URT. 1999. Village Land Act (and Regulations) No. 5 of 1999. United Republic of Tanzania: Dar es Salaam: Government Printers.

URT. 2002. Forest Act No. 14. United Republic of Tanzania: Dar es Salaam: Government Printers.

URT. 2008. Participatory forest management in Tanzania: Facts and figures (Second Edition). United Republic of Tanzania: Dar es Salaam: Government Printers.

URT. 2013. Joint forest management guidelines. Dar es Salaam: Government Printers.

Vodouhe, F.G., Coulibaly, O., Adegbidic, A. & Sinsina, B. 2010. Community perception of biodiversity conservation within protected areas in Benin. Forest Policy and Economics 12: 505-512.

Wang, S. 2004. One hundred faces of sustainable forest management. Forest Policy and economics 6(3-4): 205-213.

WB. 2004. Sustaining forests: A development strategy. World Bank: Washington, DC.

Wily, L.A. 2002. Participatory forest management in the United Republic of Tanzania. Paper presented at the Second International Workshop on Participatory Forestry in Africa, Arusha, Tanzania.

Zahabu, E. 2006. Handei village forest reserve, Tanzania. *In*: D. Murdiyarso & M. Skutsch (Eds), Community forest management as a carbon mitigation option. Bogor, Indonesia: CIFOR.

Zahabu, E. 2009. Forest land tenure systems in Tanzania: An over view of policy changes in relation to forest management. Morogoro: Sokoine University of Agriculture & Norwegian University of Life Sciences.