The case of the NGO Vi Agroforestry restoring landscapes in the Lake Victoria catchment area

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This case study[1] was written as an input to a collaborative project entitled "Inspire, Support, and Mobilize Forest and Landscape Restoration" between the World Resources Institute (WRI) and the International Union of Forest Research Organizations (IUFRO), funded by the German Ministry of Environment (BMU). The main report of the project is Stanturf *et al.* (2015), which brings forest and Landscape restoration into a wider context.

Vi Agroforestry was chosen as the subject for a case because the authors are familiar with their project and have followed the activities over the past two decades. We regard Vi Agroforestry as an outstanding agroforestry programme in its focus on quality of planting material, quality of extension to farmers and its focus on engaging smallholder farmers into income generating value chains.

The case study was written as an attempt to apply the "stoplight tool" with the aim to evaluate, design, or communicate an FLR project in terms of mitigation, adaptation, and transformation activities (see Stanturf *et al*., 2015) for an in depth description of the method. It is a "desk-study" based on publicly available information on the project and has been written independently of Vi Agroforestry. A late draft was sent to Vi Agroforestry management[2], which did not elicit any comments.

Agroforestry around Lake Victoria

Lake Victoria is the largest fresh water lake in the tropics. Lake Victoria is located 1100 meters above sea level and is shared between the three East African countries of Kenya, Uganda and Tanzania. The watershed for the lake stretches from the highlands west of the Rift Valley in Kenya to the highlands of Rwanda and Burundi. To the south there is a relatively narrow belt in Tanzania, whereas in the north in Uganda, the water flows from Lake Victoria into the river Nile.

About 35 million people live in the Lake Victoria basin. Since 1960 the population within 100 km from the shore has grown from 60 to 246 inhabitants per km^2 (Drakenberg, 2007) and the population is now growing at about 4 % per year (LVBC, 2012), see also figure 1. Poverty rates are high, in particular in Western Kenya, Burundi and Rwanda and most basin residents are very poor, earning between US$ 90 and US$ 270 per year. Around 80 % of households practice crop and livestock farming, with a per capita land holding of about 0.75 ha. This is expected to fall further to 0.35 ha by 2025 (LVBC, 2012).

The landscapes of East Africa have over the course of millennia been changing between forests, woodlands, savannas, and grasslands due to climate changes, grazing and browsing, and human activities. Humans have shaped landscapes by converting natural vegetated land to crop-and grazing land and by controlling vegetation development through fire (Marchant and Lane, 2014). The current distribution of major groups

[1] Lillesø, J-PB, Moestrup, S and Graudal, L, 2017: The case of the NGO Vi Agroforestry restoring landscapes in the Lake Victoria catchment area, 9 pp. Case study prepared for the "FLR Inspire, Support, and Mobilize Project" BMUP, WRI and IUFRO. Available at: http://www.iufro.org/science/special/spdc/flr/flr/

[2] Management of Regional Office for Vi Agroforestry, Nairobi, Kenya

of potential natural vegetation is shown in figure 2b as physiognomic types.

The potential distribution of forests, woodlands, and savannas is largely driven by differences in precipitation and temperature and illustrate the variation of conditions for agricultural production and for the suitability of indigenous and exotic tree species (Lillesø *et al*., 2011). Much of the vegetation has been degraded, altered or converted to crop land, and human influence on vegetation is particularly high around Lake Victoria (van Breugel *et al*., 2015).

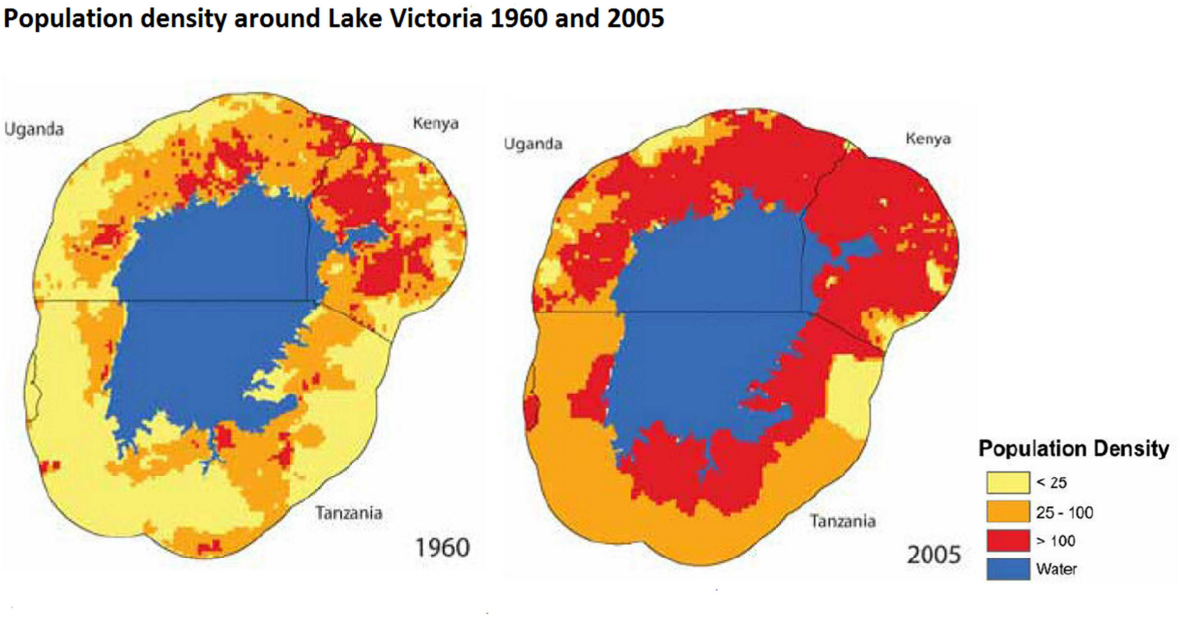


Figure 1. Population density around Lake Victoria 1960 and 2005 (Source: UNEP, Africa Lakes, Atlas of our changing environment 2006, adopted from from Drakenberg, 2007)

Governments of East African countries recognise the degrading environmental condition of Lake Victoria watershed and the East African Community executes a number of joint development programmes to ameliorate the situation. The largest programme is Lake Victoria Environment Management Programme (LVEMP, I and II), funded by the World Bank and the Global Environmental Facility (GEF) and implemented in Kenya, Tanzania and Uganda since 1994 with the current phase continuing until end of 2017. In addition, a large number of NGOs and private entities are active with projects that aim to improve management of water and fisheries and of natural resources on land, including increasing the tree cover.

Vi Agroforestry in Lake Victoria watershed

One agroforestry NGO stands out in the comprehensiveness of it operations. Vi Agroforestry started some thirty years ago as a tree planting project in Western Kenya, but has over the years expanded to target large parts of the Lake Victoria watershed (Vi Agroforestry is active in the areas around Kitale, Kisumu, Musoma, Mwanza, Bukoba, Masaka, and Kigali, see figure 2a).

The mission of Vi Agroforestry is "Through agroforestry[3] and support to farmer organisations, contribute to

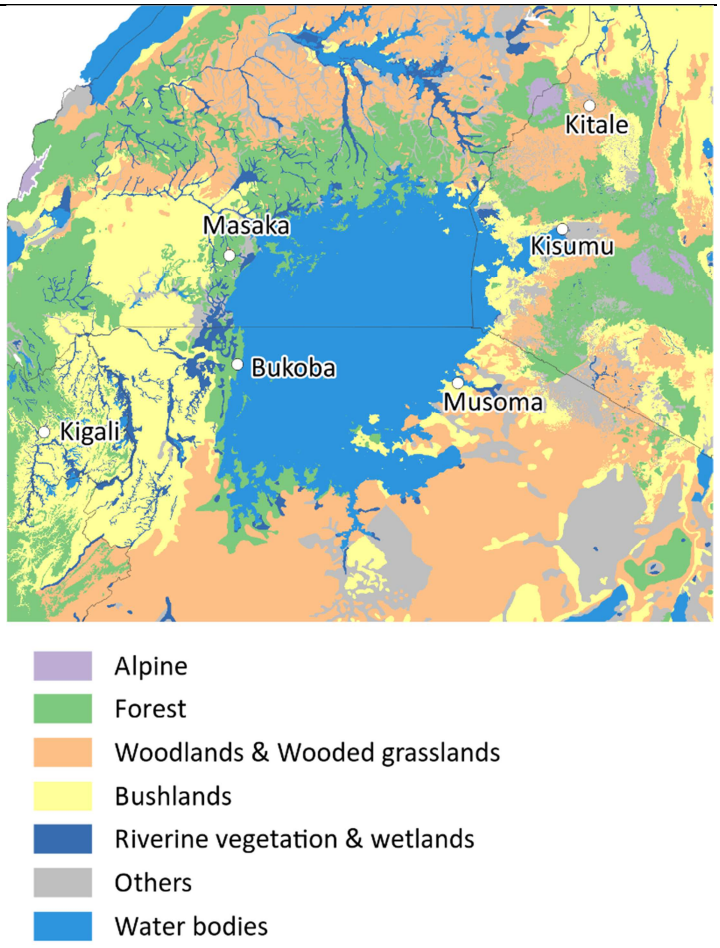
[3] Agroforestry has been defined by World Agroforestry Centre as "The inclusion of trees in farming systems and their management in rural landscapes to enhance productivity, profitability, diversity and ecosystem sustainability" (ICRAF, 2013).

reduce poverty, secure the right to food, increase incomes, increase biodiversity and adapt agriculture methods to climate change" (Vi Agroforestry Strategy 2013-2015, page 6). Vi Agroforestry's main approach is to support smallholder farmers through agroforestry in the context of a "rights" perspective, where empowerment enables individuals to become active citizens and their organisations to achieve power and influence. The support by Vi Agroforestry to smallholder agroforestry thus includes more than support to tree planting, in particular it includes intensive extension support to farming households aiming at building their capacity as producers in value chains and of strengthening farmer organisations from the level of farmer groups in the communities to regional and national organisations. All the support is done with agroforestry as the anchoring point.



(a) The operational areas of Vi Agroforestry in the 4 countries in East Africa – close to the shores of Lake Victoria as well as highlands in Kenya and Rwanda

Source: http://www.viagroforestry.org/files/2012/11/Vi_Agroforestry_GeneralBroschure_2012_ENG_210x270_Webb.pdf



(b) The operational area of Vi Agroforestry covers a wide range of environments, here illustrated by the different physiognomic types in the region, which each consist of several to many potential natural vegetation types. Source: vegetationmap4africa.

Figure 2. (a) Vi Agroforestry -areas of operation and (b) physiognomic vegetation types in the same area

Vi Agroforestry is unique among NGOs in three ways. First, throughout its existence it has emphasized the use of indigenous species and has utilised genecological[4] zoning and genetic principles for seed collection to ensure that the planting material used is appropriate for the local ecological conditions. Secondly, the

[4] Genecological: In this context using assumptions about correlation between environmental variation and genetic variation

emphasis on empowerment coupled with the technical support has led to relatively high levels of adoption. Thirdly, the intensity and duration of extension advise to farming households is higher than other NGOS - depending on the level of development of an area in terms of agroforestry technology adoption. In the initial phase of support of two to three years duration, each field adviser (living within bicycle distance to households) works with 500–1,000 households in groups of around 15 families. This is followed by an extensive phase of two-three years with 5,000–10,000 households per field adviser, where the work is consolidated and value chains are strengthened (Barklund, 2004; Vi Agroforestry Annual reports 2011-2015; Vi Agroforestry Strategy 2013-2015).

Vi Agroforestry addressing adoption and access to relevant and good planting material

Vi Agroforestry addresses two of the major impediments in agroforestry: (i) smallholder farmers' adoption of new agroforestry practices, and (ii) smallholder farmers' access to relevant and good planting material.

Re (i): Strengthening smallholder agriculture and family farming is an important strategy for development in East Africa and transition out of subsistence farming requires that agricultural extension is part of a wider programme designed to stimulate the growth of both the agricultural sector and the non-farm rural economy (Pye-Smith, 2012). Agroforestry is knowledge intensive and high levels of adoption requires support, not only on technical aspects of planting and tending trees, but also knowledge of upstream aspects of the value chains (Lillesø *et al*. 2017).

Vi Agroforestry has an exit strategy built into the programme such that local organizations can take over when Vi Agroforestry withdraws support. Communities are involved in identifying and realizing their prioritised interventions and the key area is to build capacity among farmers to develop enterprises through sustainable utilization of on-farm resources and promotion of farm based enterprises. The strengthening of farmers' own organizations is supported by rural finance and advisory services promoted through village saving and loaning associations and the creation of mutually beneficial collaboration between local, regional and national organizations (multiple stakeholders). In principle, Vi Agroforestry thus creates the demand for agroforestry products that in the longer term is the most important criterion for adoption of commercial agroforestry practices.

VI-Agroforestry collaborated with more than 100,000 farm families in the years 2013-2015 - up from around 75,000 in 2012 (Vi Agroforestry annual reports 2011-2015). Vi Agroforestry estimates that the adoption of practices in their programme areas varies between 60-70% (see also Johansson, 2015) and that annually 4 to 7 million trees are planted as well as 1,000 to 3,000 km of hedgerows are established (Barklund, 2004; Vi Agroforestry annual reports 2011-2015; Vi Agroforestry Strategy 2013-2015).

Re (ii): A number of constraints, several of which are particular to the growing of trees as compared to agricultural crops, limit the ability of smallholder farmers to make profitable tree-based investments. Included is the lack of effective, efficient means to obtain the inputs they need, such as tree planting material of good genetic quality and of the right species (Graudal and Lillesø, 2007). Currently, the high transaction costs involved for smallholders in sourcing information on what is appropriate to plant, and then obtaining the right germplasm, place them at a disadvantage in the market and these costs can be almost insurmountable barriers to full participation. Without the right inputs, it follows that the quantity and quality of the outputs from smallholders' tree plantings are lower than they could be (Lillesø *et al*., 2017).

Vi Agroforestry's solution to this conundrum is to saturate programme areas with about 50 indigenous and exotic tree and shrub species, among which around 60 % are indigenous species and 40 % exotics (Eucalyptus species are not included in the VI's definition of the "agroforestry concept"). The programme handles an average of two tonnes of tree seed annually in Kenya alone. Women groups and individuals are trained in collecting seed, following procedures that aim to avoid inbreeding and to utilise the species

according to their ecological requirements. Some species are procured through the national tree seed programmes and for fruit trees through the horticultural centres. Farmers are encouraged and trained to establish on-farm seed production of fast growing tree species (with early flowering and fruiting). One goal is that 80 % of households should plant 10 fruit trees of 5 species within five years as a bare minimum. A range of functional groups of species are promoted among which are MPTS[5], fodder, medicinal, improved fallow and timber species.

Discussion of landscape restoration effects of Vi Agroforestry approach and the "stoplight tool"

Comments on estimates of success factors: Motivate, Enable, Implement. Restoration through establishing agroforestry landscapes is different from forest restoration *per se*. The aim is not to create natural or semi-natural vegetation, but rather to obtain benefits from trees growing on agricultural land. For smallholder farmers the main benefits are tangible improvement of their livelihoods and incomes through creation of products of direct use, however, agroforestry creates many additional benefits (Garrity, 2004), including above- and below ground carbon sequestration. Secure tenure is a fundamental requirement for adoption of tree planting by smallholder families and does not require a specific law on restoration. Rather than legal instruments, direct economic incentives are often used in agroforestry, such as the offer of free seed and seedlings directly to farmers. Vi Agroforestry is in the vanguard of carbon climate financing (Tennigkeit *et al*., 2012; CCAFS, 2012), however, with the current prices of carbon it can be expected that carbon considerations will play a minor role in smallholder adoption of agroforestry compared to other more tangible benefits from the practice. See table 1 for detailed key success factors of forest landscape restoration (adopted from ROAM, IUCN/WRI, 2014).

In terms of the key themes of the stop light tool (factors to motivate, enable, and implement), Vi Agroforestry's approach creates strong motivation and enables smallholder farmers to carry out successful agroforestry enterprises by linking technical knowledge and access to good planting material with empowerment of smallholder farmers to engage in markets for their products. The chance of successful implementation is increased by the programmes' emphasis on creating self-driven organisations linked from local to national level.

There is a critical link between the technical success factor and the mitigation/adaptation potential. While Vi Agroforestry probably is the NGO in Africa delivering the best planting material to smallholder farmers in terms of ensuring genetically diverse material that is adapted to current climates, there is no programme to insure plantings counteracting climate change (see Table 2).

[5] MPTS: MultiPurpose Tree Species

Table 1. Summary of Forest Landscape Restoration Success: Motivate, Enable, Implement (assessment)

In place ❋
Partly In place ★
Not in place ×
Not relevant ◊

Theme	Feature	Key Success Factor	Level
Motivate	Benefits	Restoration generates economic benefits	❋
		Restoration generates social benefits	❋
		Restoration generates environmental benefits	❋
	Aware-ness	Benefits of restoration are publicly communicated	❋
		Opportunities for restoration are identified	❋
	Crisis events	Crisis events are leveraged	❋
	Legal require-ments	Law requiring restoration exists	◊
		Law requiring restoration is broadly understood and enforced	◊
	Incentives	**Projects/government offer incentives for tree planting**	❋
Enable	Ecological conditions	Soil, water, climate, and fire conditions are suitable for restoration	❋
		Plants and animals that can impede restoration are absent	★
		Native seeds, seedlings, or source populations are readily available	★
	Market conditions	Competing demands (e.g., food, fuel) for degraded forestlands are declining	❋
		Value chains for products from restored forest exists	★
	Policy conditions	Land and natural resource tenure is secure	❋
		Policies affecting restoration are aligned and streamlined	★
		Restrictions on clearing remaining natural forests exist	★
		Forest clearing restrictions are enforced	★
	Social condi-tions	Local people are empowered to make decisions about restoration	★
		Local people are able to benefit from restoration	❋
	Institutional conditions	Roles and responsibilities for restoration is clearly defined	❋
		Effective institutional coordination is in place	★
Implement	Leadership	National and/or local restoration champions exist	★
		Sustained political commitment exists	❋
	Knowledge	Restoration "know-how" relevant to candidate landscape exists	★
		Restoration "know-how" transferred via peers or extension services	❋
	Technical design	Restoration design is technically grounded and climate resilient	×
	Finance and incentives	"Positive" incentives and funds for restoration outweigh "negative" incentives for *status quo*	❋
		Incentives and funds are readily accessible	★
	Feedback	Effective performance monitoring and evaluation system is in place	★
		Early wins are communicated	❋

Table 2. Summary of Forest Landscape Restoration Success: Mitigation, Adaptation, Transformation (assessment)

In place ❋
Partly In place ★
Not in place ×
Not relevant ◊

Theme	Objective	Mechanism	Restoration Activity	Level
Mitigation	Sequester carbon	Increase forest landscape area	Afforestation and promote agroforestry	❋
		Increase biomass/ unit area	Increase productivity	★
			Longer –lived species and functional diversity	★
		Increase soil carbon	Increase rooting depth / soil conservations	★
	Reduce emissions	Bioenergy	Bioenergy plantations	★
Adaptation	Maintain or increase forest area	Reduce deforestation drivers	Policy reform and promoting trees in the landcapes	❋
			Conservation easements	◊
			Improve silviculture, agroforestry management to support more and trees and species with desired functions in the landscape	❋
	Maintain or increase carbon stocks	Reduce degradation	Sustainable forest landscape management including overcoming regeneration barriers	❋
	Maintain other forest functions	Improve biodiversity	Afforest with mixed species	★
			Recover endangered species	★
			Manage for species of concern	★
		Improve hydrology	Restore microsites or check dams and coutour trenches	★
			Plant stream buffers	★
	Manage for resistance	Reduce vulnerability to stressors	Integrated pest management	❋
		Reduce vulnerability by breeding	Genetically diverse seedsources	❋
			Breeding, genetically diverse seed sources, indtroduce new species, provenances or selected genetic material	×
	Manage for resilience	Expand population (within range)		★
		Expand range		★
		Create refugia		×
Transformation	Novel ecosystems	Manage spontaneous ecosystems	Management of mixed forests	★
		Create ecosystems	Translocate species	★
			Replace species within assemblages with desired functional traits	★
			Introduce exotics (non-native species) with desired functional traits	★

Comments on estimates of success factors: Mitigation, Adaptation, Transformation. VI Agroforestry is very strong in promoting adoption of agroforestry and addresses many of the mitigation and adaptation aspects. Some of the major strengths of VI Agroforestry, compared to other NGOs in East Africa, are the promotion of a relatively wide variety of indigenous species and the concern for genetic quality in collection of seed, including species site matching. A major challenge that VI Agroforestry faces with respect to adaptation, is the insufficient knowledge of the indigenous species' capacity to adapt to a changing climate. This is a challenge that should be dealt with through collaboration with appropriate national and regional research organisations. Another challenge for climate adaptation is partly the result of the method that VI Agroforestry utilises for distribution of planting material – the saturation of areas with planting material provided/organised by VI Agroforestry. This has the effect that there are no

structures available for developing and distributing new planting material, once VI Agroforestry has pulled out of an area. The challenge is thus not a purely technical issue for VI Agroforestry, but rather an institutional challenge for agroforestry in East Africa.

References:

Barklund, 2004. The Vi Agroforestry Programme In Kenya, Tanzania And Uganda. A report prepared for the project Lessons Learnt on Sustainable Forest Management in Africa. Downloaded from http://www.afforum.org/sites/default/files/English/English_125.pdf. Accessed March 15, 2017.

CCAFS. 2012. Institutional innovations in African smallholder carbon projects. Case Study: Western Kenya Smallholder Agriculture Carbon Finance Project: Vi Agroforestry. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Copenhagen, Denmark. Downloaded from https://cgspace.cgiar.org/rest/bitstreams/20187/retrieve. Accessed March 15, 2017.

Drakenberg, O. 2007. Environmental Policy Brief for the Lake Victoria Basin. Department of Economics, Environmental Economics Unit, School of Economics and Commercial Law. Göteborg University. Sweden. http://sidaenvironmenthelpdesk.se/wordpress3/wp-content/uploads/2013/04/Environmental-policy-brief-Lake-Victoria-2007.pdf . Accessed March 15, 2017.

Garrity, D.P. 2004. Agroforestry and the Achievement of the Millennium Development Goals. Agroforestry Systems 61: 5–17.

Graudal, L. and Lillesø, J.P.B. 2007. Experiences and Future Prospects for Tree Seed Supply in Agricultural Development Support—Based on Lessons Learnt In Danida Supported Programmes 1965-2005. Danida Working Paper, April 2007. Copenhagen: Ministry of Foreign Affairs of Denmark.

ICRAF. 2013. World Agroforestry Centre Strategy 2013-2022: Transforming lives and landscapes with trees. Nairobi: World Agroforestry Centre.

IUCN and WRI, 2014. A guide to the Restoration Opportunities Assessment Methodology (ROAM): Assessing forest landscape restoration opportunities at the national or sub– national level. Working Paper (Road–test edition). Gland, Switzerland: IUCN. 125pp.

Johansson; K-E. 2015. Barriers and Bridges for Introducing Agroforestry and Community-Based Forestry among Food Insecure Households in Eastern Africa. Doctoral Thesis. Swedish University of Agricultural Sciences. Sweden. Downloaded from http://pub.epsilon.slu.se/12388/1/johansson_k_150622.pdf. Accessed March 15, 2017.

Lillesø, J.-P. B., van Breugel, P., Kindt, R., Bingham, M., Sebsebe Demissew, Dudley, C., Friis, I., Gachathi, F., Kalema, J., Mbago, F., Minani, V., Moshi, H.N., Mulumba, J., Namaganda, M., Ndangalasi, H.J., Ruffo, C.K., Jamnadass, R. and Graudal, L. 2011. Potential natural vegetation of eastern Africa. Volume 1: The Atlas. Forest & Landscape Working Paper 61-2011. University of Copenhagen.

Lillesø, J.P.B., Harwood, C., Derero, A., Graudal, L., Roshetko, J.M., Kindt, R., Moestrup, S., Omondi, W. O., Holtne, N., Mbora, A., van Breugel, P., Dawson, I. K., Jamnadass, R. and Egelyng, H. (2017), Why Institutional Environments for Agroforestry Seed Systems Matter. Dev Policy Rev. Accepted Article. doi:10.1111/dpr.12233

LVBC. 2012. A Basin-Wide Strategy for Sustainable Land Management in the Lake Victoria Basin. Lake Victoria Basin Commission. Downloaded from EAC IRC Repository, East African Community's institutional repository. http://repository.eac.int/123456789/689. Accessed March 15, 2017.

Marchant., R. and Lane, P. 2014. Past perspectives for the future: foundations for sustainable development in East Africa. Journal of Archaeological Science 51: 12-21.

van Breugel, P., Kindt, R., Lillesø, J-P.B. and van Breugel, M. 2015. Environmental Gap Analysis to Prioritize Conservation Efforts in Eastern Africa. PLoS ONE 10(4): e0121444. doi:10.1371/journal.pone.0121444

Pye-Smith, C. 2012. Agricultural extension: A Time for Change: Linking knowledge to policy and action for food and livelihoods. *Series:*Policy Pointers (CTA). CTA Publishing. Downloaded from https://publications.cta.int/en/publications/publication/1689. Accessed March 15, 2017

Stanturf, J.A., Kant, P., Lillesø, J-P.B., Mansourian, S., Kleine, M., Graudal, L., Madsen, P. 2015. Forest Landscape Restoration as a Key Component of Climate Change Mitigation and Adaptation. IUFRO World Series Volume 34. Vienna. Austria.

Tennigkeit, T., Solymosi, K., Seebauer, M. and Bo Lager. 2012. Carbon Intensification and Poverty Reduction in Kenya: Lessons from the Kenya Agricultural Carbon Project. Field Actions Science Reports. Special Issue 7 Livelihoods. Downloaded from https://factsreports.revues.org/2600. Accessed March 15, 2017.

Vi Agroforestry Annual reports 2011, 2012, 2013, 2014, 2015. Downloaded from http://www.viagroforestry.org/who-we-are/resources/publications. Accessed March 15, 2017.

Vi Agroforestry Strategy 2013-2015. Downloaded from http://www.viagroforestry.org/who-we-are/resources/publications. Accessed March 15, 2017.