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Restoration Trajectories in Forest Ecosystems with special reference to Ethiopian Forest

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Abstract
This review article is about Restoration Trajectories in Forest Ecosystems with special reference to Ethiopian Forest. Restoration attempts to return an ecosystem to its historic trajectory. It has time scale but interventions can accelerate the process. There is billions of land world-wide which could be dedicated for restoration. Ethiopian landscape has been degraded severely and concerted efforts are being made to reverse the degradation. Ethiopia made commitment to restore 22 million hectares during the UN Summit in September 2014. However, we need to understand the dynamics and factors influencing restoration and its process; otherwise we believe the existing church forests in the northern and central Ethiopia can serve as reference for restoration. Due to climate change, long time degradation and desertification effects achieving the pristine forest stage might not be possible. But at least creating similar forest community as that of the existing forests might be achievable. Experiences of Korea and Costa Rica can be cited as best practices.
Keywords: Restoration, Forest, Ethiopia, church forest

1. Introduction

Forest restoration in the broad sense is not a new endeavor (Stanturf, n.d). Restoration attempts to return an ecosystem to its historic trajectory. Historic conditions are therefore the ideal starting point for restoration design (SER, 2002)[1]. There are three basic ways of restoration namely, reclamation, rehabilitation and reconstruction (Stanturf, n.d).

Another important factor for restoration is time scale. Restoration may take a decade or century. However human beings can accelerate the process.

Given efforts exist to restore the forest ecosystem worldwide the net balance shows still negative (FAO, 2010). FAO reported net forest loss; Africa lost its forest between 1990 and 2010 more than the rest of the Continents (FAO, 2010).However, the same report indicated gains in Asia and Europe. Stanturf, (n.d) has pointed out that forests can grow or restoration can happen when countries are transformed their economy from Agricultural based to industrial based and for example Europe changed energy consumption from biomass based to fossil fuel. Most of African countries' economy is dependent of agriculture and therefore forests are regressing rather than progressing. FAO, 2010 has reported that Africa lost the big chunk of forests between 1990 and 2010. According to Woods-Schank, 1990

- In 1980, 19.4 million km^2 of the earth's surface were covered by tropical forest (13% of planet's land area)
- In 1990 this figure was dwindled down to 18 million km^2. During this period FAO estimated the rate of deforestation at 114,000km^2 per year.
- Of the closed tropical broadleaved forests in existence in 1980, 56% were in Latin America, 26% in tropical Asia and 18% in Africa

In the beginning of 1980s planting of tropical forests was proceeding at a rate of 11000km^2 or 1.1million ha yearly (Woods-Schank, 1990). Before 1980s some 115,000km^2 of area was afforested in the tropics and in 1985 the afforested area reached 170000km^2 of which 72,000km^2 was accounted for Brazil, India and Indonesia (Woods-Schank, 1990). The same source indicated the ratio of deforestation to afforestation in statistcal term as 10:1(ibid).

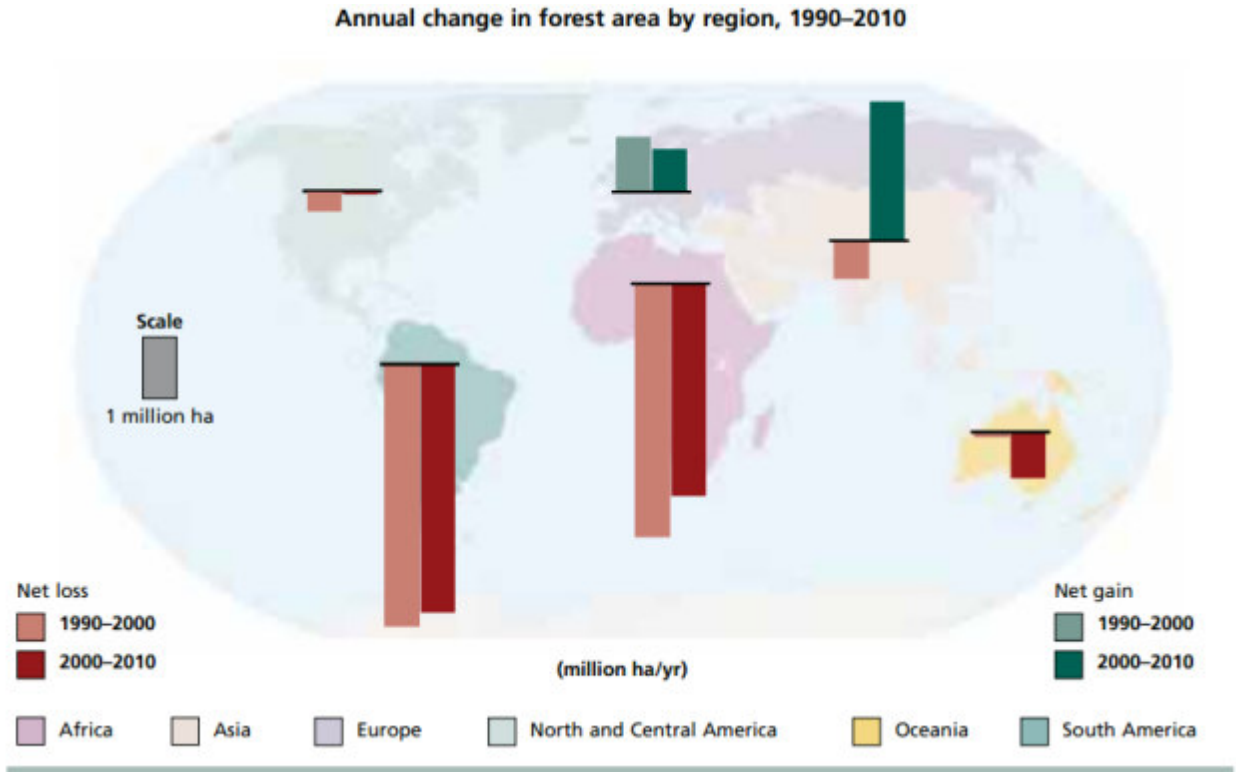
Between 1990 and 2000 there was a net loss of forest area of about 9.4 million ha yr^{-1}(–0.22% yr^{-1})(FAO 2001 in Andel & Aronson, 2006). FAO, 2010 has presented the total forest loss and gain worldwide (Figure 1 below). Except in Asia and Europe the figure shows net forest loss.

Restoration attempts to return an ecosystem to its historic trajectory (SER, 2002). However, it is not clear if

[1] Society for Ecological Restoration Science & Policy Working Group. 2002. The SER Primer on Ecological Restoration. www.ser.org/

plantations or afforested areas could reach to the natural state especially in the tropical forests. The main reason, among many, may be that in modern forestry, plantations do have objectives. In many cases the objectives are to produce timber hence monoculture and mainly exotic species are preferred over the indigenous ones as growth rate is different.

Figure 7 forest area change from 1990-2010



Source: FAO, 2010

The historic trajectory of a severely impacted ecosystem may be difficult or impossible to determine with accuracy (SER, 2002). However, the existing intact forest ecosystems, regional environmental conditions, analysis of other ecological, cultural and historic reference information could be used to trace the reference or baseline (ibid).

FAO, 1984 has indicated that the Ethiopian forest was more than 54% of the total area, including Eritrea. EFAP, 2004 has presented the deforestation rate at 150,000 to 200,000 ha per year. The same study has pointed out that forest cover dwindled from 16% in 1950s to 3.6% in early 1980s[2] (EFAP, 1994). During the same period EFAP reported that the total area planted was not possible to account as there were no systematic data and information management systems. However, the estimated commercial plantations were possible to account and it was not more than 200,000ha (EFAP, 1994).

There are attempts to restore the Ethiopian forest ecosystem by different actors mainly by the Government. The critical challenge is getting reliable data on the scale, species planted and its management. News media reports as billions of seedlings are planted but the tracing the spatial location is hard to find. This has to be corrected.

This review paper shall attempt to make review of various literatures related to the topics at hand and relate them to Ethiopian context. As part of the Bonn Challenge, during UN Summit in New York in September 2014 Ethiopia together with Democratic Republic of Congo, Uganda and Guatemala pledged to restore 30 million ha of degraded lands. Ethiopia alone shall attempt to restore 22 million ha (Mongabay, 2014). Particular attention shall be given to restoration of already degraded and deforested forest lands.

1.1 Restoration and Landscape

Strictly speaking, ecological restoration is an attempt to return a system to some historical state (Falk, Palmer, &

[2] Note that WBISPP,2005 estimated the forest area as 3.6 % as well.

Zedler, 2006). Restoration efforts have profited much from landscape concepts, such as spatial heterogeneity and connectivity, and associated dynamic models (Andel & Aronson, 2006). Restoration in Ethiopian aspect was purely for addressing the environmental problems but not to create recreation or pristine forest. The demarcation and protection of the 'Forest Priority Areas' in 1980s were mainly to meet the objectives set in for the biodiversity conservation and watershed management. But ecosystems do not function independently from their surroundings and that spatial relations matter a great deal (Andel & Aronson, 2006).

The scientific concept of landscape has its roots in central Europe and was mainly developed by German scientists, many square kilometers in size and included several villages, farms, etc. (Troll 1939, Schmitthüsen 1963 in Andel & Aronson, 2006). Forest Landscape Restoration integrates site-specific forest restoration activities with desired landscape-level objectives (Hansen & Maginnis, 2013). A landscape is a very concrete part of the surface of the Earth, with boundaries and a history. Typically it has a size of at least a few square kilometers and can be photographed or put on a map (Andel & Aronson, 2006). All landscapes are heterogeneous (Andel & Aronson, 2006). The same study subdivided the landscape into uniform groups called patches. Group of patches form patterns. Topography, disturbance and human activities are the agents of creation of patterns (Andel & Aronson, 2006).

It was realized that patches are not isolated entities but rather are connected to other patches, thus enabling an exchange of matter and organisms. The relation between such flows and the landscape pattern is often very complex (Andel & Aronson, 2006). *A landscape consists of a mosaic of two or more ecosystems that exchange organisms, energy, water and nutrients* (SER, 2002). *The size of the flows depends on the connectivity between patches, which in turn depends on the amount of suitable habitat* (Andel & Aronson, 2006).

Figure 8 church forest in Amharic Regional State

Many cultural ecosystems have suffered from demographic growth and external pressures of various kinds, and are in need of restoration (SER, 2002). Church forests in Ethiopia could be considered as one of such cultural ecosystems. Ecological restoration encourages and may indeed be dependent upon long-term participation of local people (SER, 2002), e.g., the sustainable land management and the productive safety net program in Ethiopia could be considered as good examples. In restoration cultural practices are very well recognized whereby the cultural practices and ecological processes can be mutually reinforcing (SER, 2002).

The Church forests in Ethiopia could be cited as good example cultural sites relevant to restoration process. As a tradition The Orthodox Church used to plant indigenous tree species such as *J. procera, P.falcatus, O.africana*. In recent years especially in Addis Ababa these churches are converting areas occupied by trees to construction of buildings for business centers and other purpose. But still in the rural side the church forests are significantly important for various purposes such as biodiversity conservation. Church forests in Ethiopia actually can serve two major purposes reference to restoration of forest ecosystems:

1) Use the forest as reference point. According to SER (2002), a reference ecosystem can serve as the model for planning an ecological restoration intervention, and later serve in the evaluation of that intervention.

2. To restore the surroundings degraded areas. The ultimate restoration should consist of species composition similar to the forests and structure and function as well has to be more or less similar pattern.

SER, 2002 has pointed out the following very important concepts one should consider while

restoration endeavors are implemented:

- *The restored ecosystem is self-sustaining to the same degree as its reference ecosystem, and has the potential to persist indefinitely under existing environmental conditions*
- Any intact ecosystem, the species composition and other attributes of a restored ecosystem may evolve as environmental conditions change
- *An ecosystem is said to be recovered and is restored when it contains sufficient biotic and abiotic resources to continue its development without further assistance or subsidy*
- *all ecosystem restoration should be approached with a spatially explicit landscape perspective, in order to ensure the suitability of flows, interactions and exchanges with contiguous ecosystems.*
- *A legitimate and indeed important object of much ecological restoration is the reintegration of fragmented ecosystems and landscapes, rather than focusing on just a single ecosystem.*

A natural landscape or ecosystem is one that developed by natural process and that is self organizing and self maintaining (SER, 2002). With population growth and demand for various products and services maintaining ecosystem or natural landscape may be difficult. In the highlands of Ethiopia the most visible landscape is cultural one (see Figure 2 for example). In most cases human induced changes depicts regular pattern unlike the heterogeneous and pattern less natural environment. However, sustainable cultural practices are traditional human landuses that maintain biodiversity and productivity (SER, 2002).

Worldwide there is a potential of some 2 billion ha landscape which could be could be restored (Figure 3) (Hansen & Maginnis, 2013).

Figure 9 Potential areas for restoration World Wide

(Hansen & Maginnis, 2013)

2. Restoration of Forest Ecosystems in Ethiopia

Prior to discuss on the restoration of forest ecosystems it might be worth to briefly account the drivers of deforestation as well as forest degradation. Furthermore, problems associated with land degradation are highlighted below.

2.1 Deforestation and Forest Degradation

Land above 1500 meter above seal level covers 44 percent of the land surface (EFAP, 1994). This area is

supporting the 88 percent of population, and some 95 percent of cultivation, and accommodates 75 percent of livestock herds (ibid).

The population increment (figure 4 below) has been blamed for the deforestation rate estimated by EFAP. According to the source annual deforestation rate was between 150 000 and 200 000ha. EFAP, (1994) has reported that in the past some 35 percent of the Ethiopian land area (120million ha) was high forests of either the coniferous or the broad leaved type. The same source indicated that if the savannah woodlands are added the extent could reach to 66 percent.

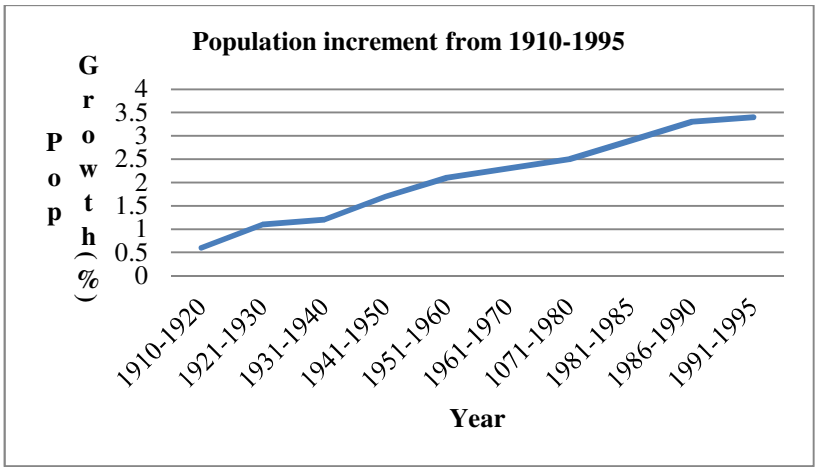
Agriculture is the main sector where the Economy of then country is based. More than 90 percent of Agriculture production comes from small holder farmers (MoFED, 2010). The report from Central Statistics Authority indicated that total area cultivated by smallholder farmers for grain crops is 12.3 million hectares and their total production is 231.3 million quintals (CSA, 2013 in Nune, 2013). The land use land cover change especially fro other land uses to agriculture has been almost incremental while the forest area has been diminishing. Fore example, from 2004/05 to 2009/10 the total land occupied by the three main crops (cereals, pulses and oil seeds) has increased from 9.8 million ha to 11.25 (MoFED, 2010).

Other major driver of deforestation as well as degradation of forest is the use of woody biomass for household energy requirements. Some 78 percent of household fuel energy comes from woody biomass (WBISPP, 2005). The same source revealed that in most cases the supply is higher than the regenerative capacity of the forest ecosystem.

In some part of the country fire is a serious problem that affects the forest ecosystem. However, there are no facts and figures on the extent of damage by fire and insect as well.

However, (Environmental Protection Authority, 2011) has reported that 50 percent and 46 percent of deforestation are caused by agriculture expansion and fuel wood consumption respectively. The remaining 4% is caused by logging.

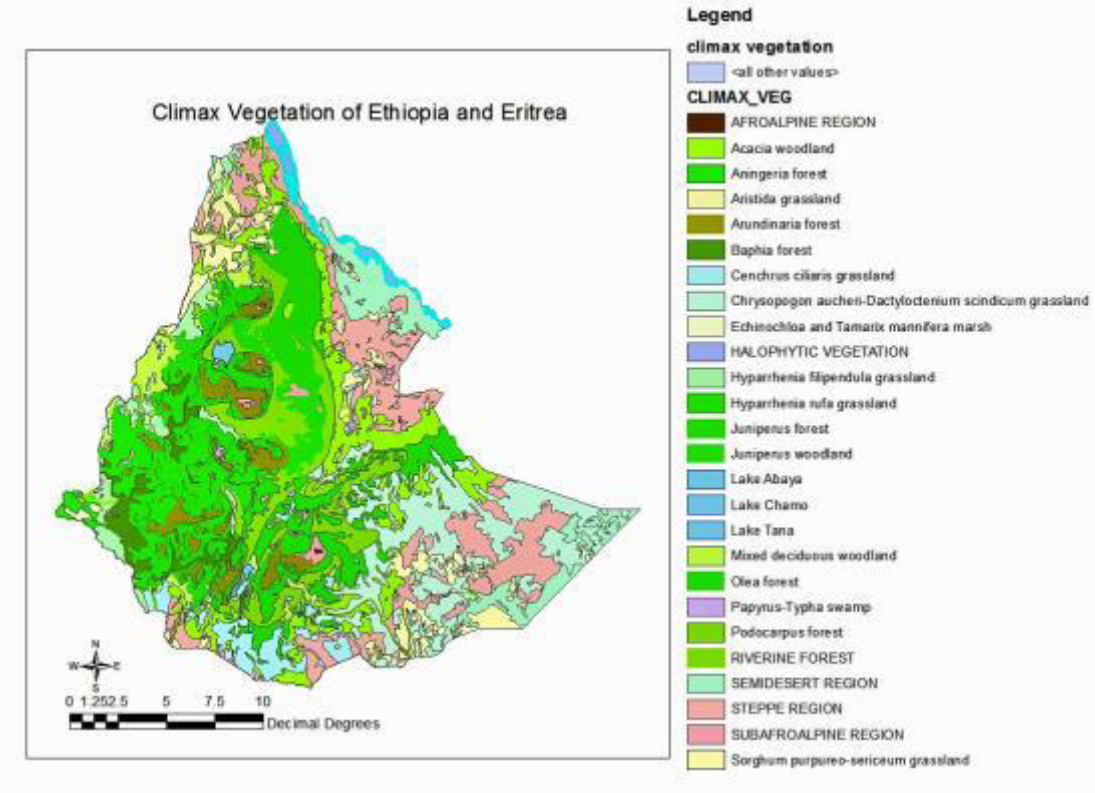
Figure 10 Population increment



Source: EFAP, 1994

FAO made an assessment of land use land cover and other analysis in 1984. Using various methods and tools such as aerial photography FAO estimated and mapped the climax vegetation (Table 1). From the study the climax forest is extracted as shown in the following Table 1. Map of the Climax forest is shown in the following Map (Map 1). As it can be seen from the table and map (also below) the forest cover was more than 54 percent. Therefore, the claim that many scholars are making on the *40 percent* forest cover that Ethiopia once has probably has valid or solid background. List and size of climax vegetation is indicated on Figure 1 and Table 1.

Figure 11 Climax Vegetation of Ethiopia (including Eritrea)



Source: FAO,1984

Table 5 Climax forest of Ethiopia

climax forest	**area** ha
Acacia woodland	11,165,858
Aningeria forest	5,818,754
Arundinaria forest	4,316,336
Baphia forest	3,203,048
Juniperus forest	7,985,941
Juniperus woodland	8,187,601
mixed deciduous woodland	3,445,894
Olea forest	12,760,164
Podocarpus forest	10,576,559
Rriverine forest	980,667
grand total	**68,440,822**

Source: FAO, 1984

Ethiopia has about 4.1 million hectares of forests, 29.5 million hectares of woodlands, 26.4 million of shrub lands and 0.5 million hectares of plantation forests, which constitute about 52.87 percent of the total land area of Ethiopia (WBISPP, 2005). According to the same study (High) forest constitutes only 3.56 percent of the total land mass of the country, whereas, Ethiopian Forestry Action Program (EFAP, 1994) estimated as 2.3 percent. However, WBISPP used recent remotely sensed tools and better GIS facilities as well as personnel. Highland and lowland bamboo comprises 31,000 and 495,564 hectares.

2.2 Consequences of degradation

The removal of forests and other vegetations almost degraded the natural environment. Highland reclamation study (Wright, 1984) has reported that 52% (27.5 million ha) of the soils of the Ethiopian Highlands show significant sign of accelerated erosion; 28% (14.5 million ha) of the soils are suffering seriously from the effects of accelerated erosion; 24% (13 million ha) of the soils show moderately or slightly accelerated erosion which is growing rapidly worse in many areas; 48% (26 million ha) are without visible indication of accelerated erosion at present but a little over half are at future risk owing to the naturally erodible nature of many soils;

Of the worst affected areas (14.5 million ha), some 6 million hectares are recommended to be completely withdrawn from agricultural production and reforested; an additional 8.5 million ha should be given protection against arable farming, and allowed to revert to, and be subsequently maintained as, permanent

pasture.

The World Bank report showed that as a result of land degradation Ethiopia could lose 2 to 3 percent of the agricultural GDP per year (World Bank, 2013).

2.3 Efforts and Achievement of Restoration in Ethiopia

The Ethiopian Government, private sector (small holder farmers, etc), civil societies and other institutions made an effort to restore the once degraded and drought stricken country, Ethiopia. Especially after the 1974 drought massive programs to restore the degraded ecosystem has been considered. Through food for work program soil and water conservation works have been conducted.

Despite absence of proper documented evidences, plantation or afforestation may be started during the time of King Zereyakob. However, documented references show that plantation has started during Menelik II (FAO, 1984). The same source has reported that some 40,000 ha plantations were planted up to 1974 (FAO, 1984). Major species planted are Eucalyptus globulus and, to a lesser extent, E. camaldulensis. With the support from the Swedish Government Ethiopia started to plant large scale industrial tree plantations in 1970s mainly to satisfy the demand for industrial forest products (Bekele, 2011). Berkeley,(2011) has also indicated that the area under plantation has increased since then and reached to some 972 000 ha in 2010.

Of the total amount under forest plantation only 20 percent qualifies commercial that provides poles, timber or sawn wood, the remaining 80 percent cover woodlots and trees on farms with no industrial value (Bekele, 2011).

SER (2002) defined ecological restoration as the *process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed.* The soil and water conservation and water shade management in general gives emphasis to the degraded or damaged sometimes destroyed landscapes. Efforts were and are being made to rehabilitate landscapes.

Since 1970s rehabilitation of degraded ecosystems has been undertaken. Still today various Gove and NGOs are striving to reverse such degradations through, among others, application of best practices in land management. For example, these days one of the flagship programs of the Ministry of Agriculture is the Sustainable Land Management Program. It is donor assisted program which is running since 2008. Basically, Sustainable Land Management Program is very well fit with the concept of restoration despite the fact that in most cases farmers or local communities priorities are given over the ecological requirements, viz. species selection. Fast growing species and income generating activities have more weight than the slow growing indigenous tree species. However, there are good practices such as area closure where degraded areas are excluded or protected from livestock and farming. This sustainable land management practice enabled community to collect grass using cut and carry system, enabled the community to be engaged in apiary, assist in recharging of ground water and minimize soil erosion and in general modify micro climates. Documented report indicates that about 210000 ha of land were managed through the support of the Sustainable Land Management Program. On communal lands such as grazing lands, hillsides and gullies about 11,265 ha is put under area closure practice (Ministry of Agriculture, 2013). Furthermore, 13,573 ha degraded hillsides are treated and 242 ha gulley land is rehabilitated using different physical and biological measures.

Area closures in Ethiopia may be considered as one of successful interventions when it comes to restoration. In this intervention it doesn't specifically address one object but more. In such case the restoration may consider grassland ecosystem as well as forest. Such interventions are referred to as reference landscape (SER, 2002).

2.4 Current status and plan for the future

The recent published Green Economy Strategy of the Government of Ethiopia has put a target regarding forest restoration. The target comprises afforestation of 2 million ha, reforestation of 1 million ha, forest management of 4 million ha of which 2 million is forest and 2 million is woodland (Environmental Protection Authority, 2011).

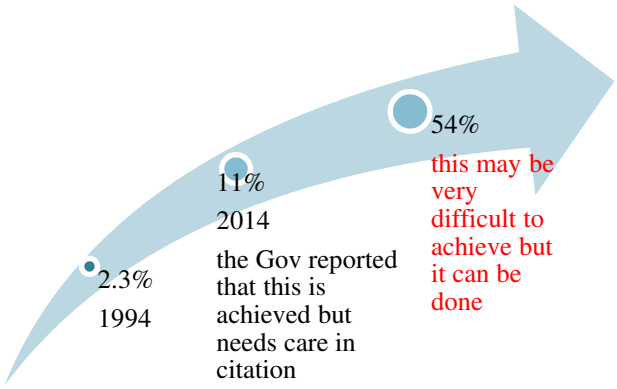
The three million ha of afforestation and reforestation plan indicated on the (Environmental Protection Authority, 2011) and the 972000 ha by (Bek11) would give us nearly 4 million ha.

FAO (2010) reclassified the classification of forest made by WBISPP and reported that in 2010 the forest area was 12 295 847 ha which is 10.25% of the country. However, one should note that there is no expansion of natural forests from the baseline of Woody Biomass Study in 2005. In reality, apart from the trees planted by mass mobilization, and regular tree planting by different agencies such as Ministry of Agriculture (Sustainable Land Management Program) and Forest Industries such as the Oromia Forest and Wildlife Enterprise there are no other afforestation or reforestation program which can be accounted. The regular plantations and trees on farm are already captured by Bekele (2011).

3. Do Afforestation and Reforestation in Ethiopia Qualify as Restoration

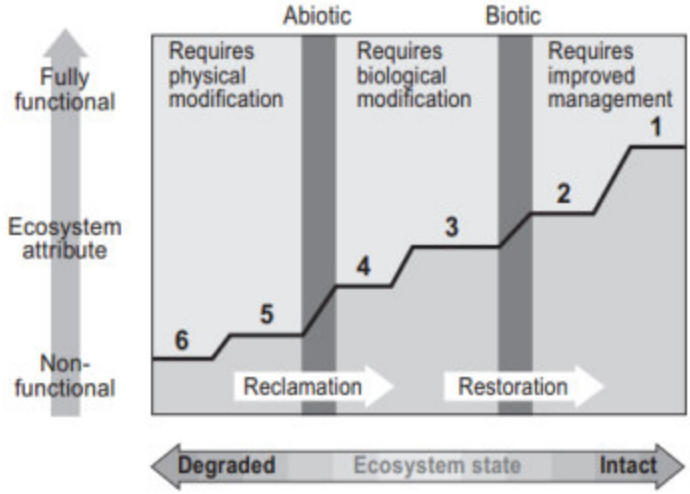
3.1Natural Forests in Glimpse

Figure 12 Restoration Trajectory of Forest Ecosystem in Ethiopia



Natural Forest Composition and Structure differs from the planted trees or/and forest planations. Ethiopian high forests consists of 300 or more tree species and of which 25 are regarded as commercial species and 30 are regarded as potentially usable for the mechanical wood industry (EFAP, 1994). These forests mostly have thre or more vertical layers. Underground lush vegetation composed of herbs, shrubs and lianas and climabers are commonly found. They are habitat for wilidlife and insects as well as endemic avifauna. For their hydrological and biodiversity values the forests were designated as forest priority areas in 1980s. Fifty seven Forest Priority Areas were identified and some of them were demarcated; very few were inventoried and management plan was prepared for them.

Figure 13 Relationship between measured ecosystem attributes, biotic and abiotic barriers, and the processes of reclamation and restoration (modified from Hobbs & Harris 2001) (Andel & Aronson, 2006).



Ethiopia is a center of diversity for both fauna and flora due to its diverse agro-ecological zones (about 32 agro-ecological zones are identified so far). In each agro-ecological zones more or less different soil type, rainfall intensity and pattern, evapo-transpiration and vegetation are believed to be found. .....

Flora of Ethiopia is estimated in the range of 6500 to 7000 species of which 12 percent are endemic. Endemic mammals are estimated to be 30 (12 percent of the total), 28 endemic species of birds (3.2 percent), 3 endemic species of reptiles (3.9 percent), 17 endemic species of amphibians (31.5 percenr), and 3 endemic species of fish (4.0 percent) (EFAP, 1994).

Ethiopian vegetation has four phytogeographical areas, namely Afromontane, Sudanian, Somali-Masai and Sahelian. Afromontane vegetation dominates the mountain massifs either side of the rift valley (White, F.1983 cited in EFAP, 1994). Montane evergreen forest found in Afromonatne vegetation zones include mainly dry evergreen Juniperus, Olea, Podocarpus forest, but also including mixed evergreen and moist evergreen forest. The Afromonatne flora overall is 75 percent endemic.

The Somali-Masai and Sudanian areas contain flora and fauna which probably have fewer country-specific endemics than the afromontane (EFAP, 1994). This category contains one-third endemic species

whereas afromonatne comprises approximately half of endemic species(ibid).

Forests and woodlands are habitat for wildlife. In Ethiopia there are 20 national parks, three wildlife sanctuaries, two wildlife reserves, seventeen controlled hunting areas, seven open hunting areas and three community conservation areas. Officially estimated size of the national parks is about 45,418 km^2 (EWCA, 2014).

3.2 The Practice of tree and forest plantation

In the process or rehabilitation exotic species are more emphasized than the indigenous trees. Most of the agricultural and homesteads in central highlands are with Eucalypts tree species. Farmers prefer Eucalypts for its fast growing habit, easy to manage and it has good market when it is matured.

In general, exotic tree species are more planted than the indigenous tree species. In most cases the rotation period of the exotics species is less than (may be by half) the indigenous ones. The interesting thing is that in most of eucalypts plantations natural regeneration is promisingly coming for example one can see such development in Wof- Wash Forest area and Gulele Botanical Garden and its surroundings.

Although it is technically sometimes possible to really recreate some former communities (true restoration) on a local small scale and at high cost, this is generally impossible at the landscape scale because of land use conflicts, long-distance effects of other activities and lack of public support (Andel & Aronson, 2006). The editors suggest that simple recreation of past species lists is unlikely to succeed: process and connectivity must be taken fully into account, along with biodiversity (ibid).

In most degraded ecosystems reclamation is taking place, especially in highly eroded areas. Mostly, the conservation of soil using different terrace works can be helpful to restore moisture and soil organic matter. Then the biological measures can facilitate further accumulation of organic matter and can enhance regeneration of other plants. Therefore, human intervention can facilitate the restoration work. In this intervention the implementers need to take care in selection of technologies and best practices. Species selection should consider the social and ecological parameters.

The introduction of *P.Julifera* for example has affected the natural environment and socioeconomic conditions of the Afar Regional State in particular. *P.Julifera* was introduced to Ethiopia in the 1970s hoping to restore the degraded environment. During the selection poor quality seed was introduced and propagated. Currently this species is categorized as invasive species and the people whose economy is dependent of agriculture and livestock in the area are highly challenged.

Tree seed supply from the reliable source doesn't exceed 35%. The rest of the demand is satisfied from seeds of unknown origin. As a result of this fact the future of forest plantations are not clear whether Ethiopia would have superior or inferior quality forest. This situation may create undesirable effect on pollinations and the like.

The current rush for Jatropha plantation for its diesel fuel is also a concern for many researches. The reason is that a) it may compete with agriculture where crop land may be shifted to such plantation; might affect the food production system; b) like *P. Julifera* it may turn out to be invasive.

Countries which are successful in restoration are developed countries whose economy is dependent of other sectors than agriculture. Therefore, transforming agriculture into industrialization probably will give chance to restore our forest ecosystem into its original trajectory (54%). However, South Korea has different story.

4. Countries with Success Stories

There are many countries with historical achievements in forest restorations world-wide. The most renowned are Costa Rica and South Korea.

Costa Rica's forest cover declined from 85 percent of its land area at the start of the 20th century to below 30 percent by 1987 (Hansen & Maginnis, 2013). Through a series of restoration efforts—the nation's forest cover climbed back to about 50 percent by 2010 according to the same source.

The mechanism to be successful to this scale is the result of an innovative financing approaches (Payment for ecosystem services), policy reforms, and technical assistance to landowners.

South Korea restored its forests from 35 percent to 64 percent within 54 years (from 1957-2007); at the same time its population doubled and its economy grew 300-fold (Hansen & Maginnis, 2013).

Another country worth to note is the United States. According to Hansen & Maginnis, 2013, in the eastern United States, about 13 million hectares of forests recovered between 1910 and 1960. Puerto Rico's forest cover climbed from 6 percent of the island around 1940 to about 40 percent in 2000; and farmers in southern Niger have miraculously restored 5 million hectares of agroforestry landscapes, improving their livelihoods and helping to reverse desertification.

Countries are motivated by benefits they expect to derive when restoration is happened. Such benefits could be watershed management, erosion control, enhancement of biodiversity, improvement of water quality,

and increase agricultural productivity. As the time of restoration increases multiple benefits may be the desired goal in restoration. Ecotourism, job opportunity, and mitigate and adpt climate change are the added values to the other benefits mentioned here.

For successful restoration three common themes are followed by those countries that are successful in restoration a (Hansen & Maginnis, 2013):

- A clear motivation. Decision-makers, landowners, and/or citizens were inspired or motivated to restore forests and trees on landscapes.
- Enabling conditions in place. These included ecological, market, policy, social, and institutional conditions.
- Implementation capacity and resources. Capacity and resources were in place and mobilized to implement restoration on a sustained basis.

5. Factors influencing restoration and its process

1. Institutional Stability is important. Forestry institution was one of the most unstable among many institutions in Ethiopia. In line with the institutional aspect conducive policy environment and proper extension services are crucial for success.
2. Long term commitment is required. There are tendencies to reallocate the rehabilitated lands under the sustainable Land Management to the landless and youngsters. However, there are no concrete research findings whether the rehabilitated area has enough capacity to carry intended activities.
3. Proper follow-up of plantations is a must. Any forestry activities to be profitable (tangible or intangible), proper forest management plans and implementation of the same is required. Most of the forest areas in Ethiopia do not have proper management plans and even if they do, the implementation is not done. In most case priority never been to forestry. Proper silvicultural activities are required to manage forests. Forest protection should be very well implemented. Disease and pest studies are lacking. In line with this, standards should be developed by proper agency for example, silvicultural standards.
4. Forest Information system has to be established. Which species for which localities and soil type etc has to be developed and disseminated to regional and woreda offices prior to any forestry operations.
5. Address drivers of deforestation and forest degradation. Increasing productivity of agriculture production avoids area expansion. Likewise, designing alternative energy sources is important to minimize or completely avoid the dependency on biomass energy[3].

The Table below describes the three common themes in detail. Key successes factors are diverse and ranging from participation to leadership; technical knowhow to policy formulation; indigenous tree species to invasive species, etc. from this Table it can be vry well understood that restoration requires diverse knowledge, cooperation and collaboration, commitments, leadership, etc.

Table 6 Key success factors for forest landscape restoration

[3] More than 90 percent of energy in Ethiopia comes from biomass.

Theme	Feature	Key success factor
1. Motivate	Benefits	• Restoration provide economic, environmental, social and cultural benefits
	Awareness	• Benefits of restoration are publicly communicated
		• Opportunities (e.g., where, how much) for restoration are identified
	Crisis events	• Crisis events are leveraged
	Legal requirements	• Law requiring restoration exists and is enforced
2. 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 for alternative use for degraded lands are declining
		• Accessible market for products from restored areas exists
	Policy conditions	• Land and natural resource tenure are secure
		• Policies affecting restoration are aligned and streamlined
		• Restrictions on clearing natural forests exist and are enforced
	Social conditions	• Local people are empowered to make decisions about restoration
		• Local people are able to benefit from restoration
	Institutional conditions	• Responsibility for restoration is clearly defined
		• Effective institutional coordination is in place
3. 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
	Financing 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

Source: Hansen&Maginnis (2013)

6. Conclusion

The population number has almost doubled since 1960s. Size of cultivated land is also increased. The volume of harvested wood for fuel wood and construction increased as well. But the planted forest and trees compared with the deforested area is incomparable as shown above. Annually over 150,000ha is deforested but the total amount of the afforestation and reforestation until 2011 does not exceed one million (Bekele, 2011).

The restoration effort undergoing in Ethiopia has been influenced by actions to respond immediate needs. Priorities were influenced by poverty reduction and economic growth objectives. Communities' need are more emphasized than the ecological requirements. Moreover, because of lack of country specific standards in silviculture and other forestry operations implementers took actions on what they think is right.

Lack of proper research on seed sources and storage facilities became reason for using seeds of unknown sources. This may have negative consequences on future forests of Ethiopia.

The existing church forests in the northern and central Ethiopia can serve as reference for restoration. Due to climate change, long time degradation and desertification effects achieving the pristine forest stage might not be possible. But at least creating similar forest community as that of the existing forests might be achiveable.

The ambition Ethiopia set, refer 3 million ha of afforestation and reforestation and management of 4 million ha, is less than 6% of the country. More targets need to be put in place.

Long term institutional commitment, collaboration and cooperation between and among various institutions/stakeholders may be an important factor for sustainable restoration engagement. Local community should buy the idea. To be successgful on this, good communication skill is required. Awarness creation, knowledge base development, engagind community in the restoration initiatives ect has to be establsihed well inadvance prior to the start of the restoration. Otherwise sustainability of the work done might be at risk.

Lessons from other countries such as South Korea surely can be worth to consider. Both economic development and restoration happened in South Korea at the same time. The notion that country should firs grow then consuider environment dosnot work in South Korean case.

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