Shinyanga Forest

Retrofitting Resilience to the Shinyanga Forest Landscape Restoration Case Study

Edmund Barrow

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Background

Shinyanga region has over 2.25 million people, an average growth rate of 2.8% p.a. (1990s), and covers 50,000 sq.km with a population density of 42 people per km^2. The high population density, combined with the people's agro-pastoral land use system which depends on livestock, and subsistence and cash cropping, exacerbated already serious problems of land clearing both prior to, and after 1986 (Barrow et al. 1988, Otsyina et al. 1993, Kilihama 1994, Maro 1995, Mlenge 2005). The area is semi-arid with an average annual rainfall of 600-800 mm, which is erratic and poorly distributed with high variability between seasons. The natural vegetation in Shinyanga historically consisted of extensive Miombo and Acacia woodlands (Burtt 1942, Malcolm 1953), and is well adapted to semi-arid climates. The Sukuma agro-pastoralists (and their institutions) are the main stakeholders, together with village, district, regional and national government officials.

This case study attempts to retrofit a resilience framework to the Shinyanga restoration from the causes of resilience loss, recognition of the problems, to addressing them and recreating resilience. It shows the importance of:

a) The adaptive capacities of the Sukuma people and their institutions; and
b) The importance of restoring diverse ecosystems and their services.

In the 1980's and 1990s resilience as a concept might have been used in research (e.g. Holling 1973), but little of this found its way to the development discourse. Resilience has come to the fore in the climate change debate. This study is based on the premise that it is possible to retrofit and learn from a resilience framework and analysis on such a long term restoration effort.

Losing Resilience up to 1985

Resilience assumes multiple states, and was defined as the magnitude of a disturbance that triggers a shift between alternative states (Holling 1973). Here a regime (or state) shift can occur when the controlling variables in a system change, and result in a different set of structures and dynamics of the systems (Walker and Meyers 2004). The word resilience has evolved from "persistence of relationships within a system, and the "ability of systems to absorb changes of state variable, driving variables and parameters, and still persist" (Holling 1973) to "the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure and feedbacks, and therefore identity, that is, the capacity to change in order to maintain the same identity" (Folke et al. 2010). Shinyanga by 1985 represented an ecosystem in transition where the ability of the system to absorb further changes was compromised. It was at a tipping point (Figure 1, based on Stafford Smith et al. 2009, but with Shinyanga data). By 1985, the semiarid Shinyanga Region in central Tanzania was called the "Desert of Tanzania" by the then President Julius Nyerere after touring the region (Ghazi et al. 2005). Trees and woodlands were cleared to eradicate tsetse fly, create land and space for agriculture and cash cropping, and cater for the needs of a growing population all served to mutually exacerbate the potential for collapse. This all came at a cost. The goods and services which trees and woodlands provided were lost. Fuelwood took between 2-4 hours to collect; the end of dry season forage so badly needed by the oxen was no longer readily available, thereby compromising land cultivation; and wild fruit and medicinal plants were rare to find. In short, all those things vital for the livelihoods of the Sukuma people, the agro-pastoralists from the region, were disappearing (Table 1, based on Folke et al. 2009, with data from Shinyanga).

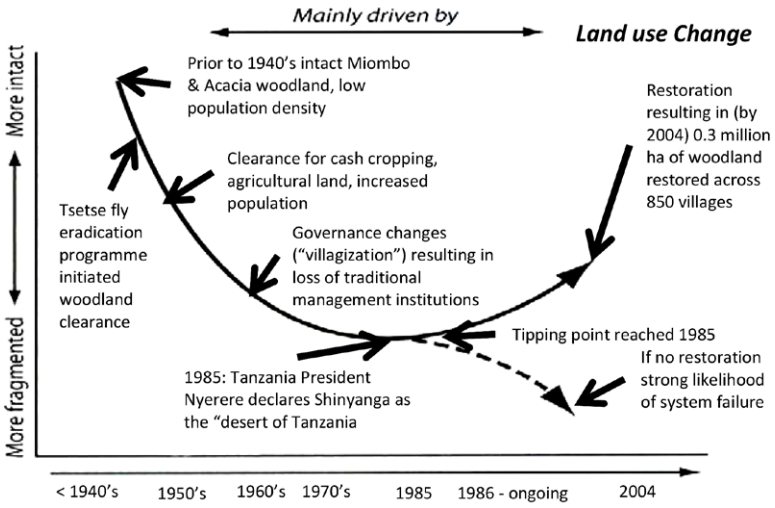


Fig 1: Ingredients for Potential System Failure in Shinyanga by 1985
Source: Malcolm 1953, Barrow et al. 1988, Ghazi et al. 2005, Mlenge 2005, Monela et al. 2005, and based on Stafford Smith et al. 2009

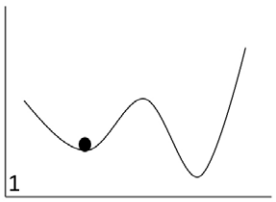
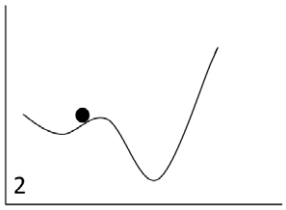
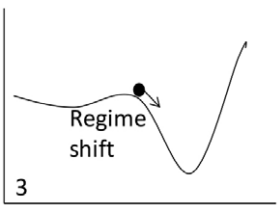
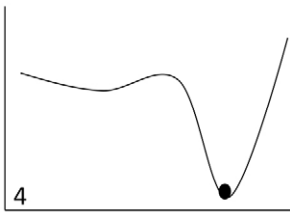
Historical (to about 1950)	Changes impacting on System (1950-1985)	1985 – at a tipping point	What could have been
			
Miombo & Acacia woodland Tsetse fly limited extent of livestock Population density low Agricultural impact relatively small Use of wood & grasslands sustainable A broadly resilient system	Extensive clearing of woodlands to eradicate tsetse fly, with a rapid increase in livestock numbers Population pressures increasing with concurrent increase in land under cultivation Increased national emphasis on cash crops (cotton, rice), agriculture, monocrops, no trees Increased use of natural products (especially for timber, forage) Traditional governance structures undermined by Tanzania policy of Ujamaa (to about 1985) This simplified the system, which became brittle & nearly collapsed	Woodlands no longer provided services No forage for oxen at critical end of dry season making timely cultivation difficult Diversity of tree goods & products lost Very few woodlands left – except degraded national forest reserves Extensive soil erosion Fuelwood 2-4 hours to collect Water 3-6 hours to collect The basis for restoration & enhanced resilience	Further clearing of remaining trees Further losses of soil fertility & more soil erosion Reduced agricultural yield Reduced ability of people to meet livelihood needs Livestock unable to survive System failure (thankfully, this state did not happen)

Table 1: Regime Shifts and Restoration in Shinyanga
Sources: Malcolm 1953, Barrow et al. 1988, Monela et al. 2005, adapted from Folke et al. 2009

In a response to this in 1986, the Government of Tanzania started the Shinyanga Soil Conservation Programme, or HASHI (In Swahili Hifadhi Ardhi Shinyanga, Barrow et al. 1988). This decision helped set in place some of the structures to enable the restoration and the resilience of the overall system. The Government of Tanzania was the major donor for this project, with additional funding from NORAD (The Norwegian Development Assistance Agency).The project relied on the rich local knowledge of the Sukuma people about their natural resources and ways of managing them. "Ngitili – or "enclosures" or "fodder reserves" in the Sukuma language were traditionally used for conservation and restoration of rangelands, and governed under customary law. The Sukuma people were and are the main driving force for the astounding success of the forest restoration in the region (Barrow and Mlenge 2003). It was clear that nearly all the aspects of resilience had been lost – the institutions of management (Ngitili, local guards or Sungusungu, and the local management institution of Dagashida), and the traditional knowledge about the importance of trees and reserved grazing areas were still known, although the Government process of "Villagization" (or "Ujamaa") since the 1960's had done much to undermine them. Lastly there were still some residual Miombo and Acacia trees as a basis for restoration (Ghazi et al. 2005, Monela et al. 2005). By 1985, the Shinyanga system had very nearly but not quite reached the tipping point (Figure 1, Table 1). The Miombo and Acacia woodland mosaics and tsetsefly were all part of the original resilience. Destroying the woodlands was a major component of destroying the resilience of the system.

Restoring Resilience – Forest Landscape Restoration

During a detailed survey (late 1990's) of a sample of 172 villages, there were 18,607 Ngitili (group or village Ngitili – 284, and 18,039 household or individual Ngitili) covering an area of about 78,122 Ha. (Maro 1995). The average size of the group or village Ngitili is 164 Ha, while the average size of the individual Ngitili was 2.3 Ha. Ninety per cent of the people in the 833 villages of Shinyanga have their own Ngitili. So by the year 2004, approximately 300,000 Ha of Ngitili had been restored (Table 2). This resulted in a mosaic of woodlands, savannahs and agricultural land without the tsetse. The HASHI experience went way beyond the dreams of many of the early proponents. This was acknowledged at the Johannesburg World Summit on Sustainable Development in 2002, where the HASHI project was selected as one of the Equator Initiative Award winners. So, how was resilience restored and improved upon, even in the context of more intensified agriculture and population pressures (Table 2)? HASHI recognized the importance of Ngitili, and the traditional knowledge as the basis for the restoration. Unlike many programmes of the time, the empowering approach of HASHI in promoting Ngitili as the vehicle for restoration was critical as this increased local people's ownership over, and capacity to manage their own natural resources (Kaale et al. 2002). It enhanced the adaptive capacities of the communities in Shinyanga (institutions, respect of knowledge, local ownership). In order to protect and restore those goods and services, participatory planning including women's groups, youth, village government, and individual farmers, was essential to try and ensure equitable forest management and avoid elite capture. Forest restoration included the planting of trees, fencing, reducing grazing, natural regeneration of trees and agroforestry.

The key stakeholders in this work were the local people and villages (their knowledge and institutions), district and regional government (local council, forest departments), the Ministry of Natural Resources and Tourism (as HASHI was a national initiative), and Non-Governmental Organizations and community groups. The private sector per se were not much involved – though many of the products from the restored Ngitili were marketed through the private sector at the local and regional levels (markets, local value chains).

The Ngitili example moved forest management from reserved forests to where even the smallest Ngitili is recognized as being important. The traditional institutions for managing their natural resources combined with supportive village governments, was key to creating the right management framework. The main principles underlying Ngitili is simple – common sense, as this relates to forage and tree needs of the Sukuma people, so it is easy to adapt and replicate, which has happened in at least two neighbouring regions (Mwanza and Tabora).

The multiplicity of tree goods (fuel, building timber, fruits, gum, medicines, fodder) and services (water catchment, erosion reduction, cultural) spread the risk, of for example crop failure, and further enhanced resilience. The increased local interest in natural resource management, for improving Ngitilis was supported by the decision to take a long term (now over 20 years) approach and investment by the Governments of Tanzania and Norway. Since HASHI started there has been an increasingly enabling policy and legal framework for natural resource management, including those relating to forestry, land tenure and local government reform. This included land tenure linked to forest policy reforms that created the enabling environment for local (farmer, village, group) security of rights and responsibilities to invest for the longer term.

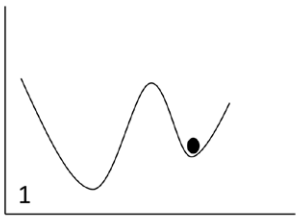
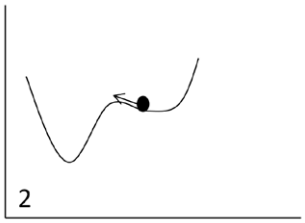
Shinyanga – Resilience Restored, even enhanced	But Resilience can be fragile
	
Between 300,000 and 500,000 restored by 2004 in over 850 villages Woodlands restored on farm, by groups (youth, women), as village forests from 0.25Ha to over 200 Ha Reasons for restoration livelihood based, but immense biodiversity gains Variety of ecosystem services further enhances social resilience (variety of products, variety of species used) Based and built on locally owned knowledge and insitutions Expanded Ngitili concept way beyond original dry season forage for oxen so as to embrace importance of trees for other products (foods, medicinals, honey, timber, as well as dry season forage)	In the past the degraded lands had little value, now with restored woodlands and trees, these lands had significant value Rich and powerful trying to buy restored lands, and so dis-empower less powerful local people Governance and transparency in decision making becoming an issue at the village level

Table 2: Restoring Resilience, but It can be Fragile
Sources: Ghazi et al. 2005, Monela et al. 2005, Shepherd 2008

Discussion and Analysis

At a time when conservation is increasingly being asked to justify itself in the context of livelihood security, poverty reduction and the Millennium Development Goals (and now the Sustainable Development Goals), the HASHI experience offers refreshing and detailed insights into the reasons for considering biodiversity conservation as a key component of livelihood security and poverty reduction (Table 3). But perhaps more important are local people's own comments about what the restoration of trees and woodlands mean to them (Box 1).

Box 1: "*Trees gave birth to livestock,*" says one villager, referring to the fact that the sale of tree products allowed him to buy livestock. *"I now only spend 20 minutes collecting fuelwood. In the past I spent between 2-4 hours collecting fuel"* says a Sukuma lady as she now uses fuel-wood harvested from the family Ngitili.

Other Sukuma agro-pastoralists point out that trees and catchment conservation improved water quality in the region; that restored woodlands provide fodder for oxen at the critical times of the year at the end of dry season; and that revenues from the sale of tree products such as honey and poles pay for children's schooling.

In 1986 when HASHI started, there was little thought paid to climate change and the importance of trees in carbon sequestration. Though *Ngitili* restoration helps mitigate risk and enhance resilience, it is only in 2008 that a *"post-hoc"* carbon assessment was done. It was assumed that prior to HASHI the only important woody biomass was found in gazetted reserves (and even these were degraded). The main carbon sources included *Ngitili,* woodlots and boundary plantings, including the restored trees and woodlands, the grass and herbaceous undergrowth, the litter on the ground, and the organic matter in the soils. No assessment was made of the below ground carbon sequestration, though this may constitute 50% of the above ground biomass, so the estimates made are likely to be underrather than over-estimates. The mean tree biomass on *Ngitili* was estimated at 7.25 tons/ha while the grasses and forbs yielded 2.7 tons/ha and the litter 0.98 tons/ha. The woodlots, though much fewer, had higher tree densities and were more productive with a mean biomass

of about 12 to 14 tons/ha. Assuming a total area of about 500,000 Ha on *Ngitilis* (by 2008), this gives a total biomass of about 23.21 million tons of carbon from the restored forests and woodlands, which translates to about 11.6 million tons carbon.

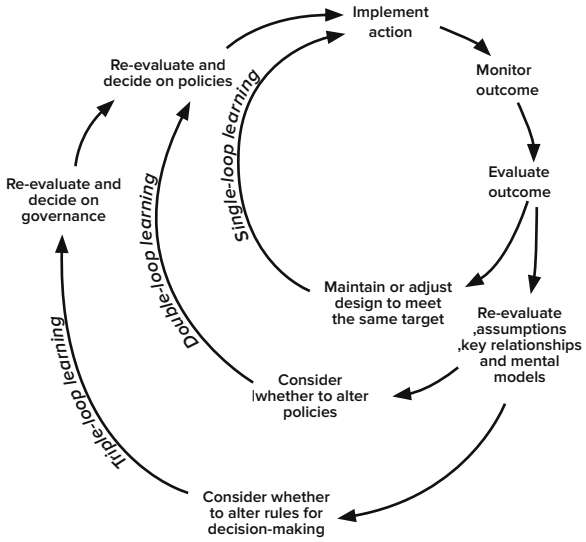
Issue	Outcome	
Economic value of restored Ngitili	$14 (national average rural consumption is $8.50) per month per person	
Costs of wildlife damage due to restored forests	Approximately $65 per family per year	
Average value of the 16 natural resource products used per annum	Per household Per village Per district	$1,200 per annum $700,000 per annum $89,620,000 per annum
Species of tree, shrub and climbers found	152	
Other flora found (dry season only)	Up to 30 different families of grass, and herbs	
Bird species recorded (dry season only) and mammals	145 bird species and 13 mammals	
Reduction in time for collecting various natural resources	Fuelwood Thatch Fodder	2 to 6 hours Pole 1 to 5 hours 1 to 6 hours Water 1-2 hours 3-6 hours
Percentages of households using Ngitili products for various reasons in the 7 districts	Education nutrition forage (over 30 spp) 61% (54% to 63%)	36% (10% to 61%) Diversify 22% (7%-55%) Fodder and 21% (10%-37%) Medicinals 14% (5%-36%) Fuelwood
Estimates of Carbon Sequestration (but villages would not be able to trap all the value, and this is averaged over 25 years)	Total Carbon Sequestered in CO2 Sequestration Average value (25 years) Average value (25 years)	23.21 million tons Equivalent 42.6 million tons Total Value of $213 million $10,227 per village per year $3.8 per person per year

Table 3: Some Outcomes from the Ngitili Study
Sources: Ghazi et al. 2005, Monela et al. 2005, Otsyina et al. 2008

Restored natural trees and woodlands are very important livelihood and economic assets. But in achieving livelihood outcomes, it is clear that significant amounts (area) and variety (species) of biodiversity are restored in the context of underlying livelihood objectives. It demonstrates that natural resource assets are significantly more important in terms of livelihood security and economic benefits than is generally assumed (Table 3). There is a clear message here for Government investment in Poverty Reduction Strategy implementation (and for the future SDGs) that the environmental goods and services have to be more clearly taken into account and invested in at the local, district and national levels. Though not part of the original objectives, Ngitili have made a significant contribution to carbon sequestration as well as being important for risk management and resilience enhancement.

Conclusions and Lessons Learnt

The HASHI program recognized the importance of the traditional practices of managing forests with enclosures, the Ngitili, and used the traditional knowledge as the basis for the restoration. This empowering approach was critical as it increased local people's ownership over, and capacity to manage their own natural resources. It is clear that the social and ecological memory in system restoration is important as it relates to the social memory of people and the genetic memory of the biota as being equally important and available. Environmental and natural resources are important livelihood options for many rural people to meet their cash needs (education, building), for fuel and building timber, to provide valuable medicinals at the local levels, and improve the ground water supply. These are also key qualities for risk management and resilience enhancement in that there is diversity (variety of different products); there are governance systems that are self-organizing (village government, traditional institutions); that the techniques used are both sustainable and owned locally (types of restoration, methods used); and that there is learning and adaptation (different types and scales of Ngitili and different uses of Ngitili).



Over the 25+ years of the HASHI pro- gramme learning has been a central theme – at village, government and NGO levels. Much of the learning originated in the re- cognition of the rich local knowledge and institutional base of the Sukuma people of Shinyanga. From the first learning that the people wanted to plant/restore "their" trees not those of the Government, this fostered a culture of "learning from the people, building on what they know".

Loop 1: Government Forest Authority produced many (over 1 million) mostly exotic trees, which were left unplanted by villages and people.
Learning: Listen to and respect what trees local people want to plant and restore, build on importance of local institutions (Ngitili, traditional Sukuma guards, or Sungsungu).

Loop 2: HASHI support for natural restoration and tree planting using species people wanted, and respecting local institutions – and ensuring that such knowledge and institutional systems are respected by government.
Learning: Success can sow the seeds for its demise. As the restoration increased in scale and scope, governance becomes an issue as land, hitherto with little value, assumed significant value.

Loop 3: Local governance to respect farmers, groups and villages restoration still an issue, and could be exacerbated by climate change impacts. Restoration now spread beyond the region to neighbouring regions.
Learning: Need for improved tenure and secure rights for local people, as well as enhanced legal recourse for such people (still work in progress).

Table 4: Learning and Feedback Loops in Shinyanga – a Continuous Process
Sources: Adapted from Folke et al. 2009 with Shinyanga data and analysis

Yet within this success there are dangers that need to be acknowledged, understood and, where possible, mitigated, including for example elite capture – as the powerful and rich try and usurp the process for their own benefit, and consolidate and further strengthen their own rights at the expense of the less powerful and so create landlessness and inequity; or differential benefit accrual and wealth capture – as men may benefit more than women, and those with large land holdings can benefit disproportionately to those with smaller holdings (Shepherd 2008). This is another kind of rigidity trap known as 'success to the successful' (Meadows 2008), where from a development perspective, the people of Shinyanga need to know how they can deal with it. So resilience can be fragile. This implies the need for careful monitoring of unintended consequences, the importance of checks and balances, and the need for a self-critical approach.

Successful processes such as Ngitili cannot be left to "take care of itself". Balance and equity need to achieved, and constantly re-negotiated so that the poorer and less powerful can also improve their livelihoods. Putting in place participatory (so that all different groups in the village are involved) monitoring (to assure that some of those danger signs are picked up and addressed) and evaluation (so that external perspectives can help point out potential problem areas together with the means to address them) is an important long term process. This demonstrates the importance of continued interaction, and ensuring that there are mechanisms to ensure equity both within the family (gender), and within the village (to reduce elite capture). Fair negotiated tenure rights would appear central to fostering equity,

and reducing incidences of elite capture. The main outcomes of this work were largely a result of building social capital (appropriate local institutions which enhanced cooperation – adaptive capacities), restoring the natural capital (ecosystem functionality), and developing transforming structures (policies that supported traditional knowledge and local institutions). From a resilience perspective, other key lessons (Barrow and Mlenge 2008) from this case study included:

1. Government policy (villagization), which advocated removal of trees, contributed significantly to the near system failure, and is an example of the way in which even well intentioned policies can have serious negative results. However such policies that encouraged forest degradation were replaced with supportive policies, and transformed pressures to degrade the environment into incentives to restore it. Access to and control over resources increases the willingness of individual and groups to manage them sustainably.

2. The success of the forest restoration (ecosystem outcome) was a result of local people restoring ecosystem functionality as a livelihood resource after the long term ecosystem disturbances. Local environmental knowledge was important. The reinvigoration of traditional institutional arrangement (ngitili, dagashida and sungusungu) was essential for demonstrating that adaptive capacities, though weakened, had not been lost. One major contribution of the HASHI programme was allowing traditional institutions to function, which worked by removing constraints.

3. Community action can lead to significantly improved ecosystems. Even though the overall goal was not ecosystem restoration, the area affected by forest restoration was very large. But there is no simple causal relationship between population growth and environmental degradation, as the conservation improved Shinyanga at the same time the population was increasing. Likewise it is often assumed that the main opportunities for combining conservation and livelihoods come from high-value resources, but in Shinyanga the restoration of degraded environments can have major conservation and livelihood benefits.

The Ngitili case is an important example of trends which will become more common: if resources acquire greater value, there will be greater competition for ownership of them. The responses need to include improved tenure and improved legal recourse for the poor, or we shall see increased injustice and impoverishment. It is not just about equity, it is also about the whole question of detecting and averting regime shifts. Local rights and authority to act is the only way that people can have a chance of adapting successfully in the increasingly uncertain times.

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