

**Socio-ecological resilience of people evicted for establishment of Uluguru Nature Reserve in
Morogoro Region, Tanzania**

Oliva M. Nyenza, Emmanuel F. Nzunda and Josiah Z. Katani

Department of Forest Mensuration and Management,

Sokoine University of Agriculture,

P.O. Box 3013, Chuo Kikuu, Morogoro, Tanzania

Abstract

Eviction of people for establishment of protected areas is often accompanied with negative consequences to the livelihoods of the evicted. This study assessed the eviction process and its effects on the socio-ecological resilience of the evicted, examined coping strategies for the evicted and analysed socio-economic factors that affected socio-ecological resilience of people evicted for establishment of Uluguru Nature Reserve in Morogoro, Tanzania. The results show that most of the evicted did not receive eviction notice prior to eviction nor proper training on how to cope with the eviction. There was also low involvement of the evicted in planning the eviction. Most of the evicted had low ability to reorganize themselves after the eviction. Provision of casual labour was mostly adopted by the evicted as a coping strategy after the eviction because they could not adopt other coping strategies. This resulted in reduced income and certainty of livelihood. Male respondents were better informed and better able to reorganise than female respondents. It is recommended that eviction planning should be participatory and include provision of appropriate prior information to the to-be evicted in a gender-considerate manner in order to enhance their socio-ecological resilience in the face of eviction.

Keywords: Adaptation; community participation; complex adaptive systems; conservation policy; coping strategies; gender; income; poverty alleviation; sustainable livelihood; vulnerability

Introduction

Utilization of ecosystem goods and services has been steadily increasing due to rapid population growth. When the demand exceeds ecosystem capacity to supply goods and services, the pressure created on the ecosystems threatens their sustainability (NEMC 2006). In response, policies and practices have been established to regulate the use of natural resources to ensure their sustainability (Marshall and Marshall 2007). The restrictions required to sustain the supply of ecosystem goods and services may sometimes have negative effects on resource users (Marchlis and Force 1988; Stedman 1999). In particular, when people are evicted for establishment or expansion of protected areas, the communities that lose access to the land they formerly used may have negative socio-ecological experiences such as insecure income, increased poverty and food insecurity (Cernea and Schmidt-Soltau 2006; Schmidt-Soltau and Brockington 2007).

Policies that are implemented without due consideration of socio-ecological consequences often generate conflict and lead to poor compliance (Hiedanpaa 2005). This in turn undermines the effectiveness of the policies in achieving the original goal of resource sustainability (Maiolo et al. 1992). Understanding the responses of resource users to planned changes in resource policy is central to effective management of natural resources (Mukul et al. 2012).

The aim of this study was to assess the socio-ecological resilience of people evicted from Bunduki gap for connection of formerly Uluguru North and Uluguru South forest reserves to form Uluguru Nature Reserve (UNR) on Uluguru Mountains in Morogoro Region, Tanzania. Specifically, the study aimed to:

- (1) assess the eviction process for establishment of UNR and its effects on socio-ecological resilience of the evicted people;
- (2) examine socio-ecological resilience of people evicted from UNR and;
- (3) assess socio-economic factors that affected socio-ecological resilience of the evicted people.

Uluguru Nature Reserve

Uluguru Nature Reserve (UNR) is located on the peak of Uluguru Mountains, which are part of the Eastern Arc Mountains chain which stretches 900 km from Makambako in south Tanzania to Taita Hills in south coastal Kenya (Frontier-Tanzania 2005). The Uluguru Nature Reserve supports a wealth of endemic species, found nowhere else on the planet. Notable endemic species include 135 different plant and more than 50 animal species. In addition to wildlife protection, UNR is also important for water catchment and carbon sequestration.

Bunduki gap was a corridor of 661 hectares separating the then Uluguru North Forest Reserve from the Uluguru South Forest Reserve (Figure 1). It was observed that the existence of the gap caused fragmentation of Uluguru landscape with consequences on biodiversity loss from the forest reserves and the Uluguru mountains landscape as a whole (Frontier-Tanzania 2005).

Island biogeography theory explains the effects of fragmentation of previously continuous habitat that may lead to species decline and eventual disappearance from the fragmented habitat because of lower migration rates (MacArthur and Wilson 1967). Forest fragmentation is a threat to long-term viability of many endemic plant and animal species in the Eastern Arc Mountains (Newmark 1991, 1993, 2002). Most of the forest endemic mammals, birds, amphibian, reptiles and invertebrates of the Eastern Arc Mountains do not venture outside the forest and they do not even cross small gaps (Batulaine 2007; Burgess 2004). With this regard, the government of Tanzania in 2008 conjoined the former Uluguru North Forest Reserve to the Uluguru South Forest Reserve and thus formed the Uluguru Nature Reserve (UNR) (William 2010). To achieve this, people who used the gap for farming had to be evicted.

Eviction for conservation

Eviction for conservation, like other forms of eviction comprises two processes: physical removal of people from their homes and economic displacement in the form of the exclusion of people from particular areas in their pursuit of livelihood through such things as losing farming land, grazing land or reduced access to forest resources (Brockington and Igoe 2006; Cernea 2006). For example, people dwelling on edge of newly formed park would be unable to gather firewood or wild foods, hunt, or fish, or walk to through the park after the formation of the park. Therefore exclusion of economic activity which does not lead to moving homes but displaces livelihood

activity to elsewhere also is eviction (Cernea 2006). In this study the concept of eviction is used in the sense of latter aspect of economic displacement of activity as evidenced in the study area rather than physical movement of residences.

Even though the literature on eviction is not so massive, it is possible to recognize certain patterns in the eviction literature, both geographically and historically (Brockington and Igoe 2006). Studies of eviction have shown that establishment of protected areas in many African and Asian countries have depended on such population evictions (Brockington and Igoe 2006; Vangen 2009). Most protected areas, from which evictions have been reported, were established before 1980 (Brockington and Igoe 2006; Vangen 2009). However, the research and reports were not conducted until after 1990. This is a sign of a lower academic interest in studies of evictions before 1990 (Brockington and Igoe 2006).

Socio-ecological resilience

Ecological, economic and social systems are entangled and difficult to delineate and treat separately (Folke et al. 2005). Ecosystem provides essential goods and services that are vital for the survival and civilization of human beings including food, water, soil formation and prevention of erosion, carbon sequestration, nutrient cycling, recreation and education (Folke et al. 2005). Thus the system comprising the social, economic and ecological components is referred to as socio-ecological system (Gardner and Dekens 2007; Walker et al. 2006).

The term socio-ecological resilience has been defined differently by different authors in different contexts. However, similar meaning has been maintained by the various definitions. Essentially, socio-ecological resilience is the ability to absorb disturbances while maintaining structure, functions and feedbacks (Folke et al. 2005). It is the ability of socio-ecological systems to cope with and adapt to change through reorganisation (Anderies et al. 2006; Walker et al. 2006). A resilient socio-ecological system is a system with a greater capacity to avoid unwelcome surprises in the face of external disturbances (Walker et al. 2006). In complex resource management contexts it is often the nature of the interactions between the social and the resource system that determines the system's capacity to adapt to changes (Walker et al. 2006).

The terms resilience, adaptation, adaptive capacity and vulnerability are often used interchangeably, since a universally-accepted framework for defining these terms and their relationships to one another does not exist (Jain 2012). Consider an agricultural system (Morton 2007): *“Climate variables, such as precipitation, vary from year to year. Precipitation impacts human livelihoods, since agricultural production is tied to the amount of water available in a system. If a farmer is entirely dependent on rainfall for his crop production, he may have high income and yields during ideal precipitation years but low income and yields when the precipitation is too high (i.e. floods) or too low (i.e. droughts). This farmer is said to be vulnerable to changes in climate, since his livelihood is very dependent on the variability in climate. However, a farmer could become less vulnerable to climate by adapting his livelihood strategies; he could adapt by switching to less climate-dependent livelihoods such as salaried professions, gaining access to irrigation, or altering cropping strategies to suit current climate patterns. Adaptation ensures that the farmer maximizes his income despite the variability in climate. This farmer, whose income is not as heavily dependent on climate, is said to be resilient to climate change. Certain farmers are better able to adapt to climate change than others. For instance, a wealthy farmer who can afford irrigation is better able to adapt to climate change than a poor rain-fed farmer. This wealthy farmer who has an increased ability to adapt is defined as having increased adaptive capacity. Hence, adaptive capacity is seen as one of the primary factors that promote resilience of a system”*.

Adaptive capacity is the ability to plan, prepare for, facilitate and implement adaptation options (Walker et al. 2006). The system with higher adaptive capacity will be more resilient to disturbance (Jain 2012). On the other hand, systems are considered to be vulnerable if they have low resilience and are greatly impacted by changes (Jain 2012). Vulnerability is the degree to which people will be impacted by a hazard (natural or man-made) (Tompkins and Adger 2004). Reduced resilience increases vulnerability, and thus, susceptibility to the impact of hazards (Tompkins and Adger 2004).

Various studies have identified different components of resilience. For example, in a study in Australia, components of resilience comprised perception of risk associated with change; perception of the ability to plan, learn, and reorganize; perception of the ability to cope; and level

of interest in change (Marshall and Marshall 2007). Another study identified leadership and vision, knowledge network, institutions that are nested across scales, linking culture with management and enabling policies as the components of resilience (Fabricus et al. 2007). Four categories of factors contribute to building resilience, namely learning to live with change and uncertainty; nurturing diversity for reorganization and renewal; combining different kinds of knowledge, and creating opportunity for self organization (Folke et al. 2003). These may also be considered as components of resilience.

Methods

Respondents for this study came from Bunduki and Kibogwa wards, in Morogoro and Mvomero Districts of Morogoro Region. Purposive sampling was used to select three villages that were involved in the eviction for establishment of UNR and the key informants. Random sampling was employed to select 90 households from a list of the evicted, 40 from Bunduki Village, 30 households from Nyachiro Village and 20 households from Vinile Village. These selections were based on the proportionality of total number of people that were evicted and the availability during data collection: the highest number of the evicted was in Bunduki Village followed by Nyachiro Village while Vinile Village had the lowest. A list of evicted people from the two wards was compiled with the assistance of village executive officers. A structured questionnaire instrument was developed and used in a household survey through face-to-face interviews. The information collected, included opinion on eviction process, response on statements that were meant to measure socio-ecological resilience, coping strategies and factors that determine socio-ecological resilience.

To measure response on opinion of respondents on the eviction process as well as socio-ecological resilience, a list of statements about eviction process and socio-ecological resilience was generated on the basis of literature review and methodology adopted from Marshall and Marshall (2007). The survey statements attempted to measure the level of well-being of farmers after the eviction as well as their opinion on the eviction. Respondents were asked to rate their attitude to each of the 24 statements using a five-point Likert scale (That is 0=strongly disagree, 1=Disagree, 2=Neutral, 3=Agree and 4=Strongly Agree). Analysis of patterns in the responses on the statements was performed using principal components analysis (PCA).

A PCA is a statistical technique used to discover which statements form independent of one another. Statements that are correlated with one another but are largely independent of other responses are combined into factors (Marshall and Marshall 2007). A PCA is based on the assumption that certain underlying factors, which are smaller in number than the original number of statements, are responsible for the co-variation among the responses. In this study, the data were rotated using an orthogonal rotation (varimax rotation), which simplifies the factor structure by maximizing the variance of a column in the pattern matrix (Marshall and Marshall 2007).

Before performing PCA, the statements were tested for internal consistency of scale for socio-ecological resilience, as described by reliability analysis (Marshall and Marshall 2007). A reliability analysis is based on a calculation of correlation among the statements using Cronbach's α (Marshall and Marshall 2007). A Cronbach's α of 0.7 or greater was accepted as indicating reliable scale (Marshall and Marshall 2007). The five statements that had largest Cronbach's α if item deleted were removed from the scale. A total of 19 statements remained (Table 1).

Univariate analysis of variance of the general linear model was used to assess the influence of age, household size, income, gender, marital status, level of education and occupation on the four components of resilience output from PCA, namely, ability to reorganize after eviction process, awareness of the eviction, participation in planning the eviction and support from the government and NGOs. The univariate approach was chosen rather than the multivariate approach because the four principal components are statistically independent of each other.

Binary logistic regression was used to determine socio economic factors influence on the adoption of coping strategies after eviction. Binary logistic regression was chosen because it is most useful when you want to model the event probability for a categorical response variable with two outcomes. In this case respondents that adopted a respective coping strategy score 1 and those that did not adopt it score 0. Socio-economic factors included in the analysis were age, household size, income, gender, marital status, level of education and occupation. All statistical analyses were performed using SPSS 16.0.

Results

The eviction process and its implications for the socio-ecological resilience of the evicted

Majority of respondents did not receive the eviction notes and guidelines for compensation (Table 2). As a result, some respondents complained with regard to compensation they received stating that it was lower than what they deserved. During the interview with evicted people it was revealed that respondents were given the information about the time for eviction and date to list the names of the victims. However, the information regarding compensation was not given. These complaints would be eradicated if the guidelines that govern the whole eviction process as well as compensation were availed to the evicted beforehand.

Socio-ecological resilience of the evicted people

Inference from perceptions on components of socio-ecological resilience

Responses to the statements could be represented by four factors of principal components analysis, which accounted for 71.2% of the total variance (Table 3). The first principal component (PC1) represented 41.9% of the total variance (Table 3). PC1 represents statements related to ability to reorganize after eviction process. The statements that contributed to this component make reference to the condition of the evicted people after the eviction. These were statements on ability to sustain family wealth, well being, food security, household income, farm labour as well as well being. The mean value on the Likert scale for all the five statements associated with PC1 is less than 1 (Table 1), which means that most of the respondents said they could not sustain family wealth, well being, food security, household income, farm labour as well as well being after the eviction. During interview with the respondents, majority complained that before the eviction exercise they owned bigger plots which were more fertile. They also said that they were cultivating permanent crops like yams, bananas and coffee. However, after the eviction they did not have enough land. They remained with just small plots around homes. Thus they sometimes had to hire land, which is not as fertile as the land they lost. Furthermore, they could not cultivate permanent crops on hired land and thus they cultivated only seasonal crops like maize and beans which fetch less money than the permanent crops. Some of the hired land they cultivated after the eviction demanded the use of fertilizers unlike the former farms on the Bunduki gap. Most respondents claimed that they could not afford the cost of fertilizers.

The second principal component represents 13.6% of the total variance. It consisted of statements related to awareness on eviction. The mean for all the statements associated with this component is greater than 1 but less than 2, which means that the respondents disagreed with the statements but not strongly (Table 1).

The third principal component represented statements related to participation of the local community in planning the eviction and it represents 9.6% of total variance. The mean of the statements was mostly around 1, which means that the respondents disagreed with the statements. This means that involvement of the local community in planning the eviction was low. Thus the local community sparsely participated in contributing their views on how to carry out the eviction.

The fourth principal component consisted of statements related to support from the government and NGOs. The statements make reference to provision of knowledge with regard to policy through training. Before the eviction people need to be informed about the essence of eviction. This can be achieved by using government agents as well as non-governmental organizations. There was a good number of NGOs that were involved in conservation of natural resources on the Uluguru Mountains during the time when the eviction was planned. Some of the NGOs conducted meetings with the farmers to explain the importance of expanding the mount Uluguru Nature Reserve. However, the training did not cover the whole process of eviction as well as the policies and acts that govern the eviction process.

Coping strategies adopted by the evicted

Coping strategies adopted included provision of casual labour, buying land, hiring land and livestock keeping (Table 4). As it can be seen, the most adopted coping strategy was provision of casual labour. This involved working on other people's farms during the cropping season unlike working on their own farms which occupied them throughout the year. Most of the evicted could not buy other land and continue with farming as before the eviction because they claimed the compensation was too little to buy land. The provision of casual labour adopted was less profitable and less stable than farming their own land.

Socio-economic factors affecting socio-ecological resilience of the evicted

The ability to reorganise was statistically significantly influenced by gender, occupation and income (Table 5). Thus, male respondents were better able to reorganize than female respondents (Table 6). Respondents engaged in farming, livestock keeping and casual labour scored the highest on the ability to reorganise while those engaged in farming and livestock keeping scored the lowest (Table 6). Respondents with higher income were better able to reorganise than those with lower income (Table 6). Age, marital status, education level and household size had no statistically significant effect on the ability to reorganise.

Gender and occupation significantly influenced awareness of the eviction (Table 5). Age, marital status, education level, income and household size had no statistically significant influence on awareness of the eviction. Male respondents were more aware of the eviction than female respondents (Table 6). Again it was the respondents involved in farming, livestock keeping and casual labour who scored the highest on awareness of the eviction while those involved in farming alone scored the lowest (Table 6).

Participation in planning the eviction was only significantly influenced by income (Table 5) such that respondents with higher income were more likely to participate than those with lower income (Table 6). None of the studied socio-economic factors was associated with receiving support from the government and NGOs (Table 5).

Age, occupation and income were significantly influencing factors for some of the coping strategies respondents adopted (Table 7). Respondents in the age group 36-46 years were most likely to opt for provision of casual labour while those in the oldest category were the least likely (Table 8). Respondents who were engaged in farming had the highest likelihood of hiring land, followed by those that were engaged in farming and casual labour. Most of the respondents that hired land were from the low income category (Table 8). Again most of the respondents that bought land were in the lower income categories (Table 8).

Discussion

The national (Tanzania) Land Act of 1999 and Village Land Act of 1999 stipulate that information should be given in full about the whole eviction process prior to the eviction (URT 1999a, b). Accordingly, the minister shall cause to be published in the government gazette and send to the village council notice specifying location of the land to be transferred, boundaries and extent of transfer, brief statement of the reasons for the proposed transfer and the date of publication of the notice. A copy of the notice should be sent to any person occupying and using that land. The notice should be in manner and form that will be understood by the recipients. There should be clear procedures for full, fair and prompt compensation while acquiring land from citizens and the procedures should be adhered to. The low proportion of respondents that received eviction notice and compensation guidelines in the current study means the eviction process was not friendly to the local people, which may result in resentment against the government and conservation efforts (Mungenyi et al. 2005; Vangen 2009).

Resilient systems are adaptable, flexible, and prepared for change and uncertainty (Marshall and Marshall 2007). Non-resilient systems, in contrast, are prone to irreversible change and are at risk of shifting into other, often undesirable states (Gunderson and Holling 2002). Capacity to reorganize in the face of change is dependent on novelty, creativity, experimentation, learning and planning (Howard et al. 2006; Marshall and Marshall 2007; Walker et al. 2006), which in turn depend on training, expertise, financial capital (Abel et al. 2006) and strong local institutions for management of resources and social relations (Howard et al. 2006). Furthermore, high socio-ecological resilience depends on sufficient social memory that has accumulated knowledge and experience on handling similar disturbance situations over a long period (Howard et al. 2006). The results of the current study suggest weaknesses in these factors that favour high socio-ecological resilience. This is unlike the case in Northern Pakistan where there was high socio-ecological resilience facilitated by an endogenous nature trust that helped the people handle many changes introduced to their socio-ecological system (Abidi-Habib and Lawrance 2007).

In Africa women are more tied to agriculture than men, who may more likely have other sources of income (Bryson 1981). Thus in this study, women were less likely to reorganize than men, probably is due to lack of knowledge among women on doing alternative livelihood activities

rather than depending on agricultural activities as their source of livelihood. This is especially true because respondents with the most activities had the highest ability to reorganize. As expected, respondents with higher income were better able to reorganize than those with lower income, similar to the pattern reported by other studies (Howden et al. 2007; Morton 2007). This is because people with higher income have more options for livelihood.

The fact that male respondents were more informed than female respondents prior to the eviction may be caused by the fact that the methods used to spread the information was not appropriate. It was found that provision of information for eviction mostly involved use of notice board, which is not a preferable method for spreading information to women, who prefer meetings and discussions (Emmanuel 2008).

Respondents with the most activities were also the ones that were most aware of the eviction. This is probably because generally people who involve themselves with many activities tend to be more informed. However, one would expect people involved in business to be most aware.

Through more participation of local people in planning the eviction, the local people would have more influence and share control over the eviction process (World_Bank 1994). Participation of local communities broadens the range of interests and issues that need to be considered (Olsson et al. 2006; Vangen 2009). Different stakeholders assign different values to different ecosystem services and risk (Fabricus et al. 2007). Deliberation allows the differences in interests, perceptions, and explanations to be explored without forcing consensus (Fabricus et al. 2007). Trust and shared understanding are built up through repeated interactions of stakeholders and enable social learning (Olsson et al. 2006). Increased vulnerability to changes continues largely because of undermining local people involvement (Jain 2012).

Leadership is always critical in preparing a socio-ecological system for change (Anderies et al. 2006; Olsson et al. 2006). Government agents and NGOs could have done better in providing leadership in preparing the people for the eviction. For instance, more comprehensive training could have helped the evicted to become more resilient. Through training, the evicted people could even be educated on how to use the compensation they received, even though majority complained that what they got was not enough.

Adopting a less profitable and less stable strategy in the face of a disturbance is a sign of low socio-ecological resilience (Folke et al. 2003; Howard et al. 2006). This was revealed in the current study whereby more than 40% of respondents adopted casual labour as a coping strategy after the eviction. Casual labour in Tanzania is usually associated with low income and leads to poverty aggravation.

In summary, the eviction process was associated with low socio-ecological resilience of the evicted people. Some of the causes of low socio-ecological resilience were the low level of participation of the community in planning the eviction, limited information about the policy governing the eviction, unclear and low compensation and insufficient training on coping with the eviction. To ensure high socio-ecological resilience, local community should be involved in the process of eviction through providing them with information about the process. For evicted people compensation by giving them land somewhere else is more appropriate than giving them money, because for some reason the evicted may not be able to get other land using the money. The limited choice of coping strategies by the evicted was partly due to little knowledge on what to do after eviction, because the seminars and meetings conducted before the eviction were focused only on the importance of conserving UNR. The seminars offered nothing about how to cope with the situation after the eviction process. Educating the affected people would make them better able to cope with the eviction.

References

- Abel, N, Cumming, DHM, and Anderies, JM. 2006. Collapse and reorganization in social-ecological systems: questions, some ideas, and policy implications. *Ecology and Society*. 11: 1 – 17.
- Abidi-Habib, M, and Lawrance, A. 2007. Revolt and remember: How the Shimshal Nature Trust develops and sustains socio-ecological resilience in the Northern Pakistan. *Ecology and Society*. 12, No. (2): 35. [online] URL: <http://www.ecologyandsociety.org/vol12/iss32/art35/>.
- Anderies, JM, Walker, BH, and Kinzig, AP. 2006. Fifteen weddings and a funeral: case studies and resilience-based management. *Ecology and Society* 11, No. (1): 21. [Online] URL: <http://www.ecologyandsociety.org/vol11/iss21/art21/>.

- Batulaine, WM. 2007 Assessment of Baseline Ecological and socio-economic Factors for Forest Restoration planning in the Bunduki Gap,Uluguru mountain forest in Tanzania. Development Studies Institute: Sokoine University of Agriculture.
- Brockington, D, and Igoe, J. 2006. Eviction for conservation: a global overview. *Conservation and Society*. 4, No. (3): 424 – 470.
- Bryson, JC. 1981. Women and agriculture in sub-Saharan Africa: Implications for development (an exploratory study). *The Journal of Development Studies*. 17, No. (3): 29-46.
- Burgess, ND. 2004 Securing the Derema Forest Corridor in the East Usambara Forests of Tanzania: the Most Important Biodiversity Corridor in the Eastern Arc and Coastal Forests Hotspot. Dar es Salaam: Ministry of Natural Resources and Tourism p27.
- Cernea, MM. 2006. Population displacement inside protected areas: a redefinition of concepts in conservation politics. *Policy Matters* 4: 8 – 26.
- Cernea, MM, and Schmidt-Soltau, K. 2006. Poverty Risks and National Parks: Policy Issues in Conservation and Resettlement. *World Development*. 34, No. (10): 1808–1830.
- Emmanuel, G. 2008. Access to Information by Rural Communities. What Sources do they prefer? *Journal of Continuing Education*. 3, No. (1): 75 – 83.
- Fabricus, C, Folke, C, Cundill, G, and Schltz, L. 2007. Powerless spectators, coping actors, and adaptive co-managers: a synthesis of the role of communities in ecosystem management. *Ecology and Society* 12, No. (1): <http://www.ecologyandsociety.org/vol12/iss11/art29>.
- Folke, C, Carpenter, S, Walker, B, Scheffer, M, Elmqvist, T, Gunderson, L, and Holling, CS. 2005. Regime shift, resilience and biodiversity in ecosystem management. *Annual Review of Environment and Resources*. 35: 557-581.
- Folke, C, Colding, J, and Berkes, F. 2003. Building resilience and adaptive capacity in social-ecological systems. In: Berkes, F, Colding, J, and Folke, C, editors. *Navigating Social-Ecological Systems: Building Resilience for Complexity and Change*. Cambridge: Cambridge University Press. p. 352 – 387.
- Frontier-Tanzania. 2005 Uluguru component biodiversity survey volume 1, methods manual. Dar es Salaam: Forest and Beekeeping Division of the ministry of Natural Resource and Tourism, p 70.

- Gardner, JS, and Dekens, J. 2007. Mountain hazards and the resilience of socialecologicalsystems: lessons learned in India and Canada. *Natural Hazards*, No. (41): 317- 336.
- Gunderson, LH, and Holling, CC. 2002. *Panarchy: Understanding Transformations in Human and Natural Systems*. Washington DC: Island Press.
- Hiedanpaa, J. 2005. The edges of conflict and consensus: a case for creativity in regional forest policy in southwest Finland. *Ecological Economics* 56, No. (4): 485-498.
- Howard, PL, Puri, R, and Smith, L. 2006 *A Scientific Conceptual Framework and Strategic Principles for the Globally Important. Agricultural Heritage Systems Programme from a Social-Ecological Systems Perspective*. Rome: FAO.
- Howden, S, Soussana, J, Tubiello, F, Chhetri, N, Dunlop, M, and Meinke, H. 2007. *Adapting Agriculture to Climate Change*. *National Academy of Science* 104, No. (50): 33-52
- Jain, M. 2012 *Enhancing resilience in social-ecological systems: a quantifiable framework for adapting to change*.
- MacArthur, RH, and Wilson, EO. 1967. *The Theory of Island Biogeography*. Princeton: Princeton University Press.
- Maiolo, JR, Johnson, J, and Griffith, D. 1992. Applications of social science theory to fisheries management: three examples. *Society and Natural Resources*. 5: 391-407.
- Marchlis, GE, and Force, JE. 1988. Community stability and timber dependent communities. *Rural Sociology*. 53: 220 – 234.
- Marshall, N, and Marshall, PAoU. 2007. Conceptualizing and operationalising social resilience within commercial fisheries in Northern Australia. *Ecology and Society*. 12, No. (1): <http://www.ecologyandsociety.org/vol12/iss11/art11/>.
- Morton, J. 2007. The impact of climate change on smallholder and subsistence agriculture. *National Academy of Science*. 104, No. (50): 19680-19685.
- Mukul, SA, Manzoor-Rashid, AZM, Quazi, SA, MUddin, MB, and Fox, J. 2012. Local peoples' responses to comanagement regime in protected areas: A case study from Satchari National Park, Bangladesh. *Forests, Trees and Livelihoods*. 21, No. (1): 16–29.
- Mungenyi, O, Twesigye, B, and Muhereza, E. 2005 *Balancing Nature Conservation and Livelihoods: A legal Analysis of the Forestry Evictions by National Forestry Authority*. ACODE Policy Briefing Paper.

- NEMC. 2006 Integrated-ecosystem assessment in Tanzania: experience in ecosystems management. University of Dar es Salaam.
- Newmark, WD. 1991. Tropical forest fragmentation and the local extinction of understory birds in the Eastern Usambara Mountains, Tanzania. *Conservation Biology*. 5, No. (1): 67-77.
- Newmark, WD. 1993. The role and design of wildlife corridors with examples from Tanzania. *Ambio* 22, No. (8): 500-504.
- Newmark, WD. 2002. *Conserving Biodiversity in East African Forests. A study on the Eastern Arc Mountains*. Berlin Heidelberg Germany: Springer-Verlag
- Olsson, P, Gunderson, LH, Carpenter, SR, Ryan, P, Lebel, L, Folke, C, and Holling, CS. 2006. Shooting the rapids: navigating transitions to adaptive governance of social-ecological systems. *Ecology and Society* 11, No. (1): <http://www.ecologyandsociety.org/vol11/iss11/art18/>.
- Schmidt-Soltau, K, and Brockington, D. 2007. Protected Areas and Resettlement: What Scope for Voluntary Relocation? *World Development*. 35, No. (12): 2182–2202.
- Stedman, RC. 1999. Sense of place as an indicator of community sustainability. *Forestry Chronicle*. 75: 765 – 770.
- Tompkins, EL, and Adger, EN. 2004. Does adaptive management of natural resources enhance resilience to climate change? *Ecology and Society*. 9, No. (2): <http://www.ecologyandsociety.org/vol9/iss2/art10/>.
- URT. 1999a. Land Act. Dar es Salaam: Ministry of Lands, Housing and Human Settlement Development of the United Republic of Tanzania.
- URT. 1999b. Village Land Act. Dar es Salaam: Ministry of Lands, Housing and Human Settlements Development of the United Republic of Tanzania.
- Vangen, C. 2009 The process of Eviction and its Impacts on Local Rural livelihoods in Mount Elgon, Uganda. Oslo: Norwegian University of Life Sciences, p 139.
- Walker, B, Gunderson, L, Kinzig, A, Folke, C, Carpenter, S, and Schultz, L. 2006. A handful of heuristics and some propositions for understanding resilience in socio-ecological systems. 11, No. (13): <http://www.ecologyandsociety.org/vol11/iss11/art13/>.
- William, CMP. 2010 Ecology, Conservation and Climate-Fire challenges on Uluguru Mountain Biodiversity Hot Spot, Tanzania. University of Minnesota.

World_Bank. 1994 Report of the learning Group on Participatory Development. Washington DC:
World Bank, p 150.

TABLES

Table 1. Descriptive statistics and reliability analysis for the response of a sample of people evicted for establishment of Uluguru Nature Reserve

Survey item	Mean [†]	Standard deviation	item-total correlation	Cronbach's α if item deleted
I have sustained my family wealth	0.47	0.99	0.673	0.893
I have sustained my household food security	0.43	0.878	0.615	0.895
I have sustained labour for my farm	0.43	0.964	0.575	0.895
I managed to sustain my income after the eviction	0.39	0.912	0.597	0.895
I have sustained my social welfare	0.65	1.198	0.643	0.893
The eviction process little disturbed our life style	0.51	1.099	0.492	0.897
I was informed by government officials before eviction	1.46	1.538	0.567	0.895
Information on eviction process was given on right time	1.78	1.65	0.549	0.896
I received information about the eviction well before the start of the eviction	1.64	1.502	0.684	0.891
Eviction process maintained solidarity among us	1.06	1.309	0.508	0.896
The level of local participation in decision making processes was high	0.94	1.219	0.506	0.896
Community was highly involved in the design of eviction process	1.04	1.313	0.556	0.895
There was the consideration of local people's needs while making management plans for eviction	0.51	0.841	0.517	0.897
The eviction process followed the rules and regulations	1.04	1.177	0.794	0.890
The eviction process was well conducted	1.01	1.239	0.748	0.890
I was provided with information on the policy that govern eviction process	0.74	1.123	0.533	0.896
There was training on familiarizing with the eviction process	0.9	1.262	0.679	0.892
I was involved in conservation of mount Uluguru	1.9	1.323	0.452	0.898
The compensation I got was appropriate	0.33	0.863	0.402	0.898
The eviction process created more trouble to my family*§	0.2	0.547	0.263	0.900
I am proud that local ecological knowledge was recognized during establish of UNR*	1.64	1.141	0.11	0.905
Researchers gathered information from us with regard to	1.07	1.259	0.352	0.900

conservation of UNR*				
I was given right to get land on other place*	1.24	1.357	0.352	0.900
I got my compensation on time to enable me establish new life*	3.11	1.292	-0.036	0.909

†Calculated from scores on a five-point Likert scale whereby 0=strongly disagree, 1=Disagree, 2=Neutral, 3=Agree and 4=Strongly Agree.

§The data for negatively worded statements were reversed prior to analysis

*The five statements that were removed from the scale were those with the largest Cronbach's α if item deleted

Table 2. Response with regard to receiving information prior to the eviction

Question	Response			
	Yes		No	
	Count	%	Count	%
Did you receive eviction notice?	19	21.1	71	78.9
Did you receive any guidelines for compensation?	39	43.3	51	56.7
Did you receive a list of people to be evicted?	67	74.4	23	25.6

Table 3. Principal components analysis results matrix showing loadings of statements on aspects of resilience of evicted people to first four principal components

Survey item	Principal component 1*	Principal component 2	Principal component 3	Principal component 4
I have sustained my family wealth	0.920			
I have sustained my household food security	0.892			
I have sustained labour power for my farm	0.831			
I manage sustained my income after eviction	0.822			
I have sustained my social welfare	0.835			
The eviction process little disturbed our life style	0.666			
I was informed by government leaders before eviction		0.848		
Information on eviction process was given in time		0.797		
I received information about the eviction well before the start of the eviction		0.768		
Eviction process maintained solidarity among us		0.704		
The eviction process followed the rules and regulations		0.505	0.589	
The level of local participation in decision making processes was high			0.873	
Community was highly involved in the design of eviction process			0.873	
There was consideration of local people's needs while making management plans for eviction			0.654	
The eviction process was well conducted			0.560	
I was provided with information on the policy that govern eviction				0.757

process

There was training on
familiarizing with the eviction
process

0.765

*Principal components 1-4 were interpreted as ability to reorganize, awareness of the eviction, participation of local people in planning the eviction and receiving support from government and NGOs. The four components explained 41.9%, 3.6%, 9.6% and 6.1% of the total variance respectively.

Table 4. Coping strategies adopted by the evicted people*

Coping strategies	Number	%
Buy land	29	32.2
Livestock keeping	7	7.8
Provision of casual labour	39	43.3
Hire land	25	27.8

*Respondents had more than one coping strategy

Table 5. Effect of socio-economic factors on components of resilience summarized through PCA.

Results of univariate analysis of variance of the general linear model for each component against socio-economic factors. Values are F-ratios while in brackets are P values, bold type indicates significance at $P < 0.05$.

Socio-economic factor	Ability to reorganize	Awareness of the eviction	Participation of the local community in planning eviction	Receiving support from government and NGOs
Age	0.705(0.552)	0.609(0.611)	0.611(0.773)	0.611(0.505)
Gender	5.554(0.021)	6.629(0.012)	0.012(0.634)	0.012(0.126)
Marital status	0.124(0.945)	0.784(0.507)	0.507(0.595)	0.507(0.278)
Education level	2.596(0.082)	0.128(0.808)	0.880(0.980)	0.880(0.846)
Household size	0.162(0.851)	0.019(0.981)	0.981(0.433)	0.981(0.835)
Occupation	5.472(0.000)	2.444(0.043)	0.043(0.865)	0.043(0.084)
Income	3.338(0.024)	1.058(0.373)	0.373(0.018)	0.373(0.082)

Table 6. Summary statistics of the value of a principal component analysis component associated with a category of a socio-economic variable. Only socio-economic variables with statistically significant influence (Table 5) are shown.

Component of resilience	Socio-economic factor		Mean	Standard deviation		
Ability to reorganize	Gender	Male	0.21	1.10		
		Female	-0.16	0.88		
	Income*	Less than 100,000.00	-0.28	0.62		
		100,000-200,000.00	0.10	1.02		
		200,000-300,000.00	0.61	1.08		
		More than 300,000.00	1.73	1.98		
	Occupation	Farming	-0.18	0.64		
		Farming and livestock keeping	-0.60	1.23		
		Farming and casual labour	0.39	0.58		
		Farming, livestock keeping and casual labour	1.21	1.62		
		Farming and business	0.84	1.66		
		Casual labour	0.65	0.66		
		Awareness of the eviction	Gender	Male	0.32	1.00
				Female	-0.25	0.93
Occupation	Farming		-0.24	0.89		
	Farming and livestock keeping		0.29	0.98		
	Farming and casual labour	-0.13	0.97			
	Farming, livestock keeping and casual labour	1.01	0.75			
	Farming and business	0.11	1.49			
	Casual labour	0.46	1.15			
Participation in planning eviction	Income	Less than 100,000.00	-0.15	0.87		
		100,000-200,000.00	0.09	1.08		
		200,000-300,000.00	0.41	1.54		
		More than 300,000.00	0.76	1.38		

*Annual income in Tanzania shillings (TZS). At the time of the study 1US\$ = TZS1,400/=.

Table 7. Effect of socio-economic factors on adoption of coping strategy in response to eviction. Results of logistic regression analysis of each coping strategy against socio-economic factors.

Socio-economic factor	<i>B</i>	<i>P</i>	<i>B</i>	<i>P</i>	<i>B</i>	<i>P</i>	<i>B</i>	<i>P</i>
	Buying land		Livestock keeping		Provision of casual labour		Hiring land	
Age	0.53	0.227	1.35	0.123	-0.92	0.041	-0.41	0.350
Gender	-0.09	0.879	-0.44	0.697	-1.02	0.101	0.67	0.271
Marital status	-0.65	0.066	-0.38	0.521	0.12	0.675	0.17	0.540
Education level	0.13	0.806	1.15	0.268	0.39	0.462	-0.94	0.066
Household size	-0.37	0.375	-0.81	0.308	0.34	0.417	0.04	0.933
Occupation	-0.30	0.147	0.23	0.424	-0.30	0.138	0.63	0.005
Income	0.82	0.026	0.66	0.166	-0.21	0.535	-1.44	0.002
Constant	-1.02	0.596	-6.72	0.074	2.10	0.275	1.49	0.449

Table 8. Distribution of responses on coping strategies in relation to socio-economic characteristics of the respondents. Only socio-economic characteristics with statistically significant influence (Table 5) are shown.

Coping strategies	Socio-economic factor	Yes*		No				
		Frequency	% [†]	Frequency	%			
Provision of casual labour	Age	Below 25	0	0.0	0	0.0		
		25 - 35	2	2.2	8	8.9		
		36 – 46	25	27.8	0	0.0		
		47 – 56	12	13.3	20	22.2		
		Above 56	0	0.0	23	25.6		
		Total	39	43.3	51	56.7		
Hiring land	Occupation	Farming	17	18.9	25	27.8		
		Farming and livestock keeping	1	1.1	9	10.0		
		Farming and casual labour	5	5.6	17	18.9		
		Farming, livestock keeping and casual labour	1	1.1	7	7.8		
		Farming and business	1	1.1	3	3.3		
		Casual labour	0	0.0	4	4.4		
		Total	25	27.8	65	72.2		
		Income	Less than 100,000.00	100,000-200,000.00	13	14.4	17	18.9
				200,000-300,000.00	2	2.2	2	2.2
				Total	10	11.1	41	45.6
Total	13			14.4	17	18.9		

		More than 300,000.00	0	0.0	5	5.6
		Total	25	27.8	65	72.2
Buying land	Income	Less than 100,000.00	12	13.3	39	43.3
		100,000- 200,000.00	12	13.3	18	20.0
		200,000- 300,000.00	2	2.2	2	2.2
		More than 300,000.00	3	3.3	2	2.2
		Total	29	32.2	61	67.8

*Yes is for those that adopted the strategy while no is for those that did not.

† % of the total number of respondents, which was 90.

FIGURE LEGEND

Figure 1. Map showing the location of study area

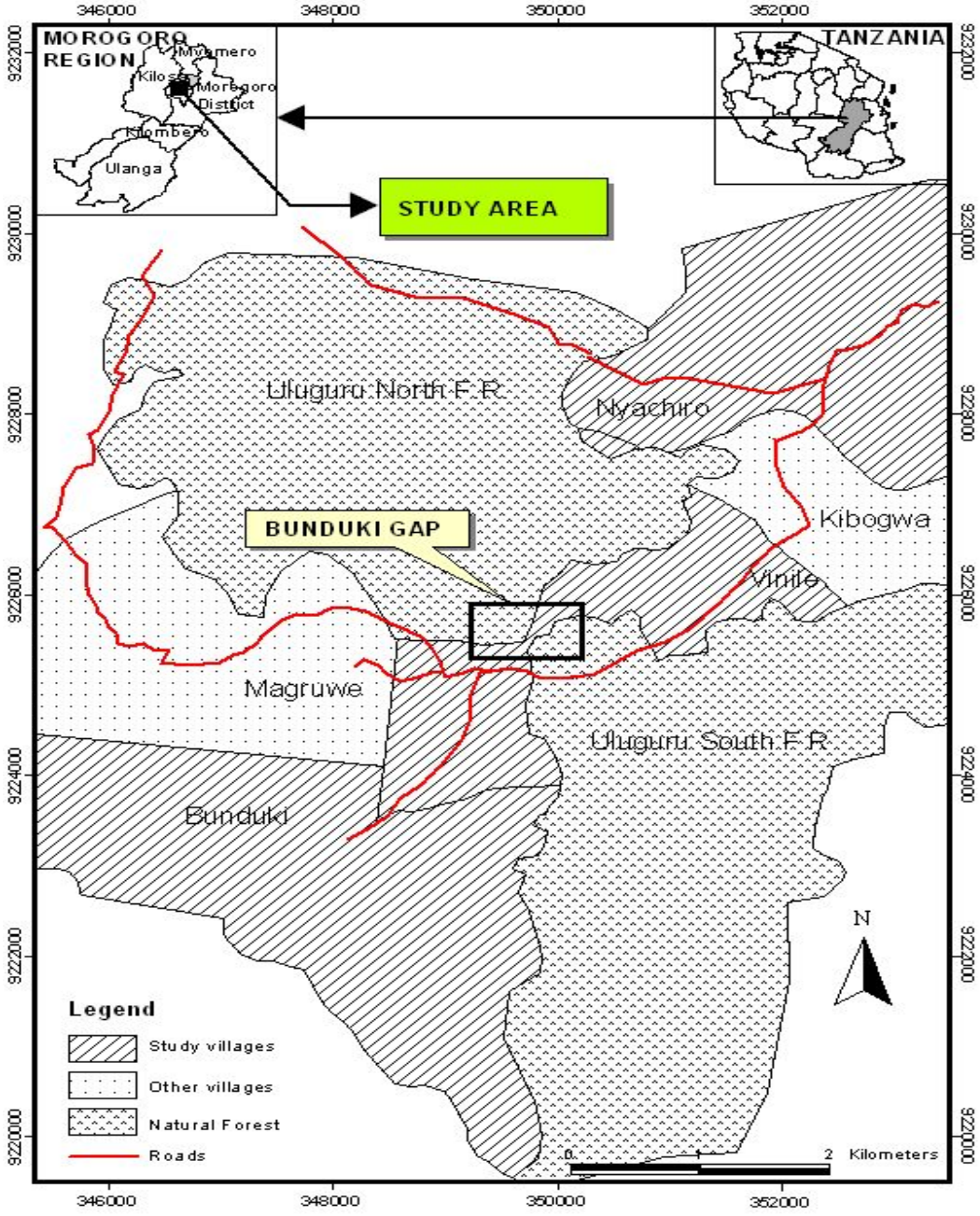


Figure 1.