Local Knowledge on the Changes in Vegetation Composition and Abundance in Rusinga Island, Homa Bay County, Kenya

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Abstract

Local communities have been coping with environmental dynamics since time immemorial, and they often possess considerable knowledge about environmental change, as well as mechanisms of coping with the consequences of such changes. Local knowledge on the changes in vegetation composition and abundance is therefore fundamental for the development of management strategies aimed at sustainable use and conservation of natural vegetation resources. Household interviews (*n*=150), Key informant interviews (*n*=30) and Focus group discussions (*n*=4) were used in this study to extract information on the communities' perceptions on the status of vegetation in Rusinga Island of Homa Bay County of Kenya, and the suggested management strategies for the environment, particularly the vegetation resources for posterity. Rusinga Island is a biodiversity hotspot and an ancient historic area with numerous archeological sites that have given the World fossils dating back millions of years but the area has been experiencing downward trend in its ecosystems. Majority (86%) of the respondents reported having observed changes in vegetation composition and abundance in the study area. The changes were attributed to deforestation, high human population, overgrazing, inadequate rainfall, and soil erosion. Most (68%) of the respondents perceived the changes had occurred mainly in the forests/hills, in the entire Island (15.3%) and in the homesteads (2.7 %). To reverse the changes, the local community proposed tree planting, protection of existing trees, use of alternative sources of fuel, increased awareness creation on environmental conservation and controlled livestock grazing as the best strategies to reduce vegetation degradation. Besides sensitization and building capacity of the communities to engage in sustainable management of vegetation resources, land restoration interventions in the study area should target the plants species at risk through re-introduction and re-afforestation practices.

Introduction

Globally many plant species are decreasing at alarming rates driven majorly by the expansion of agricultural fields and ever-increasing demand for plant resources by the local people who depend on the natural resources as s source of livelihood. These trends are believed to be the cause of extensive losses in biodiversity and ecosystem goods and services (Strauch et al. 2016). Deterioration in the status of natural vegetation results into a clear decline in most of the highly valuable benefits derived from those resources with an apparent effect on local people's daily lives (Lykke 2000).

Since time immemorial the local communities have been coping with the changes in their environments thus, they often have an extensive knowledge about environmental changes and means to cope with their consequences (Bowman 2002). Such knowledge not only compels for a scientific investigation on the causes of the changes but also helps in the design of adaptation and mitigation measures to deal with changes in vegetation since the local people express their interests and desire for an improved management strategy (Chaudhary et al. 2011).

The local people hold detailed and reliable information about changes in vegetation, thus their knowledge is key in the awareness of the long-term changes in vegetation composition and abundance (Kinlund 1996). Moreover, the elderly people can give reliable information on the changes that have occurred in vegetation over a certain period of time (Lykke 2000). However, there is no available data on vegetation resources found in Rusinga Island, their historical changes and status. Therefore, the objective of the current study was to assess the different uses of woody plant species, the perceptions of the local people on the changes in vegetation, the causes of the changes and their proposed management approaches to make sure that the woody plant resources will be available in future.

Methods and Study site

This study was carried out in Rusinga Island situated in Homa Bay County, within Lake Victoria region. The Island lies between latitudes 0°35' and 0°44' South and longitudes 34°11' and 34°22' East, the altitude varies between 1100 and 1300 m above sea level and covers an area of 44 km^2 (Olanga et al. 2015). The Island is divided into two locations namely Rusinga East and Rusinga West and there are six Sub-locations which include: Kaswanga, Wanyama, Kamasengre East, Kamasengre West, Wawere South and Wawere North. In Rusinga Island there are about 10 beach communities and a total of 36 villages (Olanga et al. 2015). Rusinga Island has around 25,000 inhabitants who generally speak the DhoLuo language together with Swahili which is a national language (Homan et al. 2015). The main occupational activities in Rusinga Island are subsistence farming of crops like Sorghum, maize, millet and fishing which is normally carried out by adult males with females involved in fish processing and trading (Weckenbrock and Oldesloe 2004). Fish net repair and boat making are other activities that are carried out in Rusinga Island (Olanga et al. 2015).

A purposive sampling approach (Molenberghs 2010) was employed to select 150 households from six sub-locations in Rusinga Island. Semi-structured questionnaires comprising of both the open and close-ended questions were administered to the 150 randomly selected households. Some of the information gathered was the perceptions on the changes in vegetation composition and abundance, factors influencing the vegetation status and dynamics and the suggested management strategies for the environment. In addition, purposive and snowballing sampling techniques (Tongco 2007; Shafie 2010) were used to select respondents for Focus Group Discussions (FGDS) and Key Informant Interviews (KIIS). In total, 4 focus group discussions were conducted, comprising of 8-12 men and women participants. Thirty (30) KIIs were conducted and the participants were selected based on their roles in the community, age group and gender.

Results

Majority (64%) of the households are headed by males compared to only 36% headed by females with majority of the household heads between 31-60 years (59.3 %) followed by those over 60 years (34.7%) and below 30 years of age being represented by 6%.

The main source of livelihood as reported by the respondents was small scale farming (34%), followed by business (32%), fishing (18%) and formal employment (3.3%).

Most (86%) of the respondents had observed changes in vegetation composition and abundance in the study area during the last 30 years. Deforestation (43.3%), high human population (15.3%), overgrazing (10.7%), inadequate rainfall (10%) and soil erosion (6.7%), were mentioned by the respondents as the major causes of the changes in vegetation in the study area.

The respondents reported various uses of woody species, among them, fencing, construction, firewood, medicine and forage and fodder. The local people seemed to have a preference for species such as *Acacia seyal, Senna siamea, Balanites aegyptiaca, Euclea divinorum, Leucaena leucocephala* and *Markhamia lutea* for firewood. *Senna siamea, Markhamia lutea, Olea africana, Leucaena leucocephala* and *Euclea divinorum* were preferred for construction purposes. There was an overlap of species that were used for firewood and those preferred for construction. For instance, *Senna siamea* is a valuable firewood species and at the same time it is used for construction since it is resistant to termite attacks.

From the study, half of the respondents (50.7%) recommended planting more trees as a way of reducing vegetation degradation. Other proposed restoration strategies were; protection of existing trees (16%), use of alternative sources of fuel (8.7%), increased awareness creation on environmental conservation (6.7%) and controlled livestock grazing (4 %).

A total of 42 woody plant species both exotic and indigenous were mentioned by the informants to be found in Rusinga Island at present and about 30 years ago. Out of these, 9 woody plants were proposed for a reforestation programme. Some of the most preferred species for rehabilitation were: *Markhamia lutea, Senna siamea, Leucaena leucocephala, Olea africana* and *Euclea divinorum* while the least preferred species were: *Thevetia peruviana, Eucalyptus species, Terminalia mantaly, Acacia seyal* and *Euphorbia candelabrum.* The respondents cited harboring of snakes by some species like *Thevetia peruviana,* the requirement of a lot of water for some species to grow, myths of some species causing deaths in the family and some taking very long time to grow.

Discussions and conclusions

The large number of households headed by males is ascribed to the strong culture and tradition of the community which states that a man is the head of the family and the woman can only take up the role after the death of the husband (Rotich, 2016). Aged people have a broader knowledge and are able to understand the socioeconomic and ecological dynamics taking place in a particular area (Kaganga and Ndumbaro 2017). Therefore, the high number of respondents above 30 years of age indicated that most of them were more familiar with the area, the resources that are derived from the woody plants and the changes that may have taken place in vegetation and their respective causes. Adoption of other sources of livelihood apart from fishing which is the most common in the area is attributable to the declining levels of fish in Lake Victoria thus the residents are opting to practice small scale farming and business as a source of income. Similarly, Ketelaars (2015) and Balirwa et al. (2003) found that many families in Rusinga Island were attempting to practice other forms of generating income like agriculture both for commercial and subsistence purposes and this was attributable to "lack of fish" in the lake, making the fishing activity less viable and unreliable as a source of income and a way of sustaining a family.

Majority of the respondents perceived that there had been negative changes in vegetation composition and abundance in the study area. The observations from the current study of high human population, deforestation, overgrazing as the main causes of the changes were also reported by Sambou et al. (2016) and Wasonga et al. (2011) in Senegal and Kenya, respectively. Similarly, Zegeye et al. (2006), in Ethiopia found that cutting down of trees for various purposes was the main threat to the vegetation resources in their study area.

The community revealed that the reasons for the preference of some species over others for firewood was because they burn with minimal smoke and last longer while cooking. The local people proposed a number of adaptation measures as a result of the decreasing availability of trees which are of high socio-economic importance as has been reported in some studies (Sambou et al. 2016; Wezel et al. 2000). Celentano et al. (2014), reports that in order to overcome the continuing degradation of tropical forests planting trees ought to be considered as the best strategy.

This study showed that majority of the people in Rusinga Island are cognizant of the decline in woody vegetation in their area and the possible driving factors affecting the vegetation dynamics. For woody plant species to be effectively conserved and managed, the local people must be actively involved in the management and rehabilitation efforts. Some of the most preferred plant species for reforestation like *Markhamia lutea, Senna siamea, Leucaena leucocephala, Olea africana* and *Euclea divinorum* identified by the local people should be encouraged and promoted.

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