Applied Geography 94 (2018) 84–94

Contents lists available at ScienceDirect

Applied Geography

journal homepage: www.elsevier.com/locate/apgeog

Transformation of shifting cultivation: Extent, driving forces and impacts on livelihoods in Tanzania

Charles Joseph Kilawe[a,b,*], Ole Mertz[b], Dos Santos Aristaricky Silayo[c], Torben Birch-Thomsen[b], Salim Mohamed Maliondo[a]

[a] Department of Ecosystems and Conservation, Sokoine University of Agriculture, P.O. Box 3010, Morogoro, Tanzania
[b] Department of Geosciences and Natural Resource Management, University of Copenhagen, Øster Voldgade 10, DK- 1350 Copenhagen, Denmark
[c] Department of Forest Engineering and Wood Sciences, Sokoine University of Agriculture, P.O. Box 3012, Morogoro, Tanzania

ARTICLE INFO

Keywords:
Household survey
Land use change
Object Based Image Analysis
Slash-and-burn

ABSTRACT

Shifting cultivation is in rapid transformation in many parts of the Global South, but the drivers and consequences of these changes are still not well understood, especially in Africa. We therefore analysed the drivers of this transformation and its impacts on livelihoods between 1995 and 2014 in two villages located in Eastern Central Tanzania by combining analysis of socio-economic and remote sensing data. Results revealed that in an upland village, the number of shifting cultivators declined from 34% to 16% and the area changed from 19% to 17%. In a plateau village, the number of shifting cultivators declined from 24% to 18% and the area substantially declined from 23% to 14%. In both villages, shifting cultivators adopted intensive land preparation methods that involved deep tillage and burying of vegetation. Transformation of shifting cultivation in the upland area was driven by adoption and enforcement of land tenure policies that restrict shifting cultivation whereas in the plateau area, it was driven by population pressure causing competition for land between shifting cultivators and pastoralists. In both villages transformation of shifting cultivation negatively affected household income and increased periods of food insecurity.

1. Introduction

Shifting cultivation is a very dynamic farming system and there is increasing evidence that it is being transformed into intensive farming systems such as monoculture crop or tree plantations, permanent annual crops, grass pasture or short fallow systems (Grogan, Birch-Thomsen, & Lyimo, 2013; Schmidt-Vogt et al., 2009; Schmook, van Vliet, Radel, Manzon-Che, & McCandless, 2013; Stromgaard, 1989; Styger, Rakotondramasy, Pfeffer, Fernandes, & Bates, 2007; Ziegler et al., 2009). For example, a study of two communities in Malaysia revealed that 50% of shifting cultivators changed to oil palm cultivation between 2002 and 2011 (Mertz, Egay, Bruun, & Colding, 2013). A similar study conducted in Miombo woodland of East Africa showed that the number of shifting cultivators declined from 57% to 5% between 1997 and 2010, and that wood-based shifting cultivation were being replaced by more intensive grass-land based system (Grogan et al., 2013). Several case studies worldwide have documented this trend, which is specifically prevalent in Southeast Asia (Mertz et al., 2009; Padoch et al., 2007; van Vliet et al., 2012). However, these transformations are not occurring everywhere and there are also cases of shifting cultivation increase and persistence as documented by a review of 157 case studies showing 40% increase in East Africa and 90% persistence or increase in Central Africa and Madagascar (van Vliet et al., 2012) as has been further documented more recently (Molinario, Hansen, & Potapov, 2015; Zaehringer, Eckert, & Messerli, 2015).

The transformation of shifting cultivation in Africa is often linked to increase in population density (Araki, 2007; Chidumayo, 1987; Luoga, Witkowski, & Balkwill, 2000). However, various theoretically and empirically based studies have established other factors beyond population pressure. Stone (2001) showed how socio-cultural and economic systems influenced land-use decisions of two neighbouring communities in Central Nigeria. Similarly, Brookfield (2001) and Lambin et al. (2001) have both shown the importance of economic influence from market in shaping agricultural systems and Grogan et al. (2013) show that multiple drivers influenced intensification of shifting cultivation in Zambia and Tanzania. In general, the drivers of intensification differ from place to place and through time (Mertens, Sunderlin, Ndoye, & Lambin, 2000; van Vliet et al., 2012).

The knowledge of the current extent of shifting cultivation is essential for planners and policy makers for making correct land use and

* Corresponding author. Department of Ecosystems and Conservation, Sokoine University of Agriculture, P.O. Box 3010, Morogoro, Tanzania.
E-mail address: ckilawe@sua.ac.tz (C.J. Kilawe).

https://doi.org/10.1016/j.apgeog.2018.03.002
Received 13 July 2017; Received in revised form 28 February 2018; Accepted 5 March 2018

development decisions. However, such information is lacking, particularly in Africa (van Vliet et al., 2012), and only recently there has been a consolidated attempt at visually mapping shifting cultivation at a global level which, however, still needs validation (Heinimann et al., 2017). A key challenge has been a lack of clear methodologies for separating shifting cultivation areas from other land uses (Ornetsmuller, Verburg, & Heinimann, 2016). Recent development in remote sensing software and image classification approaches has enabled more accurate delineation of shifting cultivation areas at national and sub-national scales, mainly applied in Asia (Hett, Castella, Heinimann, Messerli, & Pfund, 2011; Hurni et al., 2013a, 2013b; Messerli, Heinimann, & Epprecht, 2009). However, there are few such studies in Africa besides Madagascar and the Congo (Molinario et al., 2015; Zaehringer et al., 2015) and there is an urgent need to test such methods in different socio-environmental contexts where shifting cultivation still persists and is in rapid transformation.

In order to address this research gap, the present paper analyses transformation processes of shifting cultivation in east-central Tanzania. Our aim is to understand the current extent of transformation in shifting cultivation, main driving forces behind these processes and their impacts on local livelihoods. The data for these issues were acquired through a combination of household surveys, focus group discussions conducted in 2013 and analyses of Landsat satellite images of 1995 and 2014.

1.1. Shifting cultivation in Tanzania

Shifting cultivation in Tanzania is officially known in Kiswahili language as "*Kilimo cha kuhamahama*" (shifting agriculture), but also unofficially known as "*mahame*" (shifted land) or '*malale*' (fallow land). It involves clearing forest fallow vegetation, collection of cleared vegetation into piles, burning, cropping practices, fallowing and shifting to open another area under fallow. Crop types, cropping and fallowing periods vary from place to place as indicated in Table 1.

According to official data, shifting cultivation occupied 7.6% (66,332 km^2), of the total country land area in 2013 (URT, 2015). There are no country level estimates of the number of people relying on this land use, but examples from district level estimates are: 5% in Sumbawanga (Grogan et al., 2013); 20–50% in Kilosa (Lusambo, Monela, & Mombo, 2007; Norrlund & Brus, 2004); 68% in Kitulanghalo (Luoga et al., 2000), 90% in Urambo (Mangora, 2012) and 70% in Lindi Rural District (Mshale et al., 2012). As it has been found in other countries, intensification of shifting cultivation to intensive grassland–based systems or continuous annual cropping has been reported in Tanzania (Birch-Thomsen, Frederiksen, & Sano, 2001; Grogan et al., 2013; Itani, 2007). However, there are also cases of shifting-cultivation persistence or increase reported in south-eastern Tanzania (Mshale et al., 2012).

Transformation of shifting cultivation in Tanzania is associated with increase in population pressure and market integration. Population increase – often through migration – reduces land available for expansion, brings new intensive farming technologies and increases the pool of cheap labour (Grogan et al., 2013; Itani, 2007; Stromgaard, 1989). The growing market for labour, staple food high, value vegetables and forest products entice shifting cultivators to intensify or change to other livelihood options (Grogan et al., 2013). Another driver for intensification of shifting cultivation is implementation and enforcement of land tenure policies that discourage shifting cultivation. The policies restrict land available for shifting cultivation and/or promote intensive cultivation through provision of subsidies such as improved seeds, fertilizers and free agricultural extension services. The two most striking of these policy developments that affected shifting cultivation are: the adoption of the villagisation program and the adoption of the National Land Policy and Acts (Daley, 2005; Kikula, 1997; Limbu, 1995; URT, 1999b).

Table 1
Examples of shifting cultivation in Tanzania.
Source: [1]Luoga et al. (2000); [2]Mwampamba & Schwartz (2011), p. [3] Norrlund and Brus (2004); [4]Mshale, Mshana, and Yared (2012); [5]Grogan et al. (2013); [6]Itani (2007);[7]Kikula (1997)

Regions in Tanzania	District	Crops	Cropping duration (years)	Fallow duration (years)	Unique aspect of the practice	Source
Morogoro	Kitulanghalo	[1]Maize, [2]Sorghum	6	4	The cleared vegetation is evenly spread on the soil surface followed by burning	1
	Nguru Mountains,	Sorghum, [3]Finger millet, [4] Beans	10	< 6	High diversity of cultivated crops and as the number of crop increases the cropping duration increases as well	2
	Kilosa	Sorghum, maize, [5] Sesame	5–10	3–5	The shifting of fields between adjacent villages	3
Lindi	Lindi rural	Sesame, [6]Hill rice, Sorghum, Maize, [7]Cassava	1–4	3–10	Rotation of long, medium and short fallow depending on crops. Directional felling of trees/vegetation to one common place where burning takes place–no collection into heaps	4
Rukwa	Sumbawanga	Finger millet, Maize	3–5	3–5	Utilization of grass and herbs as soil composite to improve structure and fertility	5
Mbeya	Mbozi	Sesame, Maize, Bean	3–5	3–4	Combination of short fallow systems and grass composite	6
Iringa	Mufindi	Finger millet, Maize	4–6	–	Combination of long fallow, short fallow and grass composite, change of dwellings	7

Crops: [1]Zea mays, [2]Sorghum bicolor, [3]Eleusine coracana, [4]Phaseolus spp [5]Sesamum orientale, [6]Oryza sativa, [7]Manihot esculenta.